



SUSTAINABLE DEVELOPMENT
TECHNOLOGY CANADA

CELEBRATING



CELEBRATING **15 YEARS** OF CANADIAN CLEANTECH

ANNUAL REPORT

SUPPLEMENT 2016/2017





Table of Contents

INTRODUCTION	1
SECTION 1: Index of SDTC Portfolio Companies	2
SECTION 2: SD Tech Fund – Introduction	3
SECTION 3: SD Tech Fund – Projects Announced	4
SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts	22
SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception	70
SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception	87
SECTION 7: SD Tech Fund – Classification of Projects by Region	113
SECTION 8: NextGen BioFuels Fund – Introduction	123
SECTION 9: NextGen BioFuels Fund – Portfolio since Inception	124



Introduction

In accordance with the terms and conditions of both Funding Agreement Six (pertaining to the SD Tech Fund) between Sustainable Development Technology Canada (SDTC) and the Government of Canada, executed November 17, 2016, and the Funding Agreement pertaining to the NextGen Biofuels Fund between the same parties executed September 4, 2007, SDTC is required to publish a First Supplement to the Annual Report providing specific details of projects funded by the Foundation. Within this First Supplement, SDTC provides the required information relating to both funds for Fiscal Year 2016/2017. As this is the first time this report is structured on the new fiscal-year reporting period (April to March), the gap period of January 2017 to March 2017 has also been included.

This First Supplement to the Annual Report, the Second Supplement to the Annual Report (consisting of the Executive Summary of the Corporate Plan), and the Annual Report itself, are tabled in Parliament by the Minister of Innovation, Science, and Economic Development Canada. These documents are made available to the public on sdtc.ca.

Purpose and Selection Criteria of Each Fund

Each Fund has a unique purpose and set of criteria for qualifying, assessing and approving projects. For the SD Tech Fund and the NextGen Biofuels Fund, these criteria are summarized at the beginning of the relevant and respective sections.

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. These measures are 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 requiring them to declare potential conflicts of interest and to refrain from participating in any discussion regarding matters that could give rise to a conflict of interest.



SECTION 1: Index of SDTC Portfolio Companies

This section includes an index of SDTC portfolio companies for which the project was announced, completed, or reported market impacts for the period January 2016 through March 2017.

Agrisoma Biosciences Inc.	60
Automotive Fuel Cell Cooperation Corp.	24
Ballard Power Systems	52
BioAmber Sarnia Inc.	62
CarbonCure Technologies Inc.	55
Cooledge Lighting Inc.	63
Corporation HET/LactoScience Inc. (LSI)	29
Corvus Energy Ltd.	64
dPoint Technologies Inc.	30
Duopar Technologies Inc.	53
Echologics, a division of Mueller Canada Ltd.	35
Eco-Ag Initiatives (Desviar)	43
Electrovaya Corp.	58
EnerMotion Inc.	68
FibraCast Ltd.	46
Fibria Innovations (Formerly Lignol Innovations Ltd.)	33
GaN Systems Inc.	26
GaN Systems Inc.	65
GHGSat Inc.	67
GreenField Specialty Alcohols Inc. (now known as Greenfield Global)	48
Imtex Membranes Corp.	39
InvoDane Engineering Ltd.	51
Ionada Inc.	59
Isowater (Available Energy Corp.)	36
Johnson Matthey Battery Materials Ltd.	23
Marine Exhaust Solutions	69
MEG Energy Corp.	49
MPT Mustard Products & Technologies Inc.	44
*Namgis First Nation	66
Nexterra Systems Corp.	25
Nsolv Corp.	47
Produits Enuchem Inc.	27
PTRC (Acquistore)	61
Pulse Energy Inc.	34
Pure Technologies Ltd.	38
S2G Biochemicals Inc.	45
Saltworks Technologies Inc.	40
semiosBIO Technologies Inc.	57
Solantro Semiconductor Corp.	56
Statoil Canada Ltd.	41
SunSelect Produce (Delta) Inc.	31
Terragon Environmental Technologies Inc.	50
Verdant Power Canada ULC	28
Vision EcoProducts Ltd.	54
Western Hydrogen Ltd.	32
Westport Power Inc.	37
Xogen Technologies Inc.	42



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 out in Canada with its purpose to develop and demonstrate new technologies to promote sustainable development, such as:

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



SECTION 3: SD Tech Fund – Projects Announced

This section of the report provides a project description for each eligible project announced for funding during the period from January 2016 through March 2017.

AFCC Automotive Fuel Cell Cooperation Corp.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$88,370,069

SDTC Funding:
\$10,000,000

Leveraged Funding:
\$78,370,069

Fuel cell vehicles (FCVs) are a vital component in the shift to lower-emission transportation. Multiple automotive manufacturers (OEMs) are currently launching or planning to launch extensive fuel-cell vehicle fleets with global production of FCVs expected to exceed 70,000 vehicles annually by 2027. The biggest challenge remaining for automotive fuel cells is cost. Mass-market adoption will not occur until performance and cost targets are met concurrently.

Automotive Fuel Cell Cooperation Corp. (AFCC) is a world leader in automotive fuel-cell technology; its fuel-cell stack technology provides best-in-class performance and durability. Building on previous-generation technology, in this project AFCC will optimize design, produce and demonstrate its GEN 4 fuel-cell stack technology as well as concurrently conduct advanced engineering on its next-generation GEN 5 technology. When completed, consortium partner Daimler AG will roll out the GEN 4 fuel-cell stack demonstration vehicles. Additionally, AFCC will deliver the detailed design for the proof-of-concept GEN 5 fuel-cell stack.

Consortium Members:

- AFCC Automotive Fuel Cell Cooperation Corp.
- Daimler AG, Ford Motor Company
- Mercedes-Benz Fuel Cells Canada
- NuCellSys GmbH

Gbatteries Energy Canada Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$3,000,080

SDTC Funding:
\$1,185,000

Leveraged Funding:
\$1,815,080

Lithium-ion batteries have become ubiquitous in consumer electronics, cordless power tools and electric vehicles. The global lithium-ion battery market surpassed \$23.5 billion USD in 2015 and continues to grow at a rate of 17% per annum. A fundamental limitation to widespread technology adoption, however, is cost of ownership, which is driven up by the limited lifespan of the batteries.

GBatteries proposes to develop and implement an Active Battery Management System (ActiveBMS), an innovative technological approach for battery management that enhances battery performance by optimizing ion flow. ActiveBMS uses a proprietary charging method, reducing degradation and increasing battery cycle life by a factor of four compared to charging using conventional methods. The technology works by measuring a battery's interface conditions and actively managing its charge in real-time, safely enabling improvements in reliability, charge rate, and cycle life. Using ActiveBMS, charging rates can be increased by at least six times over conventional methods with no adverse effect on battery performance, thus achieving a 50% charge in five minutes and an 80% charge in ten minutes—a point of particular interest for electric-vehicle applications.

Consortium Members:

- Gbatteries Energy Canada Inc.
- Carleton University
- Cypress Semiconductor
- eCamion Inc.
- Kokam America / Dow Kokam
- S&C Electric

Canfor Pulp Ltd.

Environmental Benefits:  Climate Change

Total Project Value:
\$39,216,511

SDTC Funding:
\$13,050,000

Leveraged Funding:
\$26,166,511

In many jurisdictions, existing government policies mandate fossil-fuel producers to reduce their carbon footprint by blending renewable biofuels into existing products. In addition, shifting government policies favour cellulose-based biofuels, incentivizing carbon-reduction potential rather than biofuel volumes. Canfor Pulp Products Inc. (CPPI), a leading global producer of premium pulp and paper, and Licella Fibre Fuels Pty Ltd. (Licella), an Australian biofuels production start-up, have formed a joint venture in which the companies will seek to use Licella's technology to economically convert biomass into biocrude. Using Licella's first-of-kind Catalytic Hydrothermal Reactor (Cat-HTR) technology that converts low-value biomass from wood waste and pulp mill waste to clean, sustainable biofuel, the companies will convert wood residues from CPPI's pulp mills in Prince George, British Columbia, into biocrude oil which can be refined by existing refineries into next-generation biofuels and biochemicals. The agreement follows preliminary trials conducted in Australia where Licella successfully converted wood residue streams (wood and black liquor) originating from CPPI's kraft process into a stable biocrude oil.

Consortium Members:

- Canfor Pulp Ltd.
- Licella Pty Ltd.



SECTION 3: SD Tech Fund – Projects Announced

Enerkem Alberta Biofuels LP

Environmental Benefits:  Climate Change  Clean Air  Clean Soil

Total Project Value:
\$45,232,813

SDTC Funding:
\$10,350,000

Leveraged Funding:
\$34,882,813

As part of this project, 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 utilizes 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.

Consortium Members:

- Enerkem Biofuels Alberta LP
- City of Edmonton
- Enerkem Inc.

Axine Water

Environmental Benefits:  Climate Change  Clean Water

Total Project Value:
\$4,998,093

SDTC Funding:
\$2,000,000

Leveraged Funding:
\$2,998,093

Every year, billions of litres of wastewater are generated by the manufacturers of chemicals, petroleum products, pharmaceuticals, automobiles and electronics. Axine Water Technologies has developed a low-cost solution for treating toxic organic pollutants and ammonia in industrial wastewater. Axine's advanced oxidation technology exploits electrochemical properties and catalysts that are less expensive to build, less prone to fouling and require less energy to treat the stubborn pollutants found in industrial wastewater. Axine's technology will treat wastewater on-site at a substantially lower cost compared with incumbent solutions that require wastewater to be trucked off-site for incineration and disposal. Working with consortium partner EMD Performance Materials Corp., a global leader in specialty chemicals, Axine proposes to develop, scale-up and pilot a new application of its technology for treating wastewater. Once demonstrated, this application can be widely replicated across the chemical manufacturing sector and other industries.

Consortium Members:

- Axine Water Technologies Inc.
- Hexion Inc.

Farmers Edge Corp.

Environmental Benefits:  Climate Change  Clean Water  Clean Soil

Total Project Value:
\$18,484,873

SDTC Funding:
\$6,107,563

Leveraged Funding:
\$12,377,310

While one acre of seeded land could feed one person in 1960, that same acre will need to feed three people by 2025. Climate change is expected to further stress the availability of water and land necessary for crop production while urbanization reduces the amount prime seeded land around cities. Although the sustainable intensification of agriculture will rely on genetics, crop protection and harvest technologies, a large part of the efficiency gains required to meet the global food demand will result from precision agriculture (PrAg) technologies. Farmers Edge Inc. is a Canadian developer of PrAg solutions that currently provides data-enabled agronomy services to more than 1.5 million acres of farmland (mostly in Canada). Farmers Edge flagship product is aptly named FarmCommand; it is an integrated farm management software platform that focuses on image-based variable rate fertilizer recommendations as a support to traditional agronomy services. This project focuses on the development and large-scale demonstration of FarmCommand 2.0 (FC2.0), a PrAg platform comprising hardware, software and agronomy services that will provide farmers with new decision support components including variable-rate irrigation and variable-rate pest management, as well as an improved variable-rate fertilizer component.

Consortium Members:

- Farmers Edge Corp.
- Mitsui & Company Ltd.



SECTION 3: SD Tech Fund – Projects Announced

Group NanoXplore Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$10,000,681

SDTC Funding:
\$6,700,681

Leveraged Funding:
\$10,000,681

Next-generation transportation vehicles are rapidly transitioning to electric propulsion. Today, electric motors and related vehicle systems are manufactured using mostly metal components, which can involve heavy parts, labour-intensive assembly, and undesired losses in the form of heat. In comparison, plastics are light weight; easy to shape or mold; and do not rust. However, replacing these metals with plastics would require the use of polymers with unique thermal, electrical, and strength characteristics. NanoXplore has developed and is manufacturing and selling graphene-enhanced polymers with enhanced electrical, thermal and mechanical properties. By adding trace amounts of graphene to carefully-selected polymers, they are developing engineering plastics that can be used in electric motors and their support systems. NanoXplore, and its consortium partner, propose to design, build and test a set of lighter, more reliable and higher-efficiency components for electric motor systems that use graphene-enhanced engineering plastics in place of metals.

Consortium Members:

- Group NanoXplore Inc.
- ABB Inc.

Opus One Solutions Energy Corp.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$15,121,850

SDTC Funding:
\$5,353,500

Leveraged Funding:
\$9,768,350

In recent years, significant progress has been made on the development of distributed energy resource (DER) technologies like solar photovoltaic, small-scale renewable and non-renewable generation, energy storage, controllable loads and grid-connected microgrids. What is missing, however, is a platform that allows these DER technologies to be integrated into aging, congested, and largely unmonitored electric power distribution systems. This project is designed to demonstrate a smart and integrated transactive energy (TE) network that will allow DERs to be integrated technical and financially into electric power systems. This is accomplished by developing a suite of software tools, referred to as GridOS, that efficiently and optimally connect the various components of the grid together, creating a TE network that uses technical and economic signals to manage the exchange of electricity within an electric power system. The project will demonstrate a TE network for Emera Nova Scotia Power in a feeder-based microgrid (featuring wind resources and a residential microgrid), at Emera Maine's control and operating system, and at Toronto Hydro's energy monitoring and control centre.

Consortium Members:

- Opus One Solutions Energy Corp.
- Advanced Microgrid Solutions
- Emera Maine
- Nova Scotia Power Inc.
- Ryerson CUE-Toronto Hydro
- Smarter Grid Solutions
- Toronto Hydro

Saltworks Technologies Inc.

Environmental Benefits:  Clean Water

Total Project Value:
\$12,000,000

SDTC Funding:
\$4,000,000

Leveraged Funding:
\$8,000,000

Increasingly stringent discharge regulations are forcing municipal wastewater treatment plants (WWTP) and industrial operations to treat ammonia in their effluents prior to discharge. Ammonia contaminates local bodies of water, causing algae blooms that destroy aquatic life. Conventional ammonia treatment methods are largely biological with high footprint requirements and operational sensitivities. Saltworks Technologies has developed an ammonia removal technology called the Ammonia Splitter that can either permanently destroy the ammonia to benign nitrogen gas or produce a valued fertilizer by-product without sensitivity to temperature or salinity. The Ammonia Splitter builds off Saltworks' ElectroChem advanced electrodialysis platform with ammonia tuned membranes and proprietary processing and controls. The Ammonia Splitter is a compact and modular system that can bolt on to existing plants. In this project, Saltworks and its consortium partner, EPCOR, will build upon the success of a lab scale Ammonia Splitter pilot treating WWTP centrate and landfill leachate. The project will build and dispatch a 0.2 m³/day pilot plant for on-site testing and business development at multiple facilities. A larger 100 m³/day demonstration plant will then be built and dispatched to a site with the most compelling commercialization pathway.

Consortium Members:

- Saltworks Technologies Inc.
- EPCOR



SECTION 3: SD Tech Fund – Projects Announced

Hatch

Environmental Benefits:  Climate Change  Clean Air  Clean Water

Total Project Value:
\$1,700,900

SDTC Funding:
\$561,200

Leveraged Funding:
\$1,139,700

There are over 1,500 industrial blast furnaces worldwide, from which flows an estimated 1100 Mt/y of pig iron and 275Mt/y of slag. (Slag is the stony waste matter separated from metals during the smelting or refining of ore.) Blast furnace slag can be granulated then ground to produce a one-to-one replacement for cement, resulting in significant reductions in greenhouse gasses resulting from the cement production. Conventionally, granulated blast furnace slag (GBFS) is produced using a process called water granulation. However, the effectiveness of water granulation is limited by a variety of factors. Hatch and its partners have demonstrated in lab scale experiments that a dry air-atomization process can also produce a cementitious material from blast furnace slag, at significantly lower capital and operating costs. It also entirely avoids water-related issues such as scarcity, freezing, explosions, and liquid waste. Ultimately this technology has the potential to increase the production of ground granulated blast furnace slag (GGBFS) to offset cement production and the associated CO₂ emissions. This project will investigate the viability of the technology at a pilot scale through trials at an operating blast furnace plant.

Consortium Members:

- Hatch Ltd.
- Ecomaister Co. Ltd.
- SSAB Merox AB

Illusense

Environmental Benefits:  Climate Change

Total Project Value:
\$4,809,936

SDTC Funding:
\$1,600,000

Leveraged Funding:
\$3,209,936

Current technologies for in-line inspection of oil and gas pipelines use magnetic and ultrasonic approaches to assess the health of the pipeline. These approaches share two major technology gaps that limit their overall effectiveness: they have difficulty detecting small features—those smaller than one square centimetre—and they do not accurately assess dents, welds and other internal protrusions because sensors must remain in contact with the pipe wall. Dent detection and characterization is important because dents are points of weakened material and pose higher risk of future failures. Illusense has developed a laser-based technology that provides a high resolution scan of the pipeline's interior surface. Illusense's technology is a novel, optical approach that provides pipeline operators with an entirely new perspective of their assets. The key benefit of Illusense's technology is that it capitalizes on these information gaps from incumbent technologies, allowing a complementary fit with current approaches used in the industry today. Pipeline operators can increase the confidence in their assessments with the addition of Illusense's technology. In this project, Illusense proposes to develop, test and demonstrate the first generation of the Illusense technology primarily for use in pipelines transporting natural gas or refined products like gasoline or diesel. Prototypes developed with the help of Microline will be tested at either Kinder Morgan's or Microline's testing facilities, and followed with live pipeline test runs. The Illusense technology will allow pipeline operators to better prioritize repairs and reduce the likelihood and potential environmental impact of failures and leaks.

Consortium Members:

- Illusense
- Inter Pipeline
- Kinder Morgan Canada
- Microline Technology Corp.



SECTION 3: SD Tech Fund – Projects Announced

Advonex International

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$12,881,697

SDTC Funding:
\$4,250,960

Leveraged Funding:
\$8,630,737

Typical automotive and industrial lubricants consist of a petroleum-derived base oil and various additives. In the next five years, it is anticipated that new, more rigorous environmental regulations will be applied to the automotive industry that will include improving fuel economy through the use of lower viscosity, more durable lubricants. Advonex has developed a patented technology that uses low-voltage electrolysis to produce a base oil from plant-based oils. The Advonex base oil is similar in performance to synthetic base oils, and according to preliminary testing, could improve fuel economy by approximately 2% and still be cost competitive with synthetic base oils. Advonex is proposing to scale its electrolysis technology from laboratory scale to a one-tonne-per-day pilot scale using soybean oil and corn oil supplied by consortium partners Minnesota Soybean Processors and Greenfield Specialty Alcohols. Valvoline will incorporate Altra-BASE into new lubricant formulations and secure certification for future commercialization, while consortium partner Queen's University will assist with engineering design.

Consortium Members:

- Advonex International
- Greenfield Specialty Alcohols Inc.
- Minnesota Soybean Processor (MnSP)
- Valvoline division of Ashland Inc.

e-Zn Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$1,535,045

SDTC Funding:
\$700,000

Leveraged Funding:
\$835,045

Toronto-based e-Zn has developed an electrochemical reactor technology, for storing electrical energy in zinc metal. Due to the low cost of zinc and its unique design, e-Zn's innovative technology allows for very economical energy storage. With application capabilities beyond conventional batteries at a price competitive with the least expensive forms of bulk energy storage, it offers superior flexibility of scale and deployment. The e-Zn reactor is a uniquely structured cell with three distinct sections for energy absorption (charging), energy delivery (discharging) and energy storage. The technology offers many advantages over conventional rechargeable batteries, including a low cost of capacity scaling, an inherently long life with no capacity fading and improved safety. As part of this project, e-Zn will scale up its 20-watt-per-500-kilowatt-hour prototype reactor to a demonstration-level, energy storage system rated at one one kilowatt per 24 kilowatt-hours.

Consortium Members:

- e-Zn Inc.
- Broy Engineering
- Canadian Solar
- Newesoalr

Sepro Mineral Systems

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$1,339,088

SDTC Funding:
\$440,000

Leveraged Funding:
\$899,088

Sepro Mineral Systems is developing a centrifugal gravity concentration technology that will allow mining companies to reject non-valuable minerals early in the mineral-separation process. The resulting energy and water savings will help to significantly reduce the environmental impact of mining activities. After raw ore is crushed in a mining operation, Sepro's Continuous Gravity Concentration Technology (CGCT) will separate valuable particles from waste particles, based on their size and weight. Sepro's CGCT focuses on fine particle pre-concentration of an optimum size (in the range of 10 to 1000 microns), which allows for only the valuable particles ready for processing to be introduced into the next stage of the system. This effectively diverts waste products away from the processing stream, saving energy, chemicals and water; and reduces the subsequent need for future contaminated tailings disposal. In this project, Sepro will design, build and validate a 100-tonnes-per-hour, commercial-scale, pre-concentration system at the New Gold mine.

Consortium Members:

- Sepro Mineral Systems
- New Gold



SECTION 3: SD Tech Fund – Projects Announced

Aeponyx Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$5,616,961

SDTC Funding:
\$1,900,000

Leveraged Funding:
\$3,716,961

AEPONYX, a leading North American telecommunications equipment manufacturer, has developed a low-cost, optical, micro-electrical-mechanical-system (MEMS) switch that costs one tenth of legacy optical switches, and operates one hundred times faster on switching time. The optical switch consumes less than one tenth of the power the incumbent electrical switch currently uses in data centres and telecommunications applications. AEPONYX and its manufacturing partners are proposing to design, test and fabricate optical circuit switching (OCS) modules that can be packaged with optical amplifiers and custom-control circuitry. The modules will be tested by consortium members Mellanox, Ericsson, Fiber Mountain and USIS with the goal of demonstrating the required optical performance for data centre and cellular-base-station applications at a lower power consumption cost than that of current electrical switching technology. The use of these OCS modules is expected to lead to reduced electricity use in data centres and cell networks, with a corresponding reduction of greenhouse gas emissions.

Consortium Members:

- Aeponyx Inc.
- C₂MI – Centre de collaboration MiQro Innovation
- Centres of Excellence for Commercialization and Research (CECR)
- Creativite Quebec Program
- Ericsson
- Fiber Mountain Inc.
- Mellanox Technologies Inc.
- Silicon Catalyst
- U.S. Information Systems Inc.

Schneider Electric - Solar

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$9,015,928

SDTC Funding:
\$1,803,186

Leveraged Funding:
\$7,212,742

Schneider Electric's SmartESS (Smart Energy Storage Solution) platform is a transformer-less, all-in-one, wall-mounted inverter combining a hybrid battery and solar photovoltaic (PV) inverter. The platform has been designed to address the power and energy needs of residences, small commercial businesses, off-grid communities and energy service providers. It integrates solar PV panels, lithium-ion energy storage batteries, and home electricity usage control and monitoring with a utility interface that provides visibility to the local utility and enables smart-grid functionality. For this project, Schneider Electric—with consortium partner Rainforest Automation providing cloud connection services—is proposing the development and demonstration of SmartESS on the T'Sou-ke First Nation, on the south shore of British Columbia's Vancouver Island. The project is targeting to develop an integrated solution with inverter, lithium-ion battery storage, balance-of-system, and communication technology that provides increased performance, reliability, and simplicity at a cost lower than existing solutions.

Consortium Members:

- Schneider Electric - Solar
- Rainforest Automation
- T'Sou-ke First Nation

DarkVision

Environmental Benefits:  Climate Change  Clean Air  Clean Water

Total Project Value:
\$9,250,764

SDTC Funding:
\$3,000,000

Leveraged Funding:
\$6,250,764

Led by an experienced team of entrepreneurs, DarkVision has developed a new ultrasonic-based downhole imaging technology that gives oil and gas operators the ability to view the inside components of their wells with high resolution and clarity. The technology enables operators to identify problems inside the wellbore with precision and confidence, and unimpeded by wellbore fluids. Working with its consortium partners, DarkVision will demonstrate the field-readiness of the technology by imaging a wide variety of wells during the project, allowing its partners to accurately identify problems such as problematic casing connections, cracks, sand-screen damage, scaling, erosion, corrosion, flow-control device degradation and other downhole problems that negatively impact production efficiency and lead to well failures. The environmental benefits come from providing operators a better feedback loop, allowing them to make more effective maintenance decisions that reduce emissions, optimize production and minimize failures in their wells.

Consortium Members:

- DarkVision
- Cenovus Energy Inc.
- Suncor Energy Inc.



SECTION 3: SD Tech Fund – Projects Announced

Rockport Networks Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$13,509,853

SDTC Funding:
\$4,635,000

Leveraged Funding:
\$8,874,853

Data centers are experiencing rapid growth due to increasing data storage, cloud computing, and Big Data analytics. Today's networking equipment cannot scale to accommodate these new requirements without the addition of significant cost and complexity to the customer. Rockport's RX1000 Direct Interconnect networking product is a high-performance photonic solution in which data center servers communicate directly with one another, eliminating the need for physical switches and reducing power consumption by 10X or more and contributing to a reduction of 23MT in GHG emissions, within eight years of market rollout. This technology presents a strong economic value proposition for customers, representing a capital expense savings of at least 4X savings compared to existing technology from incumbent vendors. Rockport creates ongoing operational cost savings of greater than 5X compared to traditional vendors, due to lower power consumption, reduced floor space requirements and lower maintenance costs. Rockport's product introduces three key innovations to data center networking: direct server interconnection and the elimination of physical switches; the use of emerging photonic switching technology to route network traffic and advanced software and hardware control to manage the flow of data. The new technology will provide improved performance, increased reliability and scalability, and reduced electricity consumption and cooling requirements. Consortium partner, the University of Ottawa, is working on the simulation and characterization of various aspects of the technology. Consortium partner Molex will help develop the hardware required to implement RX1000, while consortium partner Seagate Technology will provide input on system requirements and technology demonstration opportunities. Finally, ThinkOn, a Toronto-based cloud services provider, will participate as a demonstration host for the technology in a datacentre application. Validation and Development Partners: Micron Technology, University of Toronto.

Consortium Members:

- Rockport Networks Inc.
- Micon Technology
- Molex Inc.
- Seagate Technology
- ThinkOn
- University of Ottawa
- University of Toronto

ARDA Power

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$1,123,550

SDTC Funding:
\$400,000

Leveraged Funding:
\$723,550

Power comes in two forms: alternating current (AC) and direct current (DC), each having its own applications and benefits. While the predominant form of electricity usage today is AC, both renewable sources including solar and fuel cells, and an increasing number of loads including LED lighting, high efficiency HVAC, data centers and electric vehicles are DC. In addition the distributed nature of these sources and loads requires increased use of distributed storage, such as lithium and flow batteries, that are also DC. The future interconnection of these DC sources, loads and storage will inevitably involve DC microgrids, where the costs, complexity and losses associated with AC grid connections are eliminated. ARDA Power is developing an innovative technology designed for commercial and industrial sites that can benefit from the use of flexible and scalable DC microgrids. Compared to other DC microgrid technologies, the plug-and-play nature of ARDA's solution will result in a significant reduction of non-recurring engineering costs required for the design of a new system while preserving all of the cost and efficiency benefits of DC. This project will provide a proof-of-concept for the ARDA DC Microgrid system, demonstrating its plug-and-play nature via the use of standardized components, as well as its efficiency, its resiliency—in the form of back-up generation and extended battery storage—and its ability to shift AC grid load and operate on a stand-alone basis in the event of conventional grid failure.

Consortium Members:

- ARDA Power Inc.
- Etratech Inc.
- Gildemeister Energy Solutions GmbH
- Swan Creek Energy LLC



SECTION 3: SD Tech Fund – Projects Announced

Smart Pipe Company Canada Inc.

Environmental Benefits:  Climate Change

Total Project Value:
\$7,162,756

SDTC Funding:
\$2,363,709

Leveraged Funding:
\$4,799,047

Transmission pipelines are the large-diameter, high-volume energy highways that transport oil and natural gas over long distances between refining, processing, storage and distribution facilities. These pipelines are very safe, but when problems start to appear, sections of pipe may need to be replaced to ensure pipeline integrity and prevent failure. The traditional way to do this is simply to dig and replace with new steel pipe, but that is not so simple when it disrupts communities, damages the environment or stops the flow of a major pipeline artery. Smartpipe® is an alternative to traditional pipeline replacement. It is a self-monitoring composite pipe, with on-board fiber optic and communications systems, that can replace a corroded or compromised pipeline from the inside, without the need to excavate the entire pipeline. The Smartpipe® system is manufactured at the project site using a patented portable factory that allows for very long lengths to be simultaneously manufactured and installed, reducing expensive construction costs, downtime and the above-ground disruption that typically accompanies pipeline replacement. The degraded steel pipeline is replaced with a non-corroding composite Smartpipe® that is monitored 24/7 for leaks, ground movement and approaching third-party intrusion, identifying the nature and location of the problem within one meter. Smart Pipe Company Canada currently offers its pipeline system in smaller diameters; this project will apply its technology to the larger-diameter pipelines used by oilsands producers.

Consortium Members:

- Smart Pipe Company Canada Inc.
- Enbridge

Nano One Materials Corp.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$5,976,932

SDTC Funding:
\$2,081,297

Leveraged Funding:
\$3,895,635

One of the largest barriers to full-scale electric vehicle adoption is cost—and batteries are largely responsible for that. Nano One Materials Corp. is developing a battery materials production process that improves the energy-storing performance and cost of materials used in lithium ion batteries. The technology produces longer lasting materials, simplifies manufacturing, uses lower cost feedstock, brings production costs down by as much as 50% and uses less energy in the process. Nano One has been granted key patents covering methods and applications of its technology and has others in the queue. This project includes the construction of a pilot plant and the operation of that plant to refine the process to the point that Nano One will be able to demonstrate and license its technology for commercial-scale facilities.

Consortium Members:

- Nano One Materials
- BCRI

QD Solar Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$8,065,050

SDTC Funding:
\$2,550,000

Leveraged Funding:
\$5,515,050

A large portion of the available energy in sunlight that hits conventional solar panels is wasted because the silicon solar cells utilized in these panels cannot capture the sun's infrared light energy. QD Solar's solar cells use nano-engineered, low-cost materials able to absorb infrared light. Implementation of QD Solar's technology into solar panels in combination with conventional solar cells boosts the overall power generation by 20%. This project will advance the development of QD Solar's solar cells, and develop and scale up the manufacturing processes needed to economically bring this technology to market.

Consortium Members:

- QD Solar Inc.
- Northland Power
- University of Toronto



SECTION 3: SD Tech Fund – Projects Announced

Netlift Transport Social Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$1,346,022

SDTC Funding:
\$448,000

Leveraged Funding:
\$898,022

Carpooling could be a meaningful way to take cars off the road and reduce related GHGs and air pollution, but it's not always flexible for commuters. Mass transit has the same potential for the environment and is more flexible, but can be impractical. Netlift's technology combines the best of both worlds: Netlift is a platform that can recommend a combination of carpooling and mass transit to get commuters to their destination in the way that suits them best—depending on the start and end point of their journey, their willingness to walk, and other factors. Their algorithm (and its cell-phone app) optimizes journeys involving both private vehicles and public transit, to offer rides that approach the flexibility of driving, but at a fraction of the cost. With this project, Netlift seeks to refine its tool by market testing a specified test region (Montreal).

Consortium Members:

- Netlift Transport Social Inc.
- Nventive Inc.
- Société de Transport de Laval
- Société de Transport de Longueuil
- Société de Transport de Montréal

Loop Energy Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$23,164,070

SDTC Funding:
\$7,500,000

Leveraged Funding:
\$15,664,070

It will be impossible to reach international emission reduction goals without implementing solutions for heavy duty trucking, which represents 4% of total vehicles in North America, yet accounts for 20% of the fuel consumed, translating into the lion's share of emissions in the transportation industry. Loop Energy Inc. will produce a heavy duty Class 8 truck that delivers zero emissions with performance and attributes that operators demand. The Loop system combines an EV battery with a hydrogen fuel cell designed around their patented e-Flow technology to deliver superior performance to diesel engines at a lower total cost of ownership. Battery power alone is inadequate due to its limited range. This project will first develop the Loop powertrain and then demonstrate it through real-world testing with consortium partners.

Consortium Members:

- Loop Energy Inc.
- Peterbilt
- Port of Long Beach

Nsolv Corp.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$84,311,075

SDTC Funding:
\$13,000,000

Leveraged Funding:
\$71,311,075

Nsolv has developed a cleaner solution to the environmental and economic challenges of heavy oil production. It produces a higher quality oil product while significantly reducing energy inputs and greenhouse gas emissions. Proven technologies such as Nsolv's can lead a transformation in the oil and gas industry, which is what is needed for Canada to meet its climate change goals. The Nsolv technology is a made-in-Canada, patented process that uses a warm solvent rather than water for heavy oil extraction. This significantly reduces greenhouse gas emissions by about three fourths when compared to traditional extraction methods. The technology was developed with previous support from SDTC and has met with success in the field via the B.E.S.T. (Bitumen Extraction Solvent Technology) pilot project in the Athabasca oil sands region. The next crucial step for Nsolv is the commercialization of the solvent technology, which begins with the development of a commercial demonstration facility. This facility will be a 15X scale-up of the pilot project and is expected to produce 2,500 barrels per day of cleaner and more valuable Canadian oil.

Consortium Members:

- Nsolv will partner with a major heavy oil producer on the commercial demonstration facility.



SECTION 3: SD Tech Fund – Projects Announced

ASE Smart Energy Inc.

Environmental Benefits:  Climate Change  Clean Air  Clean Water

Total Project Value:
\$709,688

SDTC Funding:
\$300,000

Leveraged Funding:
\$409,688

Ottawa-based ASE Smart Energy Inc. (ASE) is a leading manufacturer of open smart home energy and comfort management solutions for the residential and hospitality markets. ASE provides scalable, fully wireless, easy-to-operate and cost-effective virtual multi-zone solutions that improve comfort while minimizing energy consumption. RetroSave, the ASE's patented technology system interoperates seamlessly with any COTS in-home HVAC appliances and thermostats. ASE solutions enable the collection and analysis of a building's environmental data and its energy-usage patterns. Collected data can be used to help utilities to more effectively cope with peak loads through their demand-side management programs. Government-led energy conservation programs can also benefit from the mass deployment of ASE solutions. HVAC service providers can take advantage of the RetroSAVE capabilities to better manage and upsell their customer base with new services that will cut down or even eliminate HVAC system downtime. ASE-developed hospitality controllers and sensors are already installed in thousands of hotel rooms throughout North America while residential RetroSave systems for buildings with Central Forced Air (CFA) are in commercial trials in several major Ontario cities.

Consortium Members:

- ASE Smart Energy Inc.
- Hydro Quebec
- The Centre of Excellence in Energy Efficiency

FORGE-Sombra Corp.

Environmental Benefits:  Climate Change

Total Project Value:
\$11,876,980

SDTC Funding:
\$4,201,814

Leveraged Funding:
\$7,675,166

National biofuels mandates are a good way to get biofuels in the tanks of cars all over the country, but to date, petroleum companies have complied with these mandates by blending in green fuels such as ethanol and biodiesel. Biofuels developers are still trying to pursue a true drop-in biofuel—that is, a fuel, made from biomass, that is chemically indistinguishable from petroleum-based fuel, and, therefore, directly compatible with currently used fuel infrastructure and engines. FORGE Hydrocarbons Corp. is developing a technology that transforms low-value fats, oils and greases into fuel. The objective of this project is to continue the accomplishments of the 200,000-litre-per-year pilot plant, which was supported by investments from Western Economic Development Canada and Alberta Livestock and Meat Agency Ltd. with the construction of a pre-commercial demonstration plant. The first of its kind in Canada, this lipid-to-hydrocarbon plant will produce renewable liquid hydrocarbons with a production capacity of 19 million litres per year.

Consortium Members:

- FORGE Hydrocarbons Corp.
- BIOX Corp.
- IGPC Ethanol Inc.
- JointVentureCO

May-Ruben Thermal Solutions Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$2,522,802

SDTC Funding:
\$832,000

Leveraged Funding:
\$1,690,802

Heating and cooling account for as much as 72% of the commercial building sector's total energy use, however, the tools used to heat and cool are very inefficient, producing significant amounts of waste heat. One way to increase energy efficiency is to combine heating and cooling with energy production, so that waste heat can be converted into energy in a single unit—a combined cooling, heating and power (CCHP) plant. May-Ruben Thermal Solutions is working on a technology (a binary fluid ejector) that integrates and enables these efficient CCHP plants, which result in lower operating and maintenance costs, while enabling energy savings of up to 60%. This project will scale up the technology from its current size to a commercial scale prototype. Note: The funding from SDTC for this project includes funds from the Canadian Gas Association.

Consortium Members:

- May-Ruben Thermal Solutions
- DuPont
- Ecologix
- GTI
- University of Calgary



SECTION 3: SD Tech Fund – Projects Announced

General Fusion Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$38,971,362

SDTC Funding:
\$12,748,560

Leveraged Funding:
\$26,222,802

General Fusion is developing fusion energy, a potentially transformational technology for the energy industry: a safe, limitless, clean, emission-free and cost-effective alternative for power generation. General Fusion's proprietary Magnetized Target Fusion (MTF) technology represents the fastest, most practical and lowest-cost path to commercial fusion power. This project will construct and demonstrate, at power-plant scale, the primary subsystems and physics underpinning General Fusion's technology. Simulation models will be tuned and used to complete the design of the world's first full-scale fusion energy system using commercially viable technology. This verification of the technical and economic viability of General Fusion's MTF technology will be a major milestone for this game-changing technology.

Consortium Members:

- General Fusion Inc.
- Hatch Ltd.

Syscor Controls & Automation Inc.

Environmental Benefits:  Clean Soil

Total Project Value:
\$5,035,294

SDTC Funding:
\$1,793,838

Leveraged Funding:
\$3,241,456

Every day, three million barrels of crude oil are transported through Canada's pipelines to domestic and foreign markets. While pipelines are the safest and most environmentally friendly way of transporting oil over long distances, leaks do occur; high reliability leak detection systems with low false-alarm rates can play a vital role in quickly identifying and addressing such problems. Syscor Controls & Automation is developing a leak-detection sensor cable designed to retrofit existing pipelines. Highly sensitive and easy to install, the technology will enable early and accurate detection of leaks, allowing operators to respond quickly.

Consortium Members:

- Syscor Controls & Automation Inc.
- Colonial Pipeline Company
- Enbridge Employee Services Canada Inc.
- Pipeline Research Council International
- TransCanada Pipelines Ltd.

Comet Biorefining Inc.

Environmental Benefits:  Climate Change  Clean Water

Total Project Value:
\$40,317,895

SDTC Funding:
\$10,890,000

Leveraged Funding:
\$29,427,895

Bio-based products can potentially replace petro-based products in a range of industries, improving sustainability through the reduction of greenhouse gas emissions. Comet Biorefining's proprietary technology converts non-food biomass, such as agricultural and forest material, into high-purity dextrose sugar. The sugar can be transformed into a range of renewable chemicals and biomaterials and valuable byproducts from the process can be used for animal nutrition and performance chemicals. Involving industry leaders across the supply chain, such as SDTC-funded BioAmber, this project will build a 200-tonnes-per-day demonstration facility to test the technology and develop upstream and downstream partnerships for large-scale commercialization.

Consortium Members:

- Comet Biorefining Inc.
- BioAmber
- Domtar
- UPM



SECTION 3: SD Tech Fund – Projects Announced

Terrestrial Energy Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$18,868,947

SDTC Funding:
\$5,739,167

Leveraged Funding:
\$13,129,780

The emerging energy priority, in Canada and globally, is for the development of clean, dependable and economic energy sources that replace fossil fuel combustion in industrial heat and electrical power provision, both on- and off-grid. Terrestrial Energy Inc. is developing a new form of nuclear energy to address this priority: the Integral Molten Salt Reactor (IMSR). The IMSR is an advanced nuclear reactor that uses a liquid fuel—nuclear fuel dissolved in molten salt. This liquid nuclear fuel method is entirely different from that used in conventional nuclear reactors, which all use the traditional solid fuel approach. With a liquid nuclear fuel, IMSR achieves high passive safety (for example, it cannot melt down); it is more fuel efficient, more waste efficient and could in the future consume virtually all of its own long-lived waste as well as that of other reactors. Importantly, it is cost-competitive with fossil-fueled power plants. Furthermore, the IMSR has a much broader set of industrial applications due to its high operating temperatures and small modular format. It can service remote off-grid communities as well as large-scale power grids. It can provide heat to industry—desalination plants, for example, or to chemical plants, for the production of hydrogen or fertilizers. This SDTC-supported project will consist of two phases: the construction of an operational, non-nuclear, IMSR core-unit system, and the continuation of laboratory studies to inform reactor component and material selection for the subsequent fully nuclear demonstration plant. Construction of the nuclear operation will incorporate the data and experience derived from this SDTC project.

Consortium Members:

- Terrestrial Energy Inc.
- Caterpillar Inc.
- Lockheed Martin

Cellufuel Inc.

Environmental Benefits:  Climate Change

Total Project Value:
\$6,523,330

SDTC Funding:
\$2,152,693

Leveraged Funding:
\$4,370,637

A drop-in biofuel—made from biomass that is chemically indistinguishable from petroleum-based fuel and compatible with currently used fuel infrastructure and engines—has been difficult to produce. Cellufuel's catalytic depolymerisation technology converts wood into renewable diesel that meets the quality of petroleum diesel. This project will build a demonstration-scale plant at a former newsprint mill, demonstrating the commercial viability of the process, including the production cost and product quality.

Consortium Members:

- Cellufuel Inc.
- Boralex Inc.

NextGrid Inc.

Environmental Benefits:  Climate Change

Total Project Value:
\$753,306

SDTC Funding:
\$300,000

Leveraged Funding:
\$453,306

Businesses and consumers in North America depend on a patchwork of local providers to deliver electricity through what has become commonly known as the “grid”. This centralized model of delivering electricity to consumers is broken and the American Society of Engineers estimates that a \$673-billion investment by 2020 will be required to fix the national grid in the United States. The result of this investment will be a steady increase in the price of electricity for consumers for years to come. To combat rising electricity prices, NextGrid Inc. proposes to decentralize electricity production. NextGrid's combined heat and power (CHP) system is a revolutionary platform (patent pending) that uses a micro-steam turbine to generate heat and electricity; the generators are the most fuel-efficient in the world with up to 95% of all fuel used converted to heat and/or electricity. NextGrid's CHP technology can substantively lower our carbon footprint, with NO_x emissions at an industry leading 0 PPM to 3 PPM and a predicted 47% reduction in GHG emissions when compared to incumbent technologies. Note: The funding from SDTC for this project includes funds from the Canadian Gas Association.

Consortium Members:

- NextGrid Inc.
- Delafield PTY
- Green Turbine V
- Ozz Energy



SECTION 3: SD Tech Fund – Projects Announced

Imtex Membranes Corp.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$10,112,395

SDTC Funding:
\$3,336,960

Leveraged Funding:
\$6,775,435

Olefins are products derived from petroleum and natural gas that are used in plastics all over the world. Purified olefins are produced by separating them from other hydrocarbon components: this separation process is currently the most energy-intensive step in the olefin production process. Imtex Membranes' membrane technology, which allows specific olefins to pass through while restricting other gases, could change that by being dramatically more energy efficient, reducing GHGs and air contaminants by up to 90% compared to the currently used technology. The project will demonstrate the technology under industrial conditions, exposing it for several months of operation and in different volumes over the life of the project.

Consortium Members:

- Imtex Membranes Corp.
- Borealis AG
- Monteco Ltd.

Sherbrooke OEM Ltd.

Environmental Benefits:  Climate Change  Clean Soil

Total Project Value:
\$3,993,316

SDTC Funding:
\$1,275,000

Leveraged Funding:
\$2,718,316

Most of recycled plastics are optically sorted using near-infrared technology to identify plastics by category. However, because the color black absorbs lights, black plastics don't respond well to this technology, making these products almost impossible to be identified and sorted. As black plastic makes up 20% of total plastic waste streams, a solution must be found to prevent these products from going to the landfill or incineration. Sherbrooke OEM's innovative optical-sorting unit will be able to identify and separate different polymers and material without color distinction, applying this process to all plastics including those that are black in colour. This project will see the design, construction and demonstration of an industrial-scale system.

Consortium Members:

- Sherbrooke OEM Ltd.
- Eagle Vizion
- Plastimum s.e.n.c
- Valoris

Ronin8 Technologies Ltd.

Environmental Benefits:  Climate Change

Total Project Value:
\$1,484,313

SDTC Funding:
\$300,000

Leveraged Funding:
\$1,184,313

Every year, between 20 million metric tonnes and 50 million metric tonnes of electronic waste are generated globally. The US alone discards 14 million to 20 million personal computers every year with 80% of "recycled" e-waste sent to developing countries where the plastic components are burned to extract metals, releasing toxic chemicals into the atmosphere. Ronin8's proprietary technology recovers high-value metals from e-waste, particularly printed circuit boards (PCBs), using a combination of electromagnets, water and sonic vibrations. In the process, circuit boards are disassembled and ground. Ronin8's powerful, low-frequency sonic reactor then separates metals from non-metals in a closed-loop environment. Non-metals are recycled to make environmentally friendly products while valuable metals are recovered and sorted. All of the process materials (water and solvents) are then cycled back and used for the next batch of e-waste. Ronin8's technology has considerable cost and environmental advantages over the incumbent technology (i.e., smelters) and offers a sustainable, economically viable solution—the recovered highly pure metal streams are expected to generate \$14 of revenue per kilogram of PCB input—for e-waste management.

Consortium Members:

- Ronin8 Technologies Ltd.
- Provectus Engineered Materials
- Sacre Davey Engineering



SECTION 3: SD Tech Fund – Projects Announced

DoodleLabs

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$8,777,762

SDTC Funding:
\$2,879,925

Leveraged Funding:
\$5,897,837

Lighting uses 15% to 20% of electricity generated worldwide, making efficient lightbulbs a key tool for reducing energy consumption. Doodle created the world's most energy efficient lightbulb and it's taking it even further by connecting it to a low-cost intelligent control platform. The platform allows users to customise lighting based on other conditions, like available sunlight or desired lighting aesthetics. The combined features of high efficiency lighting and great light quality meet the needs of users in the merchant and hospitality sectors, where the systems can eventually displace inefficient halogen lighting.

Consortium Members:

- Doodle Labs Inc.
- Impact Centre
- MaRS Cleantech
- Mercatto
- NRC Institute for Research in Construction
- University of Toronto Ancillary Services

Teck Resources Ltd.

Environmental Benefits:  Climate Change  Clean Air  Clean Water  Clean Soil

Total Project Value:
\$8,101,975

SDTC Funding:
\$2,673,652

Leveraged Funding:
\$5,428,323

Smelting of copper concentrates containing arsenic forms potentially hazardous, arsenic containing byproducts. Large copper resources containing arsenic risk being under-explored and undeveloped due to safety, environmental and technical challenges posed by arsenic during the copper recovery process. Further, 10% of all copper concentrates produced in 2014 had more than 0.2% arsenic, and are thus limited in where they can be processed due to import restrictions by various countries and regions. These restrictions are similar to an outright ban on the import of copper concentrates into China with more than 0.5% arsenic, which has the potential to be further reduced as environmental and societal pressures on current resource development practices increase. Teck Resources Ltd. and Aurubis AG are developing a technology that uses a hydrometallurgical process to refine arsenic-bearing copper concentrates, a product of the mining and concentration process, which avoids smelting altogether, and results in no untreated or harmful effluent streams or emissions. This project will complete pilot-level testing for refining concentrates containing up to 12% arsenic with a reduction of up to 40% in energy consumption and 81% in fresh water consumption versus smelting. This will help fulfill the world's growing copper consumption needs in an environmentally sound and sustainable manner.

Consortium Members:

- Teck Resources Ltd.
- Aurubis AG

Quantiam Technologies

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$16,230,148

SDTC Funding:
\$4,250,000

Leveraged Funding:
\$11,980,148

Hydrocarbons must be heated to extremely high temperatures to produce a petrochemical product called olefins, which can be made from shale-gas constituents and find their way into everyday use in plastics and other products. But when heated to that degree, hydrocarbons create an unwanted side-product called coke, which plugs up the furnace tubes used in their production, and interferes with the energy efficiency and profitability of the operation. With SDTC support, Quantiam has already commercialized a product that helps a segment of the industry: an anti-coking, furnace-coating technology. But with shale gas now revolutionizing the global petrochemical sector with high growth in North America, the demand persists for greater performance under even higher temperatures. Quantiam is pursuing another project with SDTC that will see its technology applied to even higher temperatures and operating severities. The end result will be a reduction of overall energy requirements and GHG emissions by as much as 14%.

Consortium Members:

- Quantiam Technologies
- BASF Qtech Inc.
- BASF SE - Petrochemicals



SECTION 3: SD Tech Fund – Projects Announced

Sigma Energy Storage Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$8,467,469

SDTC Funding:
\$2,736,068

Leveraged Funding:
\$5,731,401

Renewable power has the potential to reduce the use of diesel, which in turn reduces greenhouse gas emissions, emissions. However, renewable power is generated in fits and bursts depending on wind, tide, water flow or sunlight. Technologies that enable this intermittent power to be stored and made available when needed allow renewable energy to be better integrated into the conventional grid. Sigma Energy Storage has developed and designed a portable and climate-resistant Compressed Air Energy Storage (CAES) system that integrates a proprietary thermal recovery system to store energy and distribute it easily and efficiently through the use of a specially formulated thermal fluid that includes nanotechnology. The project follows Sigma's successful production of a small-scale alpha prototype and features the production and use of a full-scale, 500-kilowatt-per-two-megawatt-hours beta prototype, which can ultimately be scaled up or down as needed for various applications.

Consortium Members:

- Sigma Energy Storage Inc.
- Beacon 406
- Hatch Ltee
- Hydro-Quebec Research Institute
- Natural Resources Canada CANMET Energy
- Ville de Sherbrooke (Hydro Sherbrooke)
- Wind Energy Technocentre

Pyrowave Inc.

Environmental Benefits:  Climate Change  Clean Soil

Total Project Value:
\$3,130,327

SDTC Funding:
\$1,048,474

Leveraged Funding:
\$2,081,853

Recycling is a major component of environmental responsibility, yet the costs to haul, store, sort and process plastics are enormous. Pyrowave's technology uses a patented technology that breaks down plastics using the high heat produced by microwaves. This technology is packaged in small, modular units directly units and installed directly onsite at plastic-waste producers and recycling facilities. This convenient and mobile approach will enhance the rate and range of recyclable materials, and will produce higher-value end products from waste plastics—products such as wax, oil and styrene monomer. The result is a technology that reduces waste landfilling, waste incineration and waste hauling via a net-positive energy process. This project will produce a proven commercial-scale application of the technology.

Consortium Members:

- Pyrowave Inc.
- Greencentre Canada
- Total Petrochemicals

DMF Medical Inc.

Environmental Benefits:  Climate Change  Clean Air

Total Project Value:
\$1,635,575

SDTC Funding:
\$686,575

Leveraged Funding:
\$949,000

For many surgical procedures, general anesthesia is required to keep patients sedated. General anesthesia however, requires the use of vapors that are significant contributors to greenhouse gases (GHG). Current chemical absorbers used to safely deliver anesthesia require the release of a portion of these harmful vapors into the atmosphere. DMF Medical has developed a next-generation, chemical-free solution to address this issue. This solution significantly reduces GHG emissions, while providing best-in-class clinical outcomes. The result is a reduction in the use of costly anesthetic vapor, detrimental emissions and the elimination of hazardous chemical waste. The benefits include reduced operating costs, improved environmental footprint and better clinical outcomes. This project, through product optimization and in-patient trials, will demonstrate these improved environmental benefits.

Consortium Members:

- DMF Medical Inc.
- Brain Repair Centre
- Capital District Health Authority Department of Anesthesia
- Membrana GmbH
- University of Edmonton & Alberta Health Services



SECTION 3: SD Tech Fund – Projects Announced

Avalon Advanced Materials Inc.

Environmental Benefits:  Climate Change  Clean Air  Clean Soil

Total Project Value:
\$3,980,697

SDTC Funding:
\$1,313,630

Leveraged Funding:
\$2,667,067

Rare earth elements are a fundamental ingredient in many wide-ranging existing and developing clean and green technologies, but the processes to obtain these necessary ingredients, like with any resource extraction, can come at a cost to the environment. Avalon Rare Metals has developed an efficient, environmentally responsible and yet economically viable method for extracting rare earths from an ore body in Canada's Northwest Territories that is the most advanced, large, heavy-rare-earth project in the world outside of China and is strongly positioned to become a sustainable supplier for the international marketplace. Recently, Avalon has greatly improved the efficiency of recovering these rare earths but the processes involved rely on a number of expensive bulk chemicals. By introducing further technologies, Avalon has also been able to recover and recycle significant quantities of three of the major chemicals used in the process, thereby reducing greenhouse gas (GHG) emissions, lowering volumes of solid tailings and improving waste water quality. The project will soon be demonstrated by a pilot program to be conducted at the Saskatchewan Research Council.

Consortium Members:

- Avalon Advanced Materials Inc.
- Solvay

Quest Rare Minerals Ltd.

Environmental Benefits:  Climate Change  Clean Air  Clean Soil

Total Project Value:
\$14,925,275

SDTC Funding:
\$4,934,504

Leveraged Funding:
\$9,990,771

Rare earth minerals are a key component of many clean technologies, including energy efficient electric motors, light-emitting diode (LED) lights and wind turbines. However, current methods used to mine and process rare earth minerals have repercussions on the natural environment. Quest Rare Minerals has developed a sustainable, energy-efficient process to extract rare earths from mined ore and recycled fluorescent light bulbs. The consortium will demonstrate a novel technology that uses chemical reactions to extract rare earth from granitic ore while minimizing the extraction of unwanted elements all while producing fewer greenhouse gas (GHG) emissions and tailings waste than the current process. The project will scale up the bench scale process to the pilot stage with subsequent commercial production planned at Becancour, Quebec.

Consortium Members:

- Quest Rare Minerals Ltd.
- Helmholtz Institute Freiburg for Resource Technology
- Solvay Rare Earth Systems

Thetis Environmental Inc.

Environmental Benefits:  Climate Change  Clean Air  Clean Water

Total Project Value:
\$2,976,043

SDTC Funding:
\$1,400,000

Leveraged Funding:
\$1,576,043

Water used in many industries can be filtered and re-used, provided that the filtering technology can efficiently operate at high temperatures and produce a clean stream. Polymeric membranes have been proven very reliable for many years, but their inability to handle high temperatures prevented their adoption in demanding applications. Thetis Environmental is developing a new line of highly efficient membrane filtration systems operating at ambient and high temperatures. This new technology is capable of removing soluble oils and smaller impurities compared to incumbent technologies while maintaining a high productivity during continuous service. This project will first see the construction of a pilot plant to produce the membranes followed by the demonstration of those membranes under three different applications (i.e., industrial waste water de-oiling, high temperature liquid/solids separation like thermophilic anaerobic processes and oil-and-gas produced water). ASE, in partnership with SDTC, Hydro Quebec, and C3E, has started the development and testing of new capabilities and features to address electrical base-board, and split HVAC residential and small commercial building systems. ASE will pilot the systems in demonstration facilities as well as residences in the Province of Quebec, in order to optimize peak demand, enhance ventilation and improve the control capabilities. Within five years of the SDTC project completion, ASE projects over \$120 million in revenues and the reduction of more than 800 kTones of GHG emissions (energy conserved) as a result of the broad deployment of its innovative solutions.

Consortium Members:

- Thetis Environmental Inc.
- Aslan Technologies
- H2Flow Equipment Inc.
- Kemira Chemicals
- The Stover Group



SECTION 3: SD Tech Fund – Projects Announced

Liquid Light (Canada) Inc.

Environmental Benefits:  Climate Change

Total Project Value:
\$28,816,613

SDTC Funding:
\$8,585,597

Leveraged Funding:
\$20,231,016

Imagine if carbon dioxide (CO₂) were no longer emitted into the atmosphere and was instead being used to produce goods. That's the idea behind Liquid Light's technology. The company has developed a process that uses waste CO₂ to produce everyday chemicals that find their way into consumer goods like textiles and plastics. The core technology uses electrochemistry to convert CO₂ into a variety of chemicals. The technology will promote carbon capture technologies by creating a demand for CO₂ and can achieve cost savings of up to 25% as compared to petroleum-based products of the same nature. The project will demonstrate the process using CO₂ sourced from industrial waste streams, such as refineries and bio-ethanol plants.

Consortium Members:

- Liquid Light (Canada) Inc.
- BP Alternative Energy International Ltd. (BPAEIL)

Alliance Magnésium Inc.

Environmental Benefits:  Climate Change  Clean Soil

Total Project Value:
\$9,480,585

SDTC Funding:
\$3,000,000

Leveraged Funding:
\$6,480,585

Magnesium could be used in a variety of applications where other heavier metals like steel or aluminum are traditionally used. Alliance Magnesium is developing a novel technology that combines aspects of hydrometallurgy and electrolysis to produce magnesium metal from tailings left over by mining activity. As compared to the incumbent magnesium-extraction method, Alliance's process will reduce greenhouse gas (GHG) emissions, conserve water and reduce the amount of tailings. This project will demonstrate a pilot plant in Asbestos, Quebec.

Consortium Members:

- Alliance Magnésium Inc.
- Institut National de Recherche Scientifique
- Seneca Experts-Conseils Inc.

CO₂ Solutions Inc.

Environmental Benefits:  Climate Change

Total Project Value:
\$7,851,375

SDTC Funding:
\$2,442,000

Leveraged Funding:
\$5,409,375

Conventional amine-based, carbon-dioxide-capture technologies that reduce emissions are costly and toxic. CO₂ Solutions' enzymatic and environmentally benign technology lowers costs by over half by greater energy efficiency. This demonstration project represents an important scale-up step for this technology as it approaches commercialization. As its result, the technology will be made applicable to broad range of commercial CO₂-capture markets, most notably for Enhanced Oil Recovery (EOR) and Carbon Capture and Sequestration (CCS). Note: The funding from SDTC for this project includes funds from the Canadian Gas Association.

Consortium Members:

- CO₂ Solutions Inc.
- Resolute
- Serres Toundra
- Technoclimat



SECTION 3: SD Tech Fund – Projects Announced

Hydrogenics Corp.

Environmental Benefits:  Climate Change  Clean Soil

Total Project Value:
\$7,625,890
SDTC Funding:
\$2,500,000
Leveraged Funding:
\$5,125,890

Renewable energies enhance power supply with greener options, but storing them reliably, allowing for them to be wholly integrated, continues to be a challenge. Hydrogenics' technology converts surplus renewable electricity into hydrogen gas. This renewable hydrogen can then be injected, stored, and transported in North America's existing, and extensive, natural gas pipeline systems. With existing, high efficiency, natural-gas-fired generators, this stored renewable energy can then be brought back to the electricity grid as dispatchable, renewable power, where and when it is needed most. This project will build a power-to-gas demonstration plant that converts electricity into hydrogen. At 5MW, the plant will be the largest power-to-gas demonstration project in North America and will form the building block for future utility-scale deployments. Note: The funding from SDTC for this project includes funds from the Canadian Gas Association.

Consortium Members:

- Hydrogenics Corp.
- Enbridge

SIGMA DEVTECH Inc.

Environmental Benefits:  Climate Change  Clean Soil

Total Project Value:
\$10,490,130
SDTC Funding:
\$3,100,000
Leveraged Funding:
\$7,390,130

Biodegradable plastic is often touted as a solution to address the mountains of plastic that end up in landfills, but it is currently produced in small quantities and at a high price. Sigma Devtech intends to overcome these problems using a novel solvent-free proprietary technology that produces a type of bioplastic from pulp mill effluent sludge. The project will be demonstrated at a pulp mill in Quebec and result in the first-ever factory to produce bioplastic from this type of renewable waste. Environmental considerations include decreased use of fossil derived plastic and an opportunity for the forestry industry to add value to its waste streams.

Consortium Members:

- Sigma Devtech Inc.

Inventys Thermal Technologies Inc.

Environmental Benefits:  Climate Change

Total Project Value:
\$14,540,247
SDTC Funding:
\$3,100,000
Leveraged Funding:
\$11,440,247

The oilsands industry continues to search for carbon capture and storage (CCS) solutions that can reduce their environmental impact in an effective and efficient manner. Inventys Thermal Technologies is demonstrating its VeloxoTherm™ carbon-capture process, which separates CO₂ from other gasses produced when fossil fuels are burnt. The process promises to deliver superior performance than the incumbent technology. Inventys intends to commercialize the VeloxoTherm™ process and deliver the benefits of the technology to Canada's oil sands to reduce their environmental impact.

Consortium Members:

- Inventys Thermal Technologies Inc.
- Howden Group Ltd.
- Husky Oil Operations Ltd.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

This section provides an assessment of projects completed, or reporting on market impacts, up to March 2017, and includes completed projects not previously published in an Annual Report Supplement.

For each completed project, the project results have been highlighted and an evaluation of the project impact¹ 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 toward 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 SD Tech 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 on sdtc.ca.

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 Fiscal Year 2016/2017, some projects completed close to year end and will be reported next year once the final reports are received.

Public Works and Government Services Canada description of Technology Readiness Levels:
buyandsell.gc.ca/initiatives-and-programs/build-in-canada-innovation-program-bcip/program-specifics/technology-readiness-levels



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Phostech Lithium Inc. *(now part of Johnson Matthey Battery Materials Ltd.)*

Round 16-2009B
Sector:


Transportation

Project
Completion Date:

August 2013

Market Impact
Report Due:

August 2015

Eligible
Project Costs:

\$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


**Climate
Change**

SECONDARY



Clean Air

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 addresses 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 24X scale-up from a 100 t/y batch pilot plant to a continuous and fully integrated 2,400 t/y 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/y to a pre-commercial demonstration unit with a capacity of 2,400 t/y.
- 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 CO₂e.
- It is estimated that the market rollout will lead to cumulative GHG emissions reductions of 21.8 Mt CO₂e in Canada and 30.5 Mt CO₂e in the Rest of World (ROW), for a total of 52.3 Mt CO₂e by 2024.
- GHG emission reduction intensities are 2.1 kt CO₂e/tLiFePO₄ in Canada and 1.7 kt CO₂e/tLiFePO₄ in the ROW calculated based on a ten-year battery life.
- The rollout 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.

Market Impact:

- In the last two years, there has been increasing acceptance of LFP in plug-in hybrid vehicles, mostly in the Chinese market. It is estimated that up to 100,000 PHEV were powered by P2 LFP from Phostec's Candiac facility in the 2015 and 2016 calendar years. In addition, there has been significant usage of the different grades of P2 LFP in electric bus application and other specialty automotive applications. It is anticipated that these will convert into bigger markets in the near term.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Automotive Fuel Cell Cooperation Corp.

Round 15-2009A

Sector:



Transportation

Project

Completion Date:

October 2013

Market Impact

Report Due:

October 2015

Eligible

Project Costs:

\$51,760,258

SDTC Funding:

\$11,506,305

Leveraged

Funding:

\$40,253,953

Consortium

Members:

Automotive Fuel Cell Cooperation Corp.

Daimler AG Group

Ford Motor Company

Environmental

Benefits:

PRIMARY



Climate Change

SECONDARY



Clean Air

Project Title:

Advanced Automotive Fuel Cell Development

Project Description:

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

Objectives:

- To reduce the cost of fuel cell technology by 85%, increase the power density by 2X, and 0.5X the catalyst loading.
- To improve bipolar plates (thinner/lower cost) and increase performance of membrane and catalyst.
- To increase volumetric power density (smaller footprint) to allow for “under-hood” design.

Results:

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

Project Impacts:

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

Path to Market:

- AFCC and its consortium members are developing the next generations of FC stack technology focused on cost reduction and high volume manufacturing for anticipated vehicle deployment in 2017-2018.
- It is assumed that by 2027, 600 FCVs will be rolled out in Canada and 5,000 in the Rest of World, representing 8% of the expected global FCV market.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Nexterra Systems Corp.

Round 13-2008A

Sector:



Forestry, Wood
Products and Pulp
& Paper Products

Project

Completion Date:

October 2013

Market Impact

Report Due:

October 2015

Eligible

Project Costs:

\$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

Benefit:



Clean Air

Project Title:

Advanced Power Biomass Gasification Demonstration Project

Project Description:

Nexterra Systems Corp. (Nexterra) has developed and tested a synthesis gas (syngas) cleaning process 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 (e.g., 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 to 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, British Columbia. 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 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 CO₂e, or 5.4 kt CO₂e per MWe installed CHP system capacity.
- Demonstration CAC emissions were measured and found to be below levels set by air quality regulations.
- The rollout of Nexterra's technology is expected to result in clean air benefits and GHG emissions reductions of approximately 240 kt CO₂e in Canada and 335 kt CO₂e in the Rest of World, over the period 2014-2022.

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 (December 2013).
- Nexterra and UBC are looking for an industrial partner to aid in testing for commercial replication of the syngas conditioning application.

Market Impact:

- Technology provides an option to displace fossil fuels using waste fuels with a net reduction in CO₂ emissions at a distributed scale. Larger scale waste to energy plants are being built less frequently due to concerns about long-term fuel security.
- Technology has potential to provide economic value to waste fuels that otherwise are underutilized/valued and provides landfill management options to operators of landfills.
- Market impact expected to initially be in Europe and certain parts of Asia due to higher electricity prices and favourable public policy on CO₂ reduction. Low electricity prices in North America combined with uncertain policy outlook in the USA make the USA a less desirable market for the short term.
- Market increasingly seeking a "closing of gaps" with respect to renewable energy technologies (especially baseload) that have not been fully exploited increasing the attractiveness of this technology as it opens a new market.
- Current focus is to commercialize the underlying gasification technology on RDF (Refuse Derived Waste) type of fuels that provide the type of enhanced economics (due to tipping fees collected for waste processed) that would make the technology more attractive and financeable in private markets.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

GaN Systems Inc.

Round 16-2009B
Sector:


Energy Utilization

Project
Completion Date:

November 2013

Market Impact
Report Due:

November 2015

Eligible
Project Costs:

\$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


**Climate
Change**

SECONDARY



Clean Air

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 carmakers 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% to 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 CO₂e/y per 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 14.5% (0.36 kg), NO_x 14.2% (0.56 kg), PM 17.7% (0.06 kg) and CO 13.7% (14.79 kg).

Path to Market:

- GaN Systems has subsequently started to sell its components to power systems makers and has established world-wide 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.

Market Impact:

- Subsequent to the STDC project, GaN Systems' GaN-on-Silicon power transistors have become the number-one-selling devices on the market. The transistors are available on-line and at electronics distributors worldwide.
- GaN Systems' customers in computer and phone charger, solar, datacenter, factory motor, and electric vehicle industries have developed power electronic systems that reduce power losses up to 4X, are up to 4X smaller in size and weight, and have lower total system cost.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

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

Round 14 - 2008-B

Sector:



Energy Utilization

Project

Completion Date:

December 2013

Market Impact

Report Due:

December 2015

Eligible

Project Costs:

\$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



Clean Soil

SECONDARY



Clean water



Climate
Change

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 (C₂H₄), 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 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/y in soil.
- The release of PCE and TCE in water were measured and emission reductions reached 162 kg/y for PCE and 85 kg/y for TCE during the demonstration.
- The demonstration also resulted in GHG emission reductions of 27.4 t/y of CO₂e.
- 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 CO₂e 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.

Market Impact:

- Four new projects with large-scale dry cleaning businesses began in 2015. Two of these projects were completed in 2016. The remaining projects will be completed in 2017. There are proposals for five new potential projects.
- The market for the agro-chemical industry (fertilizers and pesticides) is open. Three new projects in this market began in 2015 with 2017 end dates.
- The market for PCB contamination with PCBs, dioxins and furans is also being considered for the Enubiodechlor XL technology.
- Contacts with Defense Canada are under way, notably with CFB Valcartier (military base). This market has potential but requires external assistance for penetration.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Verdant Power Canada ULC

Round 12-2007B
Sector:


Power Generation

Project
Completion Date:

December 2013

Market Impact
Report Due:

December 2015

Eligible
Project Costs:

\$1,200,346

SDTC Funding:

\$487,324

Leveraged
Funding:

\$713,022

Consortium
Members:

 Verdant Power
Canada ULC
St. Lawrence
College of
Applied Arts and
Technology

Environmental
Benefits:

PRIMARY


**Climate
Change**

SECONDARY



Clean Air

Project Title:

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

Project Description:

Verdant Power Canada (VPC) initiated a study for the 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 study 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 a preliminary resource assessment, which included 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 New York's East River and intends to develop an Ontario-based site, building on the resource assessment methodology, foundation design and deployment/retrieval strategies developed under this project.

Market Impact:

- As a result of, and based on, the study conducted on the St. Lawrence River for a demonstration of river KHPS, Verdant Power has conducted several preliminary resource assessments of additional national and international rivers. The estimated river KHPS potential for domestic development and export opportunities, determined by these assessments, is more than 1 GW that is being planned for development within the next ten years. Every gigawatt developed equates to approximately 1,500 full-time jobs in addition to environmental and energy benefits.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

*Corporation HET/LactoScience Inc. (LSI)

Round 11-2007A

Sector:



Waste
Management

Project

Completion Date:
December 2013

Market Impact

Report Due:
December 2015

Eligible

Project Costs:
\$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



Clean Water

SECONDARY



Climate
Change



Clean Soil

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 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 using 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 4m³ per hour for 14-hour and 15-hour runs, and consistent production of Base-L was completed with 40% to 43% protein content. With additional optimization, HET/LSI has been able to achieve over 18 kg of product/t 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 could 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 \$1.4 billion. In North America alone, 48 billion litres of whey are produced, representing \$430 million in potential revenue; Canadian cheese producers generate 3.5 billion litres annually for a potential market of \$32 million.
- Initial target rollout will be to Greek yogurt producers due to its rapidly growing market demand and limited alternative whey treatment options available.

Market Impact:

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

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



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

dPoint Technologies Inc. *(now part of Zehnder Group (Switzerland))*

Round 13-2008A
Sector:


Energy Utilization

Project
Completion Date:

June 2014

Market Impact
Report Due:

June 2016

Eligible
Project Costs:

\$3,508,695

SDTC Funding:

\$1,378,254

Leveraged
Funding:

\$2,130,441

Consortium
Members:

 dPoint
Technologies Inc.
Ecologix Heating
Technologies*

 Windmill
Development
Group*

Tridel Corp.

**Not active after
Milestone 1 of project*
**Environmental
Benefits:**

PRIMARY


**Climate
Change**

SECONDARY



Clean Air

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% to 82%) with respect to the baseline of no heat recovery. The ERV cores performed better (75% to 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, Ontario) 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 counter flow 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/CO₂e/unit/y.
- With the exception of SO_x (which increased 0.11 kg/unit/y 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 0.37 kg/unit/y, PM 0.01 kg/unit/y, CO 0.13 kg/unit/y and VOC 0.04 kg/unit/y.

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 40,000 in 2017, and 150,000 in 2024.
- Assuming successful application in the Rest of World (ROW), 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 CO₂e/y in Canada and 1.1 Mt CO₂e/y in the ROW by 2024.

Market Impact:

- dPoint ERV cores have now been installed in more than 100 high-rise buildings with over 25 real estate developers.
- The dPoint membrane has become the industry standard in Europe with more than 80% of the residential ERV systems using dPoint membrane.
- The Zehnder Group, based in Switzerland and expanding their manufacturing and employee base in Canada, acquired dPoint.
- Building codes in Canada have shifted where most residential buildings now require ERVs. The ventilation industry is lobbying the US government to adopt similar building codes. Commercial building codes now require ERVs with a minimum of 50% total energy recovery.
- The success of dPoint's ERV business has strengthened the company for its fuel cell business, which is also now growing quickly.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

SunSelect Produce (Delta) Inc.

Round 14-2008B
Sector:


Energy Utilization

Project
Completion Date:

June 2014

Market Impact
Report Due:

June 2016

Eligible
Project Costs:

\$7,235,926

SDTC Funding:

\$1,672,425

Leveraged
Funding:

\$5,563,501

Consortium
Members:

SunSelect

Produce

(Delta) Inc.

Procede Gas

Treating BV

Environmental
Benefits:

PRIMARY


**Climate
Change**

SECONDARY



Clean Air

Project Title:

 Wood Fired Heat and CO₂ Recovery Plant for Use in Greenhouse Applications

Project Description:

Greenhouses typically burn fossil fuels for heating and combust natural gas or use bottled gas for CO₂ enrichment to accelerate photosynthesis. The SunSelect system aimed to avoid fossil-based heating and CO₂ production by using biomass-based combustion with gas cleaning and CO₂ storage in a proprietary solvent system. When heat was required (e.g., on cool nights and during cold seasons), biomass was combusted and the exhaust was captured, cleaned and stored using a novel storage technique. The CO₂ was then used the next day to promote plant growth when the sun was shining. The system eliminated natural gas combustion, increased heat recovery by 20%, reduced particulate matter, increased plant growth, reduced costs and generated GHG credits.

Objectives:

- Capture food-safe carbon dioxide from wood waste flue gases for use in the production of local produce.
- Enable greenhouse operations to convert to renewable biomass not only as a source of thermal energy but also as a replacement for natural gas in the production of carbon dioxide for use in greenhouses to enhance plant growth. Improve the energy efficiency of wood waste combustion via condensing heat recovery and catalysis in an innovative manner resulting in a 20% increase in heat recovery from wood waste combustion.
- Reduce particulate emissions from the combustion of wood waste by over 90%.
- Impact climate change by utilizing renewable wood waste as an energy source alternative to natural gas.

Results:

- Produced commercial quantities (up to 7000 t/y) of 98.5% to 100% pure CO₂ with little impurities that exceeded specifications as verified by an independent testing company.
- SunSelect and Procede have been working on modifications to the technology that would permit the operating temperature of the solvent to be below 100°C that would result in greater feasibility for existing wood waste users.
- The GC6™ Green Carbon Capture System reduces particulate emissions from the combustion of wood waste by over 90% and effectively filters volatile organic compounds, carbon monoxide, NO_x and other harmful pollutants. The GC6™ state-of-the-art computer monitoring system accurately gauges all chemical compounds in the system at all levels.
- Very low natural gas prices will delay the uptake of the technology among existing biomass users.

Project Impacts:

- Relative to a natural gas combustion system to provide heat and CO₂ fertilizer to a greenhouse, the installation of the SunSelect project technologies resulted in an average savings of 12.79 kt CO₂e annually through the project period. In 2016, SunSelect will focus on eliminating the use of the natural gas boiler and meet the greenhouse demand for heat and CO₂ from the biomass burners, further reducing GHG emissions.

Path to Market:

- Although low natural gas prices in North America have stalled the adoption of the technology in North America, the relatively high price of natural gas in northern Europe and Australia continue to make the technology adoption by greenhouses in these regions attractive.
- There are currently three medium-to-large-sized greenhouse projects in quotation and design phases in Australia and northern Europe.

Market Impact:

- Based on market interest, SunSelect expects the market impact worldwide is in the potential range of \$10 million of annual sales.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Western Hydrogen Ltd.

Round 12-2007B

Sector:



Energy
Exploration
and Production

Project

Completion Date:

June 2014

Market Impact

Report Due:

June 2016

Eligible

Project Costs:

\$12,357,745

SDTC Funding:

\$4,162,653

Leveraged

Funding:

\$8,195,092

Consortium

Members:

Western
Hydrogen Ltd.
Aux Sable
Canada Ltd.

Environmental

Benefits:

PRIMARY



**Climate
Change**

SECONDARY



Clean Air

Project Title:

Molten Salt Catalyzed Gasification Plant

Project Description:

Western Hydrogen Ltd. (WHL) is a Canadian company, based in Calgary, Alberta, dedicated to the development and commercialization of a new hydrogen manufacturing technology that can use multiple, low-cost feedstocks including glycerol, crop waste and petroleum coke/residuals called Molten Salt Catalyzed Gasification (MSG). This process was projected to have economic and environmental advantages over current hydrogen-manufacturing technologies including lower hydrogen supply costs, maximum feedstock flexibility, lower greenhouse gas (GHG) emissions, high-pressure hydrogen production and “sequestration ready” carbon dioxide.

Objectives:

- To demonstrate the continuous operation of the MSG process at 5 t/d of hydrogen production.
- To demonstrate the economic and environmental benefits associated with producing high-pressure hydrogen from waste feedstocks like petroleum coke/residuals.

Results:

- The pilot plant operated for a total of 327 hours, during which 53 kg of hydrogen gas was produced; however, multiple unforeseen issues were encountered and the pilot plant did not operate as expected.
- The process required significantly more heat than expected coupled with the drop in natural gas feedstock cost that made the technology not operationally or economically viable at this time.
- Plans to increase pilot plant production capacity (as intended in the original Contribution Agreement) were not pursued. The pilot plant is, however, being used to support a subsequent WHL/SDTC project.

Project Impacts:

- Pilot plant operation resulted in approximately 460t CO₂e of GHG emissions.
- Due to the technology not being operationally or economically viable at this time, there are no market rollout forecasts attributable to this project.

Path to Market:

- Western Hydrogen is exploring ways to enhance the performance of its technology in order to achieve a path to market that includes niche markets for renewable hydrogen.

Market Impact:

- Given the current economic climate there has not been much interest in new sources of renewable hydrogen. At this time Western Hydrogen is not pursuing any further research.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Lignol Innovations Ltd. *(now part of Fibria Innovations Inc.)*

Round 14-2008B
Sector:


Forestry, Wood Products, and Pulp and Paper Products

Project
Completion Date:

June 30, 2014

Market Impact
Report Due:

June 30 2016

Eligible
Project Costs:

\$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



Climate Change

SECONDARY



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 biorefineries 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 bio refinery 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 biochemical.

Results:

- The pilot plant operated for approximately 670 days, producing 45,400 litres of ethanol.
- Lignol tested BKLP from four regions of BC, ranging in age from three to eight 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 CO₂e or 0.83 t CO₂e/t wood feedstock.
- The rollout of Lignol's technology could result in GHG emissions reductions of approximately 28 Mt CO₂e in Canada and 25 Mt CO₂e in the Rest of 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.

Market Impact:

- Fibria Innovations is continuing to develop biorefinery technology with focus on biomaterials and biochemicals rather than biofuel. In addition, Fibria Innovations has made significant advancement in lignin technologies and applications and many of these technologies will be deployed commercially over the next two to four years.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Pulse Energy Inc.

Round 15-2009A

Sector:



Energy Utilization

Project

Completion Date:

July 2014

Market Impact

Report Due:

July 2016

Eligible

Project Costs:

\$8,847,082

SDTC Funding:

\$2,556,801

Leveraged

Funding:

\$6,290,281

Consortium

Members:

B.C. Hydro

Grouse Mountain
Resorts

University of
British Columbia

Village of
Hartley Bay

Cisco Systems
Canada Co.

Environmental

Benefits:

PRIMARY



**Climate
Change**

SECONDARY



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 CO₂e, and for the Hartley Bay demonstration were 781 t CO₂e. GHG emissions reductions for a small and a large building in Canada were calculated to be 0.44 t/CO₂e per building per year and 69 t/CO₂e per building per year respectively. Similarly, GHG emissions reductions for a small and a large building in the Rest of World (ROW) were 0.85 t/CO₂e per building per year and 133 t/CO₂e per building per year.

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/y in Canada and 92 Mt CO₂e/y in the ROW by 2024.

Market Impact:

- EnerNOC sold Pulse Energy, Inc. to Yardi Canada Ltd. (Yardi) in August 2016.
- Yardi purchased the business as part of their initiative to assist commercial property management firms to make their building portfolio more energy efficient.
- In April 2017, the Pulse Energy team and technology refocused efforts toward energy efficiency for Yardi's commercial property management customers. This change in strategy means a short-term emphasis on integrating the Pulse Energy technology into Yardi's platform and products.
- Due to the recent change in focus it is difficult to provide alternate forecasts for market impact. There will, however be some general trends: the number of small building installations will be lower than forecast and the number of large building installations should be about the same or perhaps slightly larger. The energy-savings impact for each large building installation is expected to be significantly larger.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Echologics, a division of Mueller Canada Ltd.

Round 17-2010A

Sector:



Energy Utilization

Project

Completion Date:

July 2014

Market Impact

Report Due:

July 2016

Eligible

Project Costs:

\$3,217,390

SDTC Funding:

\$1,051,926

Leveraged

Funding:

\$2,165,464

Consortium

Members:

Echologics
Engineering Inc.
American Water
City of Ottawa
Mueller Systems
Pennsylvania
American Water

Environmental

Benefits:

PRIMARY



Clean Water

SECONDARY



Climate
Change



Clean Soil

Project Title:

Smart Automated Leak Detection System

Project Description:

Echologics developed and demonstrated an integrated, non-intrusive acoustic leak detection system called EchoShore®-DX. The system is capable of detecting leaks in virtually any type or size of commonly used potable water pipes. Wireless transmitters send acoustic sensor data to central or local sites for data processing and leak location identification. EchoShore®-DX technology can be deployed in a District Metered Area (DMA), for example a municipal drinking water distribution system. In comparison with commonly used leak detection methods, more leaks can be detected and water losses are minimized when these leaks are repaired prior to surfacing. This also results in GHG and CAC emissions reductions since less energy is required to treat and pump water through the distribution system. Release of water-treatment byproducts to soil, such as trihalomethanes (THM), are also reduced as a result of minimizing water leakage.

Objectives:

- To integrate a standalone smart acoustic node network for city-wide deployment.
- To conduct a full-scale demonstration of the technology:
 - Deploying the system over a DMA and monitor for four to six months, repairing leaks detected by the system.
 - Monitoring leakage levels of the DMA to demonstrate water savings.
 - Determining the leak detection accuracy of the system as a percentage of leaks detected and percentage of false alarms.
 - Comparing results with competing technologies.

Results:

- Completed system integration and testing during two successful small-scale pilot tests deployed in Liberty, Pennsylvania, and Ottawa, Ontario, respectively.
- Completed a full-scale demonstration of the technology in Liberty over a six month period:
 - All known leaks (detected by the existing system) were detected by the EchoShore® system.
 - A 20 l/min leak was detected by the EchoShore® system that had not been detected by traditional approaches to leak detection.
 - No false positives were reported and the results indicate that the EchoShore® system will outperform the leak detection targets for metallic and plastic pipes with 90% and 70% detection efficiency, respectively.
 - Improved signal-to-noise ratio as compared to previous versions of the EchoShore® system and competing technologies.
- The system was only partially installed in Ottawa. As such, quantitative results are not available.

Project Impacts:

- The demonstration in Liberty resulted in approximately 5 ML of water savings and 875 kg CO₂e of GHG emissions reductions. Minor (less than 1 kg) reductions of CACs and THM were also achieved.
- It is estimated that a market rollout will lead to total water savings of approximately 22,000 ML and GHG reductions of 4 kt CO₂e in Canada, and 122,000 ML and 32 kt CO₂e in the Rest of World (ROW) between 2015 and 2024.
- Reductions in CACs are also expected to be achieved, the most significant of which will be reductions in NO_x and SO_x of about 2 t in Canada and 50 t in the ROW between 2015 and 2024.
- Releases of THM to soil are expected to be reduced by 60 kg and 3,900 kg in Canada and the ROW, respectively, between 2015 and 2024.

Path to Market:

- Echologics has launched its technology as a permanent monitoring system available through Echologics as the EchoShore® system and Mueller Systems as the Mi.Echo® system receiving a number of significant orders since project completion. Commercial advertisements are also being run in key water industry publications with strong response.

Market Impact:

- The EchoShore®-DX system is now commercially available, and with additional development the communications technology now supports both LoRa and 3G cellular communications backhaul. Sales forecasts for this year indicate sales of approximately \$5 million USD, and there is a current order backlog of 4000 units. Echologics expects to grow sales to \$8 million USD in 2018. The plan for 2018 is now to create a variant of the technology suitable for international markets, with pilot trails in the UK, Taiwan, Australia, Singapore and Hong Kong.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Available Energy Corp.

Round 16-2009B

Sector:



Energy
Exploration and
Production

Project

Completion Date:

August 2014

Market Impact

Report Due:

August 2016

Eligible

Project Costs:

\$2,375,257

SDTC Funding:

\$1,020,000

Leveraged

Funding:

\$1,355,257

Consortium

Members:

Available Energy
Corp.

Air Liquide
Canada Ltd.

Canadian Nuclear
Laboratories
(formerly Atomic Energy
of Canada Ltd.)

Isowater Corp.

Canexus Chemicals
Canada Ltd.

Environmental Benefits:

PRIMARY



Clean Water

SECONDARY



Clean Air



Climate
Change

Project Title:

Hydrogen and Heavy Water Production

Project Description:

Available Energy Corp. (Available Energy) is developing a near zero emission and highly efficient method of producing heavy water (deuterium oxide or D₂O)—known as the D2X Process. Deuterium oxide is used in heavy-water nuclear reactors such as the CANDU reactor as well as the growing non-nuclear uses ranging from semiconductor fabrication, pharmaceuticals, fibre optics, research applications, medical procedures and health and beauty products. Available Energy's method co-produces heavy water and hydrogen from water electrolysis. For this project, a pilot plant was commissioned at an industrial partner's facility in Western Canada where various process water streams were aggregated and used as feedstock in which its deuterium concentration was increased.

Objectives:

- To develop reliable water balance models for each stage of enrichment as the deuterium content is increased from more than 150 PPM to 99.9%.
- Optimize the inter-stage concentrations to enhance production at the lowest capital investment cost and operating cost.
- To generate piping and instrumentation diagrams (P&IDs), stream lists, equipment lists, preliminary engineering and costing for the D2X process.
- To enable a technical Go-No Go decision on starting Phase 2 of the broader industrial-scale demonstration.

Results:

- Water balance models were developed for all stages of enrichment allowing determination of plant modifications needed for a range of inter-stage concentrations.
- Specific inter-stage concentration ranges were specified to achieve deuterium concentration and flow-rate targets at each enrichment stage.
- P&IDs, stream lists, equipment lists, preliminary engineering and installed cost estimates were developed for all stages of enrichment.
- Available Energy has decided to implement the project in a step wise manner. Initial focus will be development of the final stage of enrichment to recycle downgraded deuterium oxide. This would further reduce emissions and conserve deuterium at relatively high enrichment levels. As world supply of deuterium oxide continues to diminish, full-scale implementation of the D2X process will be implemented.

Project Impacts:

- Emissions were not quantified during the pilot plant demonstration. As such, no reductions are credited for the project period.
- It is estimated that the D2X process will lead to emissions reductions of 3.6 kt CO₂e/t D₂O produced, which is approximately 95% less than current processes. Based on Available Energy's expected market rollout, the D2X process will result in GHG emissions reductions of 2,018 kt CO₂e in Canada and 2,590 kt CO₂e in the Rest of World, for a total global GHG emissions reduction of 4,608 kt CO₂e by 2028.
- In terms of water benefits, market rollout is expected to avoid emissions of 23 t hydrocarbons and 1 t-Diethanolamine into water, and reduce process water use by 5.9M m³ globally.
- It is also expected that within the same period, market rollout will lead to the reduction of 3.6 kt SO_x and 5.4 kt NO_x globally.

Path to Market:

- Available Energy is a world-leading supplier of deuterium oxide to the Life Science, Environmental Science and High Technology markets. As demand for recycling services increases the refinery will be implemented. Likewise, the D2X process will be implemented as existing inventories are exhausted.

Market Impact:

- Available Energy, through its wholly owned subsidiary Isowater Corp., has become a world leader in the supply of deuterium oxide with exports to more than ten countries. Isowater is advancing the refinery to recycle downgraded deuterium oxide as well as start the implementation of the D2X process for the production of deuterium oxide from natural water.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Westport Power Inc.

Round 17-2010A

Sector:



Transportation

Project

Completion Date:

September 2014

Market Impact

Report Due:

September 2016

Eligible

Project Costs:

\$11,172,245

SDTC Funding:

\$2,302,834

Leveraged

Funding:

\$8,869,411

Consortium

Members:

Westport
Power Inc.

Electro-Motive
Diesel Inc.

GazMétro

CN National
Railway Company
Corp.

Environmental

Benefits:

PRIMARY



**Climate
Change**

SECONDARY



Clean Air

Project Title:

Natural Gas Locomotive Demonstration

Project Description:

Westport Power Inc. (Westport) and their consortium have developed and tested a High Pressure Direct Injection (HPDI) technology, which allows for a fuel mixture composed of primarily natural gas to be used in high-performance diesel engines. HPDI entails injecting natural gas at high pressure into the engine cylinder, along with a small amount of diesel fuel, which is required to initiate the combustion reaction. Natural gas is stored in the form of liquefied natural gas (LNG) in tender cars and converted to compressed natural gas (in gaseous form) prior to combustion. HPDI is ideally suited to high horsepower (HHP) applications such as locomotive engines, the application of interest for this project. In operation, a HPDI engine typically runs on 95% or greater natural gas, as opposed to the diesel-fuelled HHP engines currently on the market.

Objectives:

- Design, procure, build, test and validate an alpha level (pre-production) HPDI on-engine fuel system for an Electro-Motive Diesel Inc. (EMD) 710 locomotive engine.
- Conduct performance and emissions testing of the base diesel engine locomotive to be used in the demonstration project. The results of the base diesel testing will form the metrics for the HPDI engine performance targets.
- Integrate the alpha-level HPDI fuel system on an EMD 710 test engine; commission, test and calibrate the HPDI-EMD 710 test engine to meet the Tier 3 emissions standards and at least the equivalent fuel consumption of the base diesel engine.
- Working with suppliers; design, build, test and evaluate LNG pump(s) suitable for a production-intent tender car.
- Integrate the alpha level HPDI fuel system on the locomotive, couple it to the LNG tender car; commission the system, conduct performance and emissions test, conduct preliminary operations testing and release the locomotive for demonstration service. Operate the demonstration locomotive in service to provide its performance and suitability in rail applications.

Results:

- An alpha level HPDI fuel system was designed in May 2012 and verification and testing was completed in May 2013. Design and development of components occurred at the Westport office in Vancouver, British Columbia, and at the EMD facilities in LaGrange, Illinois.
- Performance and emissions testing of the base diesel engine locomotive was completed and used to compare against HPDI Performance targets.
- EMD upgraded a complete test cell and added high pressure gas capability (compressor and booster), allowing them to run a full size locomotive engine using HPDI technology. An EMD 710 engine with a Westport HPDI fuel system was installed and tested in the test cell. This system successfully met all Tier 3 engine emissions targets, while reducing greenhouse gases by more than 20% and improving fuel efficiency over the cycle (exceeding project targets).
- Westport commissioned and operated a complete cryogenic test facility to operate large cryogenic pumps. It was determined that commercially available pumps had limited applications in railway service. Ultimately, Westport designed and manufactured a cryogenic pump capable of supplying full pressure and flow for a railway application.
- The project demonstrated the performance of a production intent fuel system on an EMD 710 engine in a test cell at an EMD facility. The demonstration was sufficient for Westport and its partners to commit to developing a production HPDI locomotive for the rail market without requiring an on-rail demonstration.

Project Impacts:

- Reduced diesel use, new market for domestic natural gas.
- The demonstration project resulted in GHG emission reductions of 0.8 kt CO₂e per locomotive and significant reductions in CAC's. The objectives are to rollout the technology, resulting in the following cumulative reductions of 157 kt CO₂e in the period 2015-2025 in Canada (projected cumulative capacity - 342 locomotives) and 323 kt CO₂e in the period 2015-2025 for the Rest of World (projected cumulative capacity - 772 locomotives).
- The speed of transition to natural gas in the rail sector is dependent on regulatory approvals and rail road adoption rates.

Path to Market:

- HPDI technology is ideally suited to HHP applications such as locomotives due to its high performance, high efficiency, low emissions and GHG reductions. Westport and its partners believe that the HPDI technology will best meet the needs of the rail industry if it is offered as both a product for retrofit of existing locomotives and for first-fit of new OEM produced locomotives.

Market Impact:

- There are no product sales at this time. Westport and its partners continue to develop the product and explore potential markets such as India, as well as markets specifically for the high-pressure LNG pump developed within this project.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Pure Technologies Ltd.

Round 19-2011A

Sector:



Energy Utilization

Project

Completion Date:
September 2014

Market Impact Report Due:
September 2016

Eligible

Project Costs:
\$3,121,138

SDTC Funding:
\$1,000,000

Leveraged

Funding:
\$2,121,138

Consortium Members:

Pure Technologies Ltd.
The City of Calgary
The Region of Peel

Environmental Benefits:

PRIMARY



Clean Water

SECONDARY



Climate Change

Project Title:

Extra-high Resolution (XHR) Magnetic Flux Leakage (MFL) Tool for Water Pipelines

Project Description:

Pure Technologies Ltd. (Pure) and its consortium members developed and demonstrated a suite of extra high-resolution (XHR) magnetic flux leakage (MFL) inspection tools that enable the detection of wall corrosion and small pitting in water mains, which can be indicative of future pipeline failure. XHR-MFL tools are capable of conducting in-line and off-line inspections of metallic water pipes ranging in diameter from 36 inches to 78 inches and save potable water by preventing water loss associated with catastrophic failures of metallic pipes. Inspections using the tools also decrease the accidental discharge of chemical disinfectants to the environment and reduce greenhouse gas (GHG) emissions through energy saved from pumping excess water through the water mains.

Objectives:

- Develop and test a new extra high-resolution MFL sensing system for in-line inspections of large (60" to 78") metallic water transmission pipelines, able to detect ¼" diameter defects through 1" wall liners.
- Develop and test two smaller XHR-MFL tools to cover the full range of large diameter metallic water transmission pipes, with diameter ranges of 36" to 48" and 48" to 60".

Results:

- Pure developed a scalable MFL tool for large (60" to 78") water pipelines with a defect detection limit of ¼". Pure tested new tool sensors on a 72" mortar lined steel test pipe to validate new sensors. The tool was used to inspect 17 kms of 72" and 75" cement mortar lined steel pipelines and provided clients with onsite data analysis to identify areas of corrosion or wall loss requiring repairs.
- Pure developed and lab-tested two smaller scale MFL tools (36" to 48" and 48" to 60") based on the large-scale MFL tool (60" to 78"). Both tools were shown to operate with the same defect detection resolution as the larger 60" to 78" tool. An unexpected opportunity allowed Pure to develop and test a smaller 24" tool to inspect water disposal injection wells (vertical shafts), a new market for Pure's suite of MFL tools. Pure inspected two injection wells (2,300 and 2,700' deep) using the 24" MFL tool. Pure also developed an outer diameter inspection tool and inspected a 12" mortar lined pipeline in Southwestern Ontario.

Project Impacts:

- Market rollout is expected to result in GHG emissions reductions of 40 t CO₂e in Canada and 460 t of CO₂e in the Rest of World (ROW) from 2015 to 2026.
- Market rollout is expected to result in water savings of 156,000 m³ in Canada and 1,000,000 m³ in the ROW from 2015 to 2026.

Path to Market:

- Pure will showcase the suite of MFL tools as part of a package with SmartBall®, Sahara® and PipeDiver® technologies to existing clients with large-diameter metallic pipes.
- Pure will focus on the power sector where regular shutdowns allow for dewatered inspection of large-diameter critical metallic lines and on emergency response inspections to provide condition assessment of a localized area after failure.

Market Impact:

- Pure has generated over \$3 million revenue using the suite of MFL tools in the last few years and have sales prospects in Canada, US and South Korea.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Imtex Membranes Corp.

Round 14-2008B

Sector:



Energy Utilization

Project

Completion Date:
September 2014

Market Impact Report Due:
September 2016

Eligible

Project Costs:
\$5,557,359

SDTC Funding:
\$1,250,406

Leveraged Funding:
\$4,306,953

Consortium Members:

Imtex
Membranes Corp.
Shaw Canada L.P.
Monteco Ltd.

Environmental Benefits:

PRIMARY



Climate Change

SECONDARY



Clean Air

Project Title:

Membrane Technology for Olefin-Paraffin Separation

Project Description:

Olefin (ethylene/propylene) production is a \$100-billion, energy-intensive industry and the current method for separating olefins and paraffin is the most energy-consuming step in the production process. Imtex intended to develop and demonstrate a membrane technology made of composite material that is permeable to the targeted olefins while restricting paraffin and other gases. The Imtex membrane technology is designed to be 30% to 90% more energy efficient than the incumbent cryogenic distillation for separating olefin and paraffin in the petrochemicals industry depending on the mode of application. If successful, this technology could reduce GHG/NO_x emissions by up to 90% for the separation stage.

Objectives:

- Progressive scale-up of bench, pilot and large commercial scale olefin-paraffin membrane separation systems.
- Pilot plant testing is to be successfully demonstrated at two or three operating company sites; multiple sites are preferable due to the variety of real world operating scenarios (feedstock source and composition variation, ethylene vs. propylene, ambient conditions, etc.).
- A large commercial scale demonstration system is to be developed, field deployed and used in processing a significant fraction of the host site's capacity.
- Achieve a minimum of 99.0% purity (C₂H₄) olefin product with minimum 50% recovery at normal temperature and pressure from minimum 50%-weight olefin feed at the bench, pilot and large commercial scales for flux rates of 170 mL/m² to 500 mL/m², 72 L/m² to 240 L/m² and 900 L/m² to 6,000 L/m² rates respectively.

Results:

- Development of membrane hydration maintenance technology that transformed the membrane technology from a semi-bath process to a truly continuous one, much preferred by the petrochemical industry. The core membrane product was scaled up to the size and design to be used as the modular building block for all commercial systems.
- The technology was tested for thousands of hours under a variety of conditions relevant to many applications in the field in Imtex's in-house test facility, which was developed to an advanced state as part of the project. The membrane was not tested in the field.
- Process configuration and simulation applications were developed to allow system sizing and optimization for any prospective application. This also feeds information into the economic analysis for these applications. A broad base of potential adopters of the technology and channel partners was developed with wide representation from across the global olefins industry.
- All performance targets were achieved on full-size membrane units for flux rates of at least 400 mL/m² in Imtex's in-house test facility.

Project Impacts:

- Although the project did not achieve the field demonstration targets per the original scope, Imtex made significant advances in demonstrating the commercial viability of the technology and forms the basis of a follow-on project recently approved by SDTC.

Path to Market:

- Imtex intends to continue development of the technology as part of a SDTC follow-on project including a field demonstration confirming targets for olefin yield, energy efficiency and lower installed cost as compared to traditional olefin production.

Market Impact:

- While Imtex has not yet achieved commercial sales of its membrane systems in the petrochemical industry, there have been several significant advances toward commercialization. Imtex is also in the final stages of closing a strategic investment deal with a major industrial company in mid-2017. Imtex has developed its business development pipeline to the point where it is poised to gain significant traction in pilot plant deployment and early commercial adoption. Imtex is undertaking detailed applications development work with 26 major industry players, working on pilot deployment scenarios with 12 of these, with five to six of the deployments expected imminently.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Saltworks Technologies Inc.

Round 14-2008B
Sector:

 Waste
Management

Project
Completion Date:
September 2014

Market Impact
Report Due:
September 2016

Eligible
Project Costs:
\$8,064,022

SDTC Funding:
\$2,612,638

**Leveraged
Funding:**
\$5,451,384

Consortium
Members:

 Saltworks
Technologies Inc.
Powertech
Laboratories Inc.
3M Canada Corp.
Canadian Natural
Resources Ltd.
Teck
Resources Ltd.
SPX Cooling
Technologies Inc.

**Environmental
Benefits:**

PRIMARY


Clean Water

SECONDARY


**Climate
Change**
Project Title:

Saltworks Low-Energy Desalination Demonstration

Project Description:

Saltworks developed a technology that reduces energy requirements for desalination by up to 80%, thereby improving the affordability and accessibility of clean water production from both seawater and brackish water sources. The Saltworks system, called “Thermo-Ionic”, was powered by an innovative and inexpensive low temperature thermal energy conversion approach that used solar energy or process heat to reduce electricity consumption. Thermo-Ionic was subsequently split into two complementary innovations: ElectroChem, an advanced electrodialysis platform for desalination and brine concentration; and SaltMaker, a low temperature evaporator-crystallizer for treating highly aggressive wastewaters to produce solids. The project involved building and testing a transportable Thermo-Ionic pilot plant (Plant 1) for seawater desalination, a small scale ElectroChem and reverse osmosis (RO) hybrid plant (Plant 2) to treat oil sands basal aquifer water and coal mine discharge water, and a small scale SaltMaker for zero-liquid-discharge treatment of industrial waste waters.

Objectives:

- Build and test a 1,000 l/d mobile Thermo-Ionic pilot plant (Plant 1) for seawater treatment; a 50,000 l/d small scale ElectroChem-RO hybrid plant (Plant 2) to treat industry waters; and a 20,000 l/day SaltMaker for zero-liquid-discharge.
- Conduct Plant 2 testing on coalmine discharge water to remove selenium. Conduct Plant 2 and SaltMaker testing on basal aquifer water.

Results:

- Construction and commissioning of the 1,000 l/day Thermo-Ionic plant (Plant 1) was completed in May 2010. Construction and preliminary operation of the 50 m³/d ElectroChem-RO containerized plant (Plant 2) and 20 m³/d SaltMaker using basal aquifer water was completed in June 2012 and met all performance metrics. Plant 1 was outfitted with Saltworks’ new electrochemical softening technology combined with reverse osmosis, allowing successful measurement of energy use, availability, output and water quality.
- Field-testing with Plant 2 took place until December 2013 and selenium was successfully removed from metallurgical coalmine run-off.

Project Impacts:

- The project highlighted the potential of Saltworks’ technology to treat highly impaired water, resulting in net emission savings of 18.8 t CO₂e. Full scale systems provide even greater emissions savings as they exploit waste heat sources.
- Market rollout of the ElectroChem and SaltMaker technologies is estimated to reduce GHG emissions by 3.5 kt Co₂e/m³ and 3.8 kt CO₂e /m³ of water treated in Canada and in the Rest of World (ROW), respectively. It is estimated that by 2024, Saltworks’ desalination systems will prevent the release of 77 kt CO₂e in Canada and an additional 138 kt CO₂e in the ROW.
- For the selenium removal application, the demonstration project resulted in net water benefits of 188 m³ of water savings. Market rollout of the selenium application between 2014 and 2025 is expected to lead to 15M m³ and 25M m³ of water savings in Canada and in the ROW, respectively.

Path to Market:

- Saltworks has expanded its facilities to deliver commercial units of its modular systems to global markets and has developed several innovative product lines for other applications such as wastewater treatment, enhanced oil recovery, produced water treatment, ammonia treatment and landfill leachate treatment.

Market Impact:

- The project has led to the advancement of Saltworks’ ElectroChem and SaltMaker product lines for the treatment of highly contaminated industrial wastewaters across Canada and the USA. Saltworks has implemented SaltMaker units at customers’ sites treating landfill wastewater and high salinity groundwater in both Canada and the USA. These full-size pilot systems are the first of their kind and are demonstrating the commercial viability of the SaltMaker technology in the waste disposal sector.
- Saltworks has adapted the ElectroChem platform with the development of selective ion exchange membranes for advanced applications. Larger scale pilots are being implemented to treat ammonia at a municipal wastewater treatment plant as well as recycle produced water from enhanced oil recovery. Saltworks opened its second production factory, a 65,000-square-foot production facility in Richmond, British Columbia, to deliver these units and support further growth.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Statoil Canada Ltd.

Round 14-2008B
Sector:


Energy Utilization

Project
Completion Date:
September 2014

Market Impact Report Due:
September 2016

Eligible
Project Costs:
\$46,651,875

SDTC Funding:
\$6,000,000

Leveraged Funding:
\$40,651,875

Consortium Members:

 Statoil
Canada Ltd.
Schlumberger
Canada Ltd.
Alberta Innovates
Technology
Futures

Environmental Benefits:

PRIMARY


Clean Water

SECONDARY


 Climate
Change

Project Title:

Solvent Steam Co-Injection (SOLVE)

Project Description:

The SOLVE project demonstrated Statoil Canada's use of steam/solvent co-injection technology (SCI), an improvement over the current, conventional method for in-situ oil sands recovery, steam-assisted gravity drainage (SAGD). The addition of solvent to the injected steam enabled enhancement of bitumen mobility and facilitated extraction with reduced steam use. The project targeted up to 25% lower energy input and water consumption compared to conventional SAGD. A 20% increase in bitumen production was also anticipated due to the ability of solvents to penetrate deeper into the bitumen-bearing zone and improve sweep efficiency. Statoil constructed and operated the pilot facility, and contributed technical and financial resources to develop the technology for commercial use.

Objectives:

- Develop, demonstrate and evaluate co-injection steam and solvent technology to reduce the steam-to-oil ratio (SOR) of SAGD and thus reduce water and energy use, decrease CO₂ emissions, and improve resource recovery. The metrics identified to measure the success of this objective include:
 - Lowering SOR from 2.9 down to a range of 2.6 to 2.3 in the pilot (10% to 25%).
 - Increase in bitumen production rate over SAGD baseline by 10% to 20%.
 - Reduction in CO₂ emissions of 10% to 25% over SAGD baseline.

Results:

- Statoil successfully demonstrated the SCI technology at its Leismer SAGD facilities. Over the course of the three-well pilot, the project achieved a reduction in make-up water use of approximately 0.08 barrels of water per barrel of bitumen produced because of redirected steam requirements (approximately 27% reduction):
 - During the demonstration project, SOR was reduced from 2.5 to 1.85 (approximately 25%).
 - Due to process and subsurface constraints and an unexpected interruption in operation during the injection period, there was not sufficient steady-state data to demonstrate a production uplift.
 - Due to the 25% decrease of the SOR, the GHG emissions were also reduced.

Project Impacts:

- The SOLVE project helps reduce water use and energy requirements by introducing solvent to the steam which lowers the viscosity of the bitumen, allowing it to flow more easily. Therefore, the water use and energy consumption per barrel of oil produced is reduced.
- 0.08 reduced make-up water per barrel of oil produced during the demonstration project, for a total of 17,238 barrels of water.
- GHG emissions reductions for the demonstration were 2 kt CO₂e or 12.3 kg CO₂e per barrel of oil produced.
- Market rollout would result in GHG emissions reductions of 19.5 kg CO₂e per barrel of oil produced and make-up water reduction of 0.08 barrels of water per barrel of oil produced.

Path to Market:

- Statoil does not have plans to commercialize the project technology at this point as low oil prices are hindering investments into oil sands, and more collaboration within the oil sands industry is required to de-risk the commercial application of the technology.

Market Impact:

- The net benefit of the SOLVE technology remains unclear in what is predicted to be a "lower for longer" crude price environment. Statoil has not revised its five-year development plan to include SOLVE in the new drainage areas.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Xogen Technologies Inc.

Round 14-2008B

Sector:



Waste
Management

Project

Completion Date:
October 2014

Market Impact

Report Due:
October 2016

Eligible

Project Costs:
\$4,527,874

SDTC Funding:
\$1,974,104

**Leveraged
Funding:**
\$2,553,770

Consortium Members:

Xogen
Technologies Inc.

Town of
Orangeville

University of
Toronto

Newalta Corp.

Orangeville
Hydro Ltd.

Linde Canada Ltd.

Environmental Benefits:

PRIMARY



Clean Water

SECONDARY



Clean Soil

Project Title:

Xogen's Pilot Plant

Project Description:

The Xogen process is an electrochemical wastewater treatment process that 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 ten 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 project involved the design, fabrication and testing of a pilot plant to demonstrate Xogen's capabilities in achieving consistent effluent criteria; it 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 the 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 could 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.

Market Impact:

- Xogen is currently entering the US and Canadian market to use this technology to primarily destroy ammonia and at the same time reduce COD, pathogens and improve UV transmittance where required. Xogen plans to design, build and install four pilot plants in 2017 and 24 pilot plants in 2018, with 12 commercial sales ensuing in 2017/2018. Xogen is currently working with the five largest private landfill owner/operators in the US market, with the first pilot planned for a landfill in Tennessee. The technology to be deployed is mainly what was piloted at the Town of Orangeville Water Pollution Control Plant in 2014 and Newalta in 2016.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Eco-Ag Initiatives Inc. *(now part of Desviar)*

Round 14-2008B
Sector:

 Waste
Management

Project
Completion Date:

November 2014

Market Impact
Report Due:

November 2016

Eligible
Project Costs:

\$5,791,615

(Pending final audit)
SDTC Funding:

\$1,948,000

Leveraged
Funding:

\$3,843,615

Consortium
Members:

 Eco-Ag
Initiatives Inc.

 Alberta
Agriculture
and Rural
Development

 Interactive
Management
Group

**Environmental
Benefits:**

PRIMARY


Clean Soil

SECONDARY


 Climate
Change


Clean Air



Clean Water

Project Title:

Nutrient Recovery Facility Project

Project Description:

Eco-Ag Initiatives Inc. (Eco-Ag), in combination with their consortium partners, was to develop a process that integrated several basic technologies to transform wastes into nutrients for crop production for horticultural use. The project aimed to develop a process to produce safe, economically and environmentally sustainable nutrients from wastes that are currently destined for landfills. Both wet and dry materials were to be processed to create designer organic nutrients (DON) for the agriculture and horticulture industry to improve soil health, fertility and water holding capacity. DON production was also expected to reduce reliance on synthetic and mined fertilizers, resulting in GHG and CAC emissions reductions.

Objectives:

- Construct and commission the DON production process.
- Receive and process animal mortality (Specified Risk Materials (SRM) waste, liquid organic and dry organic waste).
- Produce DON from waste inputs received.
- Produce biogas by anaerobic digestion of waste materials to provide the heat and power used by the DON production process.
- Quantify odour and volatile organic carbon (VOC) sources for each process, compare effectiveness of DON with chemical fertilizer.
- Compare the effectiveness of DON with synthetic fertilizers.

Results:

- The construction of the plant in High River, Alberta, was completed, including integration of commercial scale alkaline hydrolysis, continuous thermo hydrolysis, anaerobic digesters, and stabilizer drums.
- DON from the integrated demonstration plant was not produced because of challenges in obtaining the necessary permits and approvals to run the plant. Waste inputs including processing plant waste, and food waste were tested in discrete unit operations. Outputs from each of the unit operations were combined except the alkaline hydrolysis product, in order to develop and produce the DON.
- Biogas was not produced in sufficient quantities during the demonstration project due to delays in the groundwater monitoring approval process. Therefore, biogas was not used to provide process heat and power, rather grid electricity was used.
- VOC measurements were not completed because these measurements need to occur when plant meets 80% capacity. It is unclear when the plant will become operational and meet 80% capacity.
- Crop production trials using batch produced samples of DON from the plant showed increased yields on fall rye when compared to use of equivalent amounts of synthetic nitrogen fertilizer. Tests from the demonstration plant on DON are ongoing but have not been completed.

Project Impacts:

- Eco-Ag's process is expected to result in soil benefits by enhancing soil conditions with the produced DON. Water benefits may arise if the process accepts wastes that would otherwise be discharged to waterways. These benefits have not been assessed quantitatively.

Path to Market:

- Eco-Ag expects to rollout its DON production process, with new trains being built in Alberta between 2014 to 2017. British Columbia and Saskatchewan are also being considered as potential sites for new DON production facilities.

Market Impact:

- Desviar is continuing to make sure that financial viability is intact through de-packaging of nutrients.
- Desviar is continuing to develop DON on the registered compost pads outside the facility building from de-packaged and liquid material that have been diverted/redirectioned from landfills.
- The system is fully functional and is currently being used in test production mode while provincial approval is being secured. Once provincial approval has been secured, the system will be able to operate in continuous production mode, resulting in GHG reductions associated with producing energy from waste.
- Desviar continues to develop focused pathways to success through 12 years of substantial investment and knowledge of the pitfalls that they have encountered.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

MPT Mustard Products & Technologies Inc.

Round 16-2009B

Sector:



Agriculture

Project

Completion Date:

November 2014

Market Impact

Report Due:

November 2016

Eligible

Project Costs:

\$5,936,432

SDTC Funding:

\$1,840,294

Leveraged

Funding:

\$4,096,138

Consortium

Members:

MPT Mustard
Products &
Technologies Inc.
Ag West Bio
Peacock
Industries Inc.

Environmental Benefits:

PRIMARY



Clean Soil

SECONDARY



Clean Air



Clean Water

Project Title:

Development and Demonstration of MPT's Mustard Based Biofumigant

Project Description:

Treatment of turf, vegetables and small fruit crops with synthetic pesticides to improve cosmetic appearance and yield is common practice. However, usage and application of synthetic pesticides can have serious negative environmental impacts. Mustard Products & Technologies Inc. (MPT) aimed to design, build and commission Canada's first full-scale manufacturing line for bio-pesticide produced from mustard. MPT's goal was to develop and manufacture biological-based solutions that are natural, renewable and safe to use in managing key pests.

Objectives:

- Upgrade and automate a 2.5t/day pilot facility, and design a new cold press manufacturing process to enable production of quality biofumigant and bio-oil.
- Design and build a 40t/day commercial-scale facility to demonstrate commercial production capacity.
- Test their product's efficacy as a biofumigant on initial target markets of commercial turf and produce including strawberries, raspberries, carrots and tomatoes.

Results:

- MPT has made progress but did not substantially complete all project deliverables, primarily due to determining that the first-generation MustGrow product was not economically supportable in its granular format. MPT pivoted and began work on a second-generation liquid platform.
- MPT has demonstrated the efficacy of their product for target applications on high value fruit, and continue to work on optimizing their formulation.

Project Impacts:

- Given the current non-finalized status for the formulation and testing results available, reduced line of sight to the future of the product and its market penetration, no environmental benefits reporting was completed or reviewed by a third party.

Path to Market:

- All the field trial work in this sector will support regulatory and marketing and many of the trials will be in collaboration with large multi-national growers and marketing partners. The aim is to utilize MPT existing registration (in conjunction with the data obtained from the trials) to obtain US EPA registration for the new liquid concentrate as a pre-plant soil fumigant in Q4 2017. California registration would follow in late 2018 or early 2019.

Market Impact:

- MPT has endeavoured to implement the path to market noted above. To date they have made steps towards moving these plans forward.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

S2G Biochemicals Inc.

Round 17-2010A

Sector:



Energy Utilization

Project

Completion Date:
December 2014

Market Impact

Report Due:
December 2016

Eligible

Project Costs:
\$7,720,257

SDTC Funding:

\$2,616,952

Leveraged

Funding:
\$5,103,305

Consortium

Members:

S2G
Biochemicals Inc.
Phoenix Pulp
and Polymer
International
Polyol
Chemical Inc.
HTEC Hydrogen
Technology &
Energy Corp.

Environmental

Benefits:

PRIMARY



**Climate
Change**

SECONDARY



Clean Water

Project Title:

Bio-Glycol Pilot Plant

Project Description:

Over \$25 billion worth of glycols are used each year globally in a wide array of industrial and consumer products such as antifreeze, polyester fibres, plastic drink containers, cosmetics and detergents. The project led by S2G Biochemicals Inc. (S2G) demonstrated bioglycol production using low-cost renewable byproducts of the biofuel, agriculture and forest industries as feedstock instead of fossil fuels. Byproduct sugars from next-generation biofuels were of particular interest as a growing source of feedstock—these include crude glycerine from biodiesel production and C5/C6 sugars from cellulosic ethanol production. S2G's Sugar-to-Glycol process is expected to improve the economics of biofuel production and the utilization of waste biomass resources, as well as reduce the lifecycle GHG emissions and water consumption associated with the production of conventional glycols. With this technology, S2G aims to help shift the industrial chemical industry from its traditional dependence on fossil fuels to a sustainable future based on renewable organic feedstocks.

Objectives:

- Design a pilot plant for pre-treatment and hydro processing of byproduct sugars. Modify, install and commission a 40 t/y pilot facility to confirm viability of crude glycerine and C5/C6 sugars hydro processing.
- Run pilot tests on leading by product sugar candidates including crude glycerine, energy crop sugars, and cellulosic sugars from different biomass sources and feedstock partners.
- Meet process performance and cost parameters required for commercial operation, for example greater than 85% conversion of feedstock to bioglycol.

Results:

- S2G designed, constructed, and commissioned a 40 t/y capacity pilot bioglycol production plant in Vancouver, British Columbia.
- Pilot testing was conducted for glycerine, beet sugar, and pulp straw liquor feedstocks. Approximately 1.5 t was produced through various campaigns during pilot testing.
- Process performance and cost parameters required for commercialization were met.

Project Impacts:

- The demonstration project resulted in a total of 4 t CO₂e GHG reductions and 8.5 m³ in water savings.
- It is estimated that market rollout will lead to GHG emissions reductions of 6.7 Mt CO₂e in Canada and 0.5 Mt CO₂e in the Rest of World (ROW), for a total global GHG emissions reductions of 7.2 Mt CO₂e between 2016 and 2024.
- The GHG reduction intensity in Canada is expected to be 4.7 t CO₂e/t bioglycol produced and 3.6 t CO₂e/t bioglycol produced in the ROW.
- The market rollout will also lead to savings of 6M m³ of water in Canada and 23k m³ of water in the ROW between 2016 and 2024.

Path to Market:

- Co-production of bioglycols with xylitol provides excellent economic return.
- A consortium has been formed to build a \$20-million commercial demonstration project in Ontario.
- Engineering is underway; government/partner funding is being confirmed.
- Contract manufacturers with access to suitable feedstock will be established to build commercial plants within three years.

Market Impact:

- S2G partnered with Mondelez Global, the World's top snack food company, and jointly invested over \$10 million to develop proprietary technology for the co-production of bio-glycols and xylitol that cuts xylitol costs in half and makes bioglycol cost competitive with petrochemicals. Xylitol is a natural, low-calorie sweetener with superior taste and health benefits.
- Building on a successful scale-up to commercial for a campaign at Pennakem's facility in Memphis, Tennessee, S2G is building a profitable commercial demonstration plant in Sarnia, Ontario, to convert local ag and forest residues to xylitol/bio-glycol, providing product for commercial trials and an integrated demonstration of S2G's technology.
- A \$1.4-million FEED engineering project is underway. Partner support has been obtained. Applications are being submitted for federal and provincial funding support. S2G is closing a \$2.5-million Series A equity round.
- The S2G xylitol/bioglycol process provides an excellent value-add application for pulp mills/biorefineries with C5 sugars. As such, S2G has secured support from leaning forest products and pre-treatment technology companies for feedstock for the Sarnia plant and strong interest for follow-on commercial plants to contract and manufacture xylitol and bioglycols for S2G/Mondelez.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

FibraCast Ltd.

Round 17-2010A

Sector:



Energy Utilization

Project

Completion Date:

December 2014

Market Impact

Report Due:

December 2016

Eligible

Project Costs:

\$5,902,229

SDTC Funding:

\$1,947,736

Leveraged

Funding:

\$3,954,493

Consortium

Members:

FibraCast Ltd.

Alpha Plan GmbH

Anaergia Inc.

Environmental

Benefits:

PRIMARY



Clean Water

SECONDARY



Climate Change

Project Title:

FibrePlate System

Project Description:

FibraCast has developed a new hybrid membrane (FibrePlate) for the municipal water and wastewater industry that leverages the benefits of both hollow fiber and flat sheet membrane topology that has twice the permeability, 100 times the strength, five times the packing density and is easier to clean than hollow fiber technology. The project comprised an innovative manufacturing technology for producing FibrePlate membranes at one third the cost of current state of the art hollow fiber membranes due to easier and faster manufacturing processes.

Objectives:

- To construct a pilot manufacturing line capable of producing FibrePlate membrane sheets and module assembly processes able to produce at least 60 m² of membranes per week (two modules).
- To validate long-term integrity of a module by completing a three week accelerated test under three times the aeration rates and 1,000 PPM of chlorine exposure at 40°C.
- To design and test a containerized system using FibrePlate modules that is able to treat 150 m³/d of municipal wastewater at 10,000 mg/l Total Suspended Solids (TSS) at a flux rate of 25 l/m²/h (~15 gallons/ft²/d).

Results:

- Designed and built a sheet-forming machine and dope delivery system that allows casting of consecutive FibrePlate sheets in batch mode. FibraCast also validated the casting process on the full size pilot line, tested new substrates and selected new adhesives.
- Completed accelerated testing in house at FibraCast in Hamilton using the new adhesive that allowed the module to pass the 21-day test.
- Built a containerized Membrane Bioreactor (MBR) system with a separate bioreactor tank for the Clarkson Wastewater Treatment Plant in Mississauga, Ontario. The system was able to treat over 150 m³/d at flux rates of 25 l/m²/h for at least nine months and capable of being fully adjusted, from remote online access, for all key process parameters. Another fully containerized MBR system was commissioned, creating a plug-and-play treatment system tested at the Victor Valley Water Reclamation Authority (VWVRA) in Victorville, California. The VWVRA pilot unit can treat up to 227 m³/d, with an operating limit for FibrePlate membranes of 12,000 mg/l of total suspended solids (TSS).

Project Impacts:

- The Clarkson demonstration project resulted in emission reductions of 2,740 kg CO₂e per pilot project, while the VWVRA demonstration project resulted in emission reductions of 1,052 kg CO₂e per pilot project. Both demonstration projects also resulted in significant reductions in air pollutants.
- Rollout of the technology is expected to result in cumulative reductions of 109 kt CO₂e in Canada (projected cumulative annual capacity 2,273M m³ of wastewater/water treated) and 2,248 kt CO₂e for the Rest of World (ROW) projected cumulative annual capacity of 14,833M m³ of wastewater/water treated.
- The market rollout is also expected to result in significant reductions in CAC emissions and significant water savings (1,049M m³ of water saved in the ROW rollout).

Path to Market:

- FibraCast has successfully initiated a soft commercial launch of the FibrePlate System, with product made on the pilot line being used at demonstration sites for the establishment of an international market reference list. The containerized system that FibraCast tested for their demonstration pilots has proven successful and will provide an excellent fit for small communities due to its short commissioning time and simple process controls.

Market Impact:

- Following the soft commercial launch, FibraCast is now actively developing a strong commercial presence on all major markets. The manufacturing facility was fully commissioned and is currently operational. FibrePlate membranes are now installed in over 20 systems in Asia, Europe and North America. Ten other projects are under commissioning or will be installed soon. All these projects have been won following a competitive bidding process against all market leaders. Veolia, the larger water company in the world has already used FibrePlate technology in three systems worldwide: one in Asia, one in Europe and one in US.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Nsolv Corp.

Round 18-2010B
Sector:


Energy
Exploration
and Production

Project
Completion Date:

December 2014

Market Impact
Report Due:

December 2016

Eligible
Project Costs:

\$54,085,607

SDTC Funding:

\$10,000,000

Leveraged
Funding:

\$44,085,607

Consortium
Members:

Nsolv Corp.
Suncor Energy Inc.
Hatch Ltd.

Environmental
Benefits:

PRIMARY



**Climate
Change**

SECONDARY



Clean Air



Clean Water

Project Title:

BEST (Bitumen Extraction Solvent Technology) Field Pilot Plant

Project Description:

Canada has 170 billion barrels of recoverable crude oil stored in the oil sands. Of these remaining established reserves in Alberta, 80% are too deep to be mined and are currently recovered using in-situ processes such as Steam Assisted Gravity Drainage (SAGD), which is water and energy intensive. Through this project, Nsolv demonstrated 'BEST'—a low temperature, primary, in-situ production technology for bitumen reserves using a pure, condensing solvent. BEST reduces the consumption of process water to zero and emits 75% less greenhouse gas (GHG) than SAGD on a per barrel basis. BEST is expected to have lower operating and capital costs than SAGD with fewer restrictions on the reservoir conditions under which it can operate. To prove the technical and economic performance of the pure solvent under actual reservoir conditions, Nsolv drilled and completed a 300-metre, producer and injector well pair and constructed a supporting surface facility near Fort MacKay, Alberta.

Objectives:

- Achieve SAGD oil extraction rates or better with warm solvent instead of hot steam.
- Achieve in-situ upgrading of bitumen from ~8°API to ~13°API or better, and reduce carbon residue, nickel and vanadium content of produced oil.
- Achieve solvent hold-up in extraction chamber similar to steam (water) experienced in SAGD.
- Achieve a reduction of 80% or better in GHG emissions relative to SAGD, based on heat delivered to the reservoir.

Results:

- Nsolv produced more than 80,000 barrels of oil at an average of ~160 barrels per day. When normalized for well length and pay height, the extraction rate from the BEST well is approximately the same as SAGD wells producing from the same reservoir and at lower temperature.
- Nsolv produced upgraded oil with 14° API to 16° API, and reduced carbon residue, nickel and vanadium content.
- Third party environmental quantification estimates 76% GHG emission reduction relative to SAGD for a commercial Nsolv BEST project. Although this is less than the target of 80%, Nsolv has demonstrated a step change in emissions reductions versus the incumbent technology.

Project Impacts:

- The demonstration project was successful in demonstrating the economic and environmental potential of the technology to extract bitumen under real reservoir conditions.
- The pilot facility resulted in savings of 13,375 barrels of fresh water and 11,861 barrels of saline water when compared against bitumen production from a commercial-scale SAGD facility. The GHG emission intensity of the pilot plant exceeded those of a commercial-scale SAGD facility due primarily to lack of scale.
- By 2025, the market rollout of the BEST technology is expected to result in cumulative savings of 49 million barrels of fresh water, 43 million barrels of saline water and GHG emission reductions of 3.2 MT CO₂e as compared to conventional SAGD production.

Path to Market:

- Nsolv has demonstrated that it can be economic/profitable at lower oil prices when incumbent technologies for producing from oil sands cannot. BEST is competitive against SAGD due to its lower CAPEX intensity, lower operating costs, and improved revenue per barrels resulting from in-situ upgrading.
- SDTC has recently approved a follow-on project to build the first pre-commercial demonstration plant to prove the economic viability and environmental benefits of the technology.

Market Impact:

- All market impact results will be reported through the Nsolv/SDTC follow-on project.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

GreenField Specialty Alcohols Inc.

Round 13-2008A
Sector:


Energy
Exploration
and Production

Project
Completion Date:

December 2014

Market Impact
Report Due:

December 2016

Eligible
Project Costs:

\$13,606,985

SDTC Funding:

\$3,927,964

Leveraged
Funding:

\$9,679,021

Consortium
Members:

GreenField
Specialty
Alcohols Inc.
Andritz Ltd.
Andritz Group

**Environmental
Benefits:**

PRIMARY



**Climate
Change**

SECONDARY



Clean Air



Clean Water



Clean Soil

Project Title:

GFE – Biochemical Lignocellulosic Ethanol Demonstration Project

Project Description:

GreenField Specialty Alcohols Inc. (GFSA) demonstrated a biochemical technology process for lignocellulosic ethanol production which addresses many of the issues producers are currently facing, including the cost of feedstock supply and pre-treatment processes, the efficiency of conversion processes, the high cost of enzymes for hydrolysis, the cost of concentration and purification and the value of co-products. This process was integrated into an existing ethanol facility on a pre-commercial, pilot scale using corncobs—the non-food residuals from harvesting corn—and other energy crops as feedstocks. The consortium developed improved pre-treatment and enzymatic hydrolysis processes that could be applied to first generation ethanol facilities and retrofitted to second-generation facilities.

Objectives:

- Undertake feedstock evaluation and determine process conditions for three classes of feedstocks including corn cobs and stover, energy crops such as bagasse and switchgrass, and poplar.
- Confirm ethanol production from hemicellulose sugars (mechanical and chemical procedures to recover and hydrolyse hemicellulose sugars; co-fermentation process) with a target of an overall 80% production increase.
- Upgrade pilot plant (incorporate Twin-Screw Extruder (TSE) into existing pilot facility).

Results:

- All classes of feedstock were successfully evaluated at lab facilities and in the pilot facility.
- Testing of recovery and purification of hemicellulose from cobs was successfully carried out for conditioning and pre-treatment, hydrolysis and fermentation. Target metrics were achieved.
- The pilot plant was upgraded in stages with the full commissioning of the plant occurring upon project completion.
- The upgraded plant has since been operated, tested and modified as required.

Project Impacts:

- GFSA lignocellulosic ethanol reduces emissions compared to conventional ethanol production through the use of waste biomass (cobs, stover, etc.) and assumptions related to emissions associated with feedstock production.
- GHG emission reductions on a unit basis were calculated to be 0.697 kg/CO₂e per litre ethanol produced for Canada and 0.925 kg CO₂e per litre ethanol produced for the Rest of the World.
- Implementation of lignocellulosic ethanol production also results in reductions in CAC emissions: 9.23 g SO_x, 0.5 g NO_x, 0.06 g particulate matter (PM) and 0.06 g VOC/L ethanol produced.

Path to Market:

- GFSA intends to use multiple approaches to commercialize its technology which include: building, owning and operating lignocellulosic ethanol production facilities; selling licenses for the TSE technology that includes systems for cellulosic ethanol production, systems for the production of sugars used in bio-based chemical production and systems to facilitate solid-liquid separation.

Market Impact:

- In 2016 GFSA continued to operate the upgraded pilot plant utilizing a variety of biomass feedstocks. Work is ongoing to optimize solubilisation of hemicellulose and cellulose fractions from woody biomass under continuous process conditions. These trials will inform direction for the integration of mechanical process changes before proceeding with the design, construction and operation of a pre-commercial demonstration-scale unit in 2017/18.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

MEG Energy Corp.

Round 14-2008B

Sector:



Energy
Exploration
and Production

Project

Completion Date:

December 2014

Market Impact

Report Due:

December 2016

Eligible

Project Costs:

\$18,142,245

SDTC Funding:

\$4,270,000

Leveraged

Funding:

\$13,872,245

Consortium

Members:

MEG Energy Corp.

Western

Research Institute

Alberta Innovates -

Energy and

Environment

Solutions

Environmental

Benefit:



Climate
Change

Project Title:

MEG Field Upgrading Process (known as the HI-Q® process)

Project Description:

Bitumen extracted from the oil sands requires upgrading to remove asphaltenes and other residuals before it can be fed to a conventional refinery for final processing into end products. This upgrading is an energy and capital intensive process. Additionally, the transportation of bitumen via pipeline to a central upgrader or refinery also requires the use of diluent to reduce viscosity and facilitate bitumen flow. This diluent is the largest component of bitumen production and transportation costs. MEG Energy (MEG) designed, built and demonstrated HI-Q®, a field upgrading technology which can negate the need for diluent in transportation while reducing the energy intensity of the upgrading by more than 20%. The HI-Q® technology results in lower greenhouse gas emissions, higher netbacks from the reduced bitumen price differential, elimination of diluent and enhanced access to downstream markets.

Objectives:

- Completion of the design, construction and operation of the MEG HI-Q® process pilot plant, consisting of combined thermal cracking and solvent deasphalting. Five barrels per day pilot plant to be built in Alberta, shipped, installed and operated at the Western Research Institute in Laramie, Wyoming.
- Prove technical feasibility of the MEG HI-Q® process, leading to sufficient process definition to scale the process up to field pilot demonstration scale (300 barrels per day to 1,500 barrels per day).
- Produce sufficient volumes of asphaltene products, at different operating conditions, for subsequent clean energy technology testing.

Results:

- The five-barrels-per-day pilot plant in Laramie, Wyoming, processed over 1,300 barrels of bitumen and achieved more than 700 hours of operations over 50 test runs proving the concept technically. It also demonstrated the ability to produce a high yield, pipeline ready (19° API to 20° API) product that is less energy intensive than the incumbent technology and capable of capturing more than 50% of the light/heavy oil differential.
- The pilot tests demonstrated sufficient positive technical and economic incentive for MEG to proceed with a 1,500-barrels-per-day field demonstration pilot (also co-funded by SDTC) located in Bruderheim, Alberta. Over 10 t of asphaltene byproducts were produced during the project for testing. MEG evaluated a variety of uses for the asphaltene byproducts and the asphalt product pathway appeared to be the most promising with the highest potential value generated and the lowest potential environmental footprint. Third-party analysis of asphaltene solids from the HI-Q® process demonstrated they met the requirement for solid fuels market distribution and as a back-up disposal in non-hazardous landfill is a viable option.

Project Impacts:

- Based on the results from this project, the next scale up (1,500 barrels per day) is expected to result in GHG emission reductions of 3.4 kt CO₂e/y for 1,500 barrels per day of production.
- The HI-Q® technology market rollout, calculated based on the results of this project, also expects to generate significant GHG emission reductions, in the range of 138 kt CO₂e per year per plant, with 60,000 barrels per day capacity.
- The objectives are to rollout the use of the technology, resulting in the cumulative reductions of 629 kt CO₂e from 2017-2025 in Canada (projected cumulative processing capacity of 64,500 barrels per day).
- The rollout is also expected to result in a reduction in CAC emissions.

Path to Market:

- Upon construction completion of the Bruderheim demonstration pilot (slated for 2018), MEG intends to deploy the technology with a first commercial plant in 2023. For HI-Q® to reach a critical mass in the market and realize the full value uplift, MEG estimates production should be in the 250,000 barrels per day to 300,000 barrels per day range. MEG's own initial facility will produce 60,000 barrels per day to 100,000 barrels per day of product, so an additional 150,000 barrels per day to 200,000 barrels per day of licensed production is attractive. This translates to 10% to 13% of Canadian SAGD production by 2022 to achieve critical penetration. While the broad market context is compelling, key to the success of the project will be to attract and capture or partner with individual licensors.
- As part of the commercialization process, MEG obtained a trademark for the HI-Q® product and process. Going forward, MEG is also looking at developing a certification mark for the HI-Q® product to further control the quality of all HI-Q® barrels produced, similar to a CSA, UL, or ISO certification mark.

Market Impact:

- All market impact results will be reported through the MEG Energy Corp./SDTC follow-on project.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Terragon Environmental Technologies Inc.

Round 15-2009A

Sector:



Waste
Management

Project

Completion Date:
December 2014

Market Impact

Report Due:
December 2016

Eligible

Project Costs:
\$8,006,425

SDTC Funding:
\$3,174,000

**Leveraged
Funding:**
\$4,832,425

Consortium

Members:

Terragon
Environmental
Technologies Inc.

Transport
Desgagnés

Canadian
Coast Guard

Alion Science
and Technology
(Canada) Corp.

Les Investissements
de l'Estrie Inc.
(Le Vertendre)

Environmental

Benefits:

PRIMARY



Clean Water

SECONDARY



Climate
Change



Clean Air



Project Title:

Wastewater Electrochemical Treatment Technology (WETT) and System for Total Environmental Protection



Project Description:

Terragon's WETT system operates on electricity, does not use chemicals or biological treatment and does not require specially trained personnel. The system is compact, robust and capable of intermittent operation. It can be adjusted to handle almost any type of wastewater and can provide tertiary treatment. WETT effectively treats organic and inorganic contaminants (suspended or dissolved), persistent organic pollutants such as pharmaceutical residues and pathogens. Terragon demonstrated the WETT technology on a merchant marine vessel, a government vessel, and in a remote resort. Terragon also integrated the MAGS (Micro Auto Gasification System) which was demonstrated in an earlier SDTC project with the WETT system to create a System for Total Environmental Protection (STEP). The combined process enhances the MAGS process by treating any liquid residual while providing a method of disposal for sludge from the WETT process.



Objectives:

- Proof-of-concept prototype modifications/investigations to finalize WETT development.
- Design, construction, commissioning and onsite operation of two WETT application-specific prototypes, one for sewage and one for bilge water.
- Design, construction, commissioning and demonstration of four WETT demonstration prototypes, and demonstration of STEP approach for land-based and marine situations.
- Paper study to assess the implications of the STEP integrated waste management approach on ship design and operations.



Results:

- The various aspects of the WETT System were developed to address treatment of domestic and marine wastewater (sewage, greywater, blackwater), and treatment of marine bilge water under simulated marine motion. Results compared positively with applicable standards for these different wastewaters.
- Four WETT prototypes were successfully demonstrated; one for greywater at a resort, two for bilge water on ships, and one for sewage on a ship.
- Two STEP demonstrations were carried out. One was demonstrated at the Terragon facility; a second one was successfully demonstrated on board a Canadian Coast Guard ship and then retrofitted for a land-based demonstration in Cambridge Bay, Nunavut.
- A paper study to assess the implications of the STEP approach for ship design and operations was completed considering three types of ships: a transport ship, an offshore supply vessel, and a frigate. By utilizing STEP as compared to conventional equipment/approaches, it was possible to treat almost all waste onboard for each platform, and at the same time reduce operating costs by significant margins.



Project Impacts:

- The WETT-O for oily water produced water to meet the IMO discharge standard. The WETT system for grey water met TSS, fecal coliform and pH standards. The STEP System successfully treated solid waste, blackwater, greywater and sludge at demonstration installations.
- The rollout of the technology is forecast to result in cumulative reductions of 550 t CO₂e from 2015-2020 in Canada (11 STEP installations) and 8,713 t CO₂e over the same time period for the Rest of World (152 installations).
- The rollout is also expected to result in a reduction in CAC emissions, a reduction in harmful bacteria and improved water quality.



Path to Market:

- Terragon has finalized development of the commercial WETT models. WETT-O is for marine application and WETT-G is for grey water applications in single-family dwellings as well as small hotels or camps. The scale up of the technology for use in isolated communities is currently being studied. A final design iteration for the WETT-S for black water is in progress and is expected to be demonstrated in a shipboard trial.
- Terragon is finalizing a study of the STEP concept for 150 person groups. Over the next year, Terragon will propose this concept for various applications, particularly marine, once the development efforts are completed.



Market Impact:

- WETT-O underwent certification trials in 2016 and was Type Approved by the USCG and Transport Canada, making it the world's first certified marine bilgewater treatment system based on electrocoagulation. WETT-O received the 2016 Lloyd's List North American Innovation Award and was short-listed for the Lloyd's List Global Engineering Innovation Award. A WETT-O trial was carried out over six months with an offshore support vessel operating out of Trinidad and another is being planned with a leading provider of intermodal transportation solutions to the Maritimes. Regarding WETT-G, a project for the treatment of greywater at CHARS in Cambridge Bay has been secured. A larger-scale electrocoagulation unit suitable for all WETT products has now been developed after a two-year effort in order to address projects requiring higher capacities. The company has applied for an additional patent.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

InvoDane Engineering Ltd.

Round 16-2009B

Sector:



Energy
Exploration
and Production

Project

Completion Date:

December 2014

Market Impact

Report Due:

December 2016

Eligible

Project Costs:

\$10,034,750

SDTC Funding:

\$2,467,125

Leveraged

Funding:

\$7,567,625

Consortium

Members:

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

Environmental

Benefit:



Climate
Change

Project Title:

Unpiggable Pipeline Inspection

Project Description:

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

Objectives:

- Resolve remaining technology barriers in the pre-commercial prototype which will be scaled up to a market ready system by simplifying and improving the reliability of the robot.
- Develop auxiliary technology enabling deployment of the robot into live gas pipelines with diameters in the 20" to 26" range including a launch and retrieval system.
- Develop data analysis software and anomaly sizing methodology to detect metal loss including the depth, width and length of the defect to strict tolerances.
- Extend the robot inspection range as well as the associated wireless range.
- Demonstrate the technology in both abandoned and live, high pressure gas pipelines.
- Detect and measure cracks, mechanical damage and ovality in welds and base materials of the pipe.

Results:

- The prototypes were iteratively tested and optimized to increase the reliability of the robot; this is a key criteria for pipeline operators when considering deployment of new technologies.
- Developed dedicated auxiliary equipment including launch chambers, valve protection sleeves, control interface and other components to launch and retrieve the robot in live, unpiggable pipelines in the specified diameter range.
- Robot sensors and data analysis software demonstrated ability to provide pipeline operators with accurate measurements of defects, allowing operators to make repairs and reduce the number of pipeline failures.
- Both the robot and the wireless communication range objectives were achieved.
- The technology has been demonstrated in both abandoned and live, high pressure gas pipelines.
- InvoDane deployed the robot with crack sensors twice in underground pipe networks. InvoDane successfully commercialized a sensor to measure dents and ovality.

Project Impacts:

- The project resulted in GHG emission reductions of 7.4 kt CO₂e by eliminating the need to vent natural gas from live pipelines for inspection and/or by identifying gas leakages for repair.
- The market rollout of the technology is expected to result in the cumulative reductions of 34 kt CO₂e in the period 2013-2022 in Canada and 250 kt CO₂e in the period 2013-2022 for the Rest of World (ROW).

Path to Market:

- The project technology is being commercialized through a newly created subsidiary, Pipetel Technologies, which is now serving existing and new clients by offering a service that currently has no direct competition, only less quantitative substitutes.
- One of the better path to market options for Pipetel is through its access to a group of more than 20 utilities in North America who have indirectly funded the project through the Northeast Gas Association (NGA) and who meet quarterly to discuss the progress of this technology.
- Since 2013, more than six systems have been introduced (or are currently being commissioned) for commercial service in North America and are marketed under the name Explorer.

Market Impact:

- Through InvoDane's commercializing partner, Pipetel Technologies, there are service agreements or ongoing discussions with ~80 gas pipeline operators in North America.
- Inspections have been performed for seven of the top ten gas pipeline operators (ranked by number of customers).
- In 2016, five companies were brought onboard as new customers.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Ballard Power Systems Inc.

Round 17-2010A
Sector:


Power Generation

Project
Completion Date:

December 2014

Market Impact
Report Due:

December 2016

Eligible
Project Costs:

\$20,994,157

SDTC Funding:

\$7,061,620

Leveraged
Funding:

\$13,932,537

Consortium
Members:

 Ballard Power
Systems Inc.

Logan Energy

Toyota Motor

Sales USA Inc.

Environmental
Benefits:

PRIMARY


**Climate
Change**

SECONDARY



Clean Air

Project Title:

Ballard Power System's Byproduct Hydrogen Fuel Cell Project

Project Description:

Ballard Power Systems (Ballard) has developed a megawatt-scale, stationary-fuel-cell, power-generation system for use in both urban environments and remote locations. Ballard's fuel-cell technology is based on a Proton Exchange Membrane (PEM). To obtain the desired amount of electrical power, individual fuel cells are combined to form a fuel cell stack. The core technology is Ballard's new FCgen-1300 stack designed for the stationary power market which includes co-generation, telecom backup power, supplemental power and distributed generation. The FCgen-1300 maintains the same quality, efficiency and reliability features as the previous general Mark1100 stack design, and is primarily targeted at the back-up power market, but at a lower cost and with much higher durability to meet the commercial requirements of the high-use power generating market. The commercialization of stationary fuel cells for megawatt-scale power generation can aid in reducing the demand for conventional grid electricity generation. This project involved the development and demonstration of Ballard's megawatt-scale stationary Proton Exchange Membrane (PEM) fuel-cell platform. In addition to in-lab testing during development, the fuel-cell system was deployed at a one-megawatt installation at a Toyota Motors facility in California.

Objectives:

- To demonstrate successfully the stationary PEM fuel cell platform as a means of generating electricity at a megawatt-scale and at a cost of less than \$2,500/kW installed.

Results:

- A stationary PEM fuel cell platform was developed and installed in Torrance, California. The plant continues to operate successfully since its commissioning in October 2012. Durability tests showed more than 26,000 hours achieved with one stack sample. Advancements in materials and system control continue to allow for longer stake lifetimes. Ballard Power has begun building its next one-megawatt unit at the cost of less than \$2,500/kW.

Project Impacts:

- The demonstration project led to a GHG emissions reduction of 336 t/CO₂e and CAC emissions reductions of NO_x, SO_x, PM and VOCs (below 1 t each). The GHG emission reduction intensity was calculated as 0.28 t/CO₂e/MWh electricity generated.
- For Canada, it is estimated that market rollout between 2017 and 2026 will result in GHG emissions reductions of 60 kt CO₂e and CAC emissions reductions of 8 kt NO_x, 3 kt SO_x, 0.2 kt PM and 0.4 kt VOCs. The average GHG emission reduction intensity for Canada is calculated as 0.24 t CO₂e/MWh electricity generated.
- For the Rest of World (ROW), it is expected that between 2017 and 2026, market rollout will result in GHG emissions reductions of 744 kt CO₂e, as well as CAC emissions reductions of 371 kt NO_x, 947 kt SO_x, 36 kt PM and 6 kt VOCs.

Path to Market:

- Ballard's expected path forward is a licencing strategy, whereby Ballard licenses the system design to a third party to enable them to market, produce and distribute the system, with Ballard maintaining the fuel cell stack sales to the system licensee.

Market Impact:

- The success of the ClearGen unit demonstration in Torrance, California has allowed Ballard to secure additional contracts. Ballard will deliver an additional one-megawatt system to the Island of Martinique during 2017.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Duopar Technologies Inc.

Round 14-2008B
Sector:

 Waste
Management

Project
Completion Date:

January 2015*

Market Impact
Report Due:

January 2017

Eligible
Project Costs:

\$6,753,517

SDTC Funding:

\$2,597,696

Leveraged
Funding:

\$4,155,821

Consortium
Members:

 Duopar
Technologies Inc.
Canadian
Imperial Railway

**Environmental
Benefits:**

PRIMARY


Clean Soil

SECONDARY



Clean Air



Clean Water

**Project related activities were completed in January 2015; however, final project reporting was completed in 2016.*

Project Title:

Composite Railway Infrastructure Products

Project Description:

Soil and run off water pollution from the decomposition of creosote covered rail ties and railway crossings is a 200-year legacy problem in Canada. Duopar Technologies Inc. has developed 100% waste-based composite rail infrastructure products from difficult-to-recycle plastic and asphalt wastes. Their use alleviates leaching of toxic creosote chemicals into the surface soil and waterways while meeting railway specifications. Over 20 million railway ties are consumed in North America every year and each tie leaches up to 15 kg of creosote over its lifetime. Duopar's technology aimed to eliminate this problem with an environmentally friendly and economical alternative.

Objectives:

- Validate the heated auger processing and linear molding system concepts and fabricate a prototype production cell to produce 7,000 lbs (or ~20 rail ties)/hr.
- Design and manufacture a Prototype Production Core to produce 20,000 lbs (or ~60 rail ties)/hr, optimizing the process and adapting the concept to a production function.

Results:

- For the railway tie production cell, Duopar faced some technical challenges in production (e.g., temperature and pressure control, molding, etc.) and had to modify the manufacturing prototype several times in order to achieve the desired product. They were able to manufacture a total of 470 railway ties.
- Duopar completed the conceptual design of a prototype railway crossing system mold, but the fabrication of the prototype was not completed during the timeframe of the project due to the time and capital invested in overcoming the unforeseen issues it encountered in the fabrication of ties.
- A railway tie production line conceptual design was completed, however, fabrication of the production line was not completed during the timeframe of the project due to the unforeseen fabrication issues.

Project Impacts:

- Duopar manufactured 470 railway ties in its facility located in Brampton, Ontario. Approximately 60 ties were installed in the CPR railway marshalling yard in Markham, Ontario. Duopar was unable to complete the project within the contracted timeframe due to the unforeseen fabrication issues.
- The demonstration project resulted in GHG emission reductions of approximately 143 t CO₂e. The demonstration project also resulted in relatively minor CAC emission reductions (82 kg NO_x, 56 kg SO_x, 5 kg TPM, 5 kg VOCs and 34 kg CO).
- The GHG emission reduction intensity of manufacturing railway ties during the demonstration project is calculated as 305 t CO₂e per 1000 ties. CAC production intensities are minor (less than 1 kg per 1000 ties).
- Soil benefits were deemed negligible due to the disposal of waste ties by incineration and an expected ban on creosote by 2018.

Path to Market:

- Duopar plans to complete the demonstration of the Railway Crossing System with the City of Brampton and Canadian Natural Railway (CN) in 2017.
- Duopar also plans to complete one-year field tests with the rail ties to secure potential customers.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Vision Ecoproducts Ltd.

Round 19-2011A

Sector:



Energy Utilization

Project

Completion Date:

February 2015*

Market Impact

Report Due:

February 2017

Eligible

Project Costs:

\$11,272,947

SDTC Funding:

\$3,252,342

Leveraged

Funding:

\$8,020,605

Consortium

Members:

Vision
Ecoproducts Ltd.

Vision
Extrusion Ltd.

Masonite Doors
Harvey Building
Products

Sunview Patio
Doors Ltd.

Environmental

Benefits:

PRIMARY



**Climate
Change**

SECONDARY



Clean Air

**Project related activities were completed in February 2015; however, final project reporting was completed in 2016.*



Project Title:

Bio-composite Applications in Building Products



Project Description:

Increasing attempts to reduce the environmental footprint of buildings is driving demand for construction materials that reduce the amount of energy expended during all phases of a building's life. Vision Ecoproducts (VEP) developed one such material. VEP replaced polyvinyl chloride (PVC) plastic and aluminum in the manufacture of window frames and doors with a low-cost biocomposite made from post-consumer recycled plastic and rice hulls—an agricultural waste product. The energy cost of producing the VEP biocomposite was estimated to be 35% of the energy cost of producing the equivalent amount of PVC and less than 6% of the energy costs of an equivalent amount of aluminum. The VEP biocomposite can be used to build higher R-value windows and doors that will reduce energy consumption in the buildings in which they are used. The material is itself recyclable and its use will reduce the amount of PVC plastic currently ending up in landfills.



Objectives:

- Develop new formulations (e.g., base, foamed and reinforced) for non-structural and structural building components.
- Redesign, engineer and build extrusion equipment and downstream machinery to adapt to each of the formulations.
- Achieve internal throughput volume of up to 1500 lbs/h 24-hours-per-day-seven-days-per-week continuous operation of six months.
- Achieve a rejection rate of 3% to 5% from the current 70% to 90% from the bench test, depending on product and stage development process; and recycle 95% of rejected material.



Results:

- Base formulation was successfully produced (i.e., met the standards) but the foamed and reinforced formulations need more development work to meet desired specifications.
- Equipment and machinery were completed for the base formulation.
- The production line for the base formulation ran continuously for four days per week over a four-month period before ramp-up to commercial production.
- The target rejection and recycle rates were achieved for the base formulation.



Project Impacts:

- The VEP bio-composites reduce emissions by diverting existing waste from landfill.
- Emissions reductions during the project were calculated to be 517 t CO₂e, 400 kg of NO_x, 1.29 t of SO_x, 60 kg of PM, 80 kg of VOCs and 1.79 t of CO.
- Emissions reductions per kg of composite (for base formulation demonstration and market rollout) were calculated to be 0.91 kg CO₂e, 0.70 g NO_x, 2.3 g SO_x, 0.11 g PM, 0.15 g VOCs and 3.2 g CO.



Path to Market:

- TruNorth Composites Inc. bought the technology and it was commercialized under the name TruNorthDeck.
- TruNorth has secured a first commercial contract in Canada.
- Intense marketing is taking place in Canada and the USA.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

CarbonCure Technologies Inc.

Round 18-2010B

Sector:



Energy Utilization

Project

Completion Date:
September 2015*

Market Impact

Report Due:
September 2017

Eligible

Project Costs:
\$4,296,182

SDTC Funding:
\$1,492,000

Leveraged

Funding:
\$2,804,182

Consortium

Members:

CarbonCure Technologies Inc.
Air Liquide
Atlas Block Co. Ltd.
Basalite Concrete Products
The Shaw Group Ltd.

Environmental Benefits:

PRIMARY



Climate Change

SECONDARY



Clean Air



Clean Water

Project Title:

Concrete Curing Technology Demonstration

Project Description:

CarbonCure Technologies Inc. has developed universal retrofit technologies that utilize waste CO₂ in concrete production. Concrete blocks are produced with CO₂ that is permanently stored in the building material as solid limestone. Ready mixed concrete can be produced with reduced cement loadings in response to a strength enhancement associated with an optimal dose of CO₂. The project aimed to validate the performance of the technologies through industrial demonstrations.

Objectives:

- Complete concrete block production demonstrations with the Shaw Group (Nova Scotia), Basalite Concrete Products (California), and Atlas Block (Ontario).
- Complete three commercial green building installations to validate the product sourced from each demonstration plant.
- Complete a full-scale demonstration of the CarbonCure ready-mix system.
- Complete third-party material, industrial, economic and environmental studies.

Results:

- Production demonstrations were completed at three locations: Shaw, Basalite and Atlas.
- Blocks were installed in three green buildings in the Halifax area and one in the Toronto area. Installers did not indicate any issues with block quality.
- Masonry concrete technology integration was successfully achieved where the system could be retrofit to an existing line and efficiently deliver carbon dioxide to the concrete.
- Ready-mix concrete demonstrations took place at multiple industrial facilities in Canada and the United States. A strength benefit associated with an optimal dose of carbon dioxide was realized.
- Third-party testing confirmed that the carbonated blocks and ready mixed concrete met relevant performance standards.

Project Impacts:

- The demonstration of CarbonCure's project in installations in Nova Scotia and California resulted in net GHG emissions reductions of 0.14 t CO₂e.
- For rollout of the technology in Canada as applied to ready-mix concrete, emissions reductions are estimated to be 411 kt CO₂e by 2025.
- For rollout of the technology in Canada for precast concrete, estimated emissions reductions are 33 kt CO₂e by 2025.
- For Rest of World (ROW) rollout of the technology in Concrete Masonry Units (CMUs), the resulting emissions reductions are 180 kt CO₂e by 2025. For rollout of the technology in the ROW, as applied to ready-mix concrete, emissions reductions are estimated to be 7,577 kt CO₂e by 2025. For rollout of the technology in the ROW for precast concrete, estimated emissions reductions are 320 kt CO₂e by 2025.

Path to Market:

- The project with SDTC was instrumental in laying the groundwork to help CarbonCure successfully enter both the masonry and ready-mix concrete markets.
- CarbonCure is currently offering the technology to the concrete industry through a fixed monthly fee, which is offset by production savings.
- CarbonCure currently has contracts with 50 concrete producers in Canada and the US, and is growing rapidly.

**Project related activities were completed in September 2015; however, final project reporting was completed in 2016.*



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Solantron Semiconductor Corp.

Round 18-2010B
Sector:


Power Generation

Project
Completion Date:

September 2015*

Market Impact
Report Due:

September 2017

Eligible
Project Costs:

\$7,866,871

SDTC Funding:

\$2,049,234

Leveraged
Funding:

\$5,817,637

Consortium
Members:

Solantron Semiconductor Corp.
 nv Wienerberger sa
 System
 Photonics S.p.A.
 BIPV Inc.
 Tecta Solar
 Solarcentury
 Holdings Ltd.
 Bosch Solar
 CISTech GmbH
 Captelia SAS
 Aliavis S.r.l.

Environmental
Benefits:

PRIMARY


**Climate
Change**

SECONDARY


Clean Air

* Project related activities were completed in September 2015; however, final project reporting was completed in 2016.

Project Title:

Nano-inverter Chipset Development and Demonstration of AC-BIPV (Building Integrated Photovoltaic) Architectures

Project Description:

Solantron Semiconductor Corp. has developed and demonstrated an AC-grid approach for interconnecting BIPV modules based on its patented nano and micro-inverter chipsets. This approach has demonstrated the potential to increase solar energy harvest between 4% and 70% depending on environmental conditions, reduce the cost and time of installation, and eliminate certain restrictions on site suitability. The project focused on the demonstration of the chipsets in both nano-inverter and micro-inverter configurations. It compared the performance of AC-BIPV systems built with the micro-inverters to conventional DC-BIPV systems, using standard inverters in a number of different geographical locations, each with unique grid-tie requirements.

Objectives:

- Conversion efficiency greater than 94% for output powers of 20W, 60W, and 100W.
- Energy yield increase for AC-BIPV of 30% over current DC-BIPV in a typical household.
- Installation labour costs for AC-BIPV 50% less than for current DC-BIPV.
- Six months of field trials in North America and Europe, in northern and southern regions.
- Life span/reliability of more than 15 years for nano-inverters in AC-BIPV.
- Life span/reliability of more than 20 years for IC chipset in AC-BIPV.
- Cost of nano-inverters of \$0.30/W (\$0.20/W by 2015) for volume production of 10M units.

Results:

- Power weighted conversion efficiency greater than 96% measured using CEC test standards.
- Improved energy yield for AC-BIPV vs DC-BIPV under partial shading conditions verified in tests conducted at the NRC. The gains depended on severity of shading and ranged up to 50% for nano-inverters and up to 70% for micro-inverters.
- The demonstrated tolerance for partial shading leads to significant reductions in the cost of installation design, while the AC approach to interconnecting panels reduces the cost of high-voltage cabling.
- 49 inverters (nano and micro) were shipped to 19 different customers in 12 different countries (in North America, Asia, and Europe) for field trials.
- The micro-inverters were subjected to accelerated aging tests and the results indicate a reliability of greater than 29 years for the IC chipsets corresponding to life spans exceeding 20 years for the micro- and nano-inverters using them.
- P300A micro-inverter chipsets are estimated to cost \$0.18/W in quantities of 10M.

Project Impacts:

- The limited duration tests at NRC of Solantron's AC-BIPV system resulted in GHG emission reductions of 0.005 kg CO₂e per day and corresponding reductions in CAC emissions.
- The rollout of Solantron's AC-BIPV process is expected to result in GHG and CAC emission reductions resulting from improvements in energy yield over conventional DC-BIPV systems. The actual amount will depend on the physical layout and the partial shading challenges of each installation site and therefore the future savings are difficult to estimate in the absence of the deployment details.

Path to Market:

- Solantron has developed the digital power processor (DP2) chipset, which has various applications, including micro-inverters for AC-BIPV, DC optimizers, charge controllers, AC battery and fuel cell inverters. Using the DP2 chipset, Solantron has successfully established various design-wins with very large multi-national companies, with one company launching a new product, which incorporates the DP2 and others anticipated to enter the commercial space in the near future.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

semiosBIO Technologies Inc.

Round 20-2011B

Sector:



Agriculture

Project

Completion Date:

October 2015*

Market Impact

Report Due:

October 2017

Eligible

Project Costs:

\$16,033,807

SDTC Funding:

\$4,980,000

Leveraged

Funding:

\$11,053,807

Consortium

Members:

semiosBIO Technologies Inc.

University of British Columbia

University of British Columbia - Okanagan Campus

Kootenay Sterile Insect Release Program

University of Guelph

Environmental Benefits:

PRIMARY



Clean Soil

SECONDARY



Clean Water

**Project related activities were completed in 2015; however, final project reporting was completed in 2016.*

Project Title:

Area-wide Demonstration of Automated and Integrated Pest Management System

Project Description:

semiosBIO developed a pest management system (AIPM) comprised of mating-disrupting pheromones and automated sensory and dispersion equipment to apply pheromones in controlled dosages and when needed. The system prevents pests such as the oriental fruit moth and codling moth from mating, thereby reducing the eclosion rate of larvae that damage crops and Canadian orchards important yield losses and revenue annually cost. Through the SDTC project, semiosBIO completed a large-scale, pre-commercial demonstration of the AIPM system.

Objectives:

- Large-scale pre-commercial demonstration of:
 - semiosNET, a cloud based network and automated aerosol dispensing system;
 - semiosTRACKER, a mating disruption pheromone tracking technology;
 - semiosVUE, a networked and automated pheromone trap system equipped with digital cameras monitoring pest intensity; and
 - semiosLIVE, a modular software that provides precision data quantifying pest intensity and used for adjustments of pheromone dispersion rates.
- Large-scale pre-commercial demonstration of high intensity remote temperature monitoring facilities for use in the prediction and real-time monitoring of critical frost events.
- Pre-commercialization demonstration of semiosBIO technologies for the management of pests in nut orchards, namely almonds, walnuts and pistachios.

Results:

- Large-scale pre-commercial demonstrations were completed as follows:
 - semiosNET was successfully tested at multiple sites globally.
 - semiosTRACKER results did not meet expectations and is not considered a critical component of the semiosBIO system.
 - semiosVUE digital pest count in traps was successfully demonstrated on 3,520 ha globally.
 - 236 commercial and trial users tested semiosLIVE software in 2015.
- The desired temperature accuracy for the frost monitoring system was achieved, as was system reliability.
- semiosBIO completed successful demonstrations on 227 ha of walnut farms in Europe. System reliability and success was also demonstrated on 417 ha of almond farms and 32 ha of pistachios in California.

Project Impacts:

- The successful global demonstration of the semiosBIO AIPM system covered thousands of hectares in Canada, US and Europe for apples, pears, peaches, grapes, walnuts, almonds, pistachios and oranges.
- By 2020, the rollout of the semiosBIO system is expected to result in GHG reductions of 0.6 kt CO₂e/y and soil benefits due to 2,369 kg of pesticide use avoided per year.

Path to Market:

- semiosBIO currently offers the only proven wireless network for their target market and use a direct sales model to rollout the technology.
- The proprietary wireless network is deployed on a customer's property. semiosBIO maintains the title to the hardware and charges an annual fee per acre for Software as a Service (SAAS).
- semiosBIO currently focuses on California nuts, stone fruit and citrus and Washington apples. Other markets will be initiated in the next two to three years, including EU grapes and Latin American apples and grapes.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Electrovaya Corp.

Round 15-2009A
Sector:


Transportation

Project
Completion Date:

November 2015*

Market Impact
Report Due:

November 2017

Eligible
Project Costs:

\$28,789,007

SDTC Funding:

\$8,524,171

Leveraged
Funding:

\$20,264,836

Consortium
Members:

Electrovaya Corp.

Chrysler LLC

Environmental
Benefits:

PRIMARY


**Climate
Change**

SECONDARY



Clean Air

*Project related activities were completed in November 2015; however, final project reporting was completed in 2016.

Project Title:

Advanced Lithium-Ion SuperPolymer® Battery Systems for Plug-in Hybrid Electric Vehicles

Project Description:

Electrovaya developed and demonstrated its advanced, high-energy-density, lithium ion SuperPolymer® battery packs for applications in a test fleet of plug-in hybrid electric vehicle (PHEV) versions of the Ram 1500 pickup from Chrysler Group's Ram truck brand and Dodge Town and Country minivans. Electrovaya's battery packs have demonstrated the ability to provide greater energy density than competitors using a unique zero-emission cell-manufacturing production process with no toxic solvents. This project was built on Electrovaya's previously funded SDTC project and included the development of advanced cells and battery modules, an optimized manufacturing and assembly process, as well as cost reduction for the lithium-ion battery systems. This is one of the safest, highest-performance, lowest-cost batteries in the industry. SDTC also funded the development of an advanced, battery-management system (BMS), which can be used in electric transportation to control and monitor the battery as well as communicate to the central control block. The BMS has both passive and active balancing capabilities. This project has enabled Electrovaya to step up to a new level of lithium-ion battery technology that has enabled it to compete in the global markets of electric transportation and large-scale energy storage.

Objectives:

- Development of cells, modules, and packs, with associated battery management for Chrysler's Dodge Ram pickup truck and Town and Country models to enable their conversion to PHEV drive trains.
- Build one of the safest and highest performing 35 kWh battery packs with integrated BMS in the mobile transportation industry.
- Development and implementation of automated equipment, including amalgamation of unit processes, to improve Electrovaya's clean manufacturing process (that does not use toxic n-methyl pyrrolidone in its production) and costs.
- Production target costs at \$550/kWh USD including the integrated BMS.

Results:

- Electrovaya's technology was fully demonstrated in 108 Dodge Ram pickup trucks and 23 Dodge Town and Country minivans.
- The production target of 6,000 battery packs per year was achieved.
- Automation of the manufacturing process increased capacity and a roll-to-roll coating speed was achieved to make for an efficient process, avoiding further bottlenecks and excess scrap. The yield target of more than 92% A-grade cells was achieved and surpassed. Costs have improved and reductions have surpassed the objective.
- Developed a highly integrated BMS that monitors 54 cells (servicing up to 60 cells), controls six relays, checks relay and fuses.
- Built and tested a 35 kWh system with integrated BMS for 35 kWh capacity and 3,500 kW power density. The cells passed performance tests and multiple safety tests.

Project Impacts:

- The demonstration of Electrovaya's batteries resulted in GHG emissions reductions of 528 t CO₂e and reductions in CAC emissions.
- The rollout of Electrovaya's batteries is expected to result in GHG and CAC emission reductions. For Canadian rollout in PHEVs, the 35 kWh battery results in reductions of 2.26 t CO₂e/y. For PEVs in Canada, the 35 kWh battery results in reductions of 2.51 t CO₂e/y. For Rest of World (ROW) rollout in PHEVs, the 35 kWh battery results in reductions of 1.5 t CO₂e/y. For PEVs in ROW, the 35 kWh battery results in reductions of 0.92 t CO₂e/y.

Path to Market:

- The acquisition of Litarion GmbH (Litarion) in 2015 has enhanced Electrovaya's business model and capabilities by providing it manufacturing scale and the SEPARION™ separator technology. The acquisition strengthens Electrovaya to build larger scale energy storage system projects and expands the business into new markets.
- The Lithium Ion SuperPolymer®2.0 technology is the current generation cell and systems technology developed through this SDTC project. Electrovaya sells the technology under a few sales points that can be made into slightly different "Lego block" battery modules for multiple applications.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Ionada Inc.

Round 24–2013B

Sector:



Transportation

Project

Completion Date:

March 2016

Market Impact

Report Due:

March 2018

Eligible

Project Costs:

\$4,881,762

SDTC Funding:

\$1,394,495

Leveraged

Funding:

\$3,487,267

Consortium

Members:

Ionada Inc.

Canadian

Steamship Lines

Ryerson University

Environmental

Benefits:

PRIMARY



Clean Air

SECONDARY



Climate Change



Project Title:

Marine Clean Air Membrane Scrubber



Project Description:

The International Maritime Organization (IMO) has imposed global emissions regulations upon the shipping industry, necessitating newly reduced emissions for sulphur oxides, in effect from 2015 onwards. Ship operators can either switch to expensive, lower-sulphur fuel alternatives or use heavy-fuel oil and install a scrubber on their vessel to remove the sulphur oxides. Scrubbing is the most cost-effective means for the industry, but some scrubbers have proven very difficult and expensive to install or retrofit into existing vessels. Enter Ionada's Ionic Capture Technology (ICT), a marine scrubber that removes sulphur oxides using dry, membrane-gas separation and salt water or ionic liquids. The technology is more energy efficient than widely available devices and 50% smaller, and it has a less complex configuration that makes it easier and more cost effective to retrofit shipping vessels.



Objectives:

- Build a pilot demonstration of the Marine Separation Scrubber (MSS) capable of treating an equivalent of 2 MW marine diesel engine exhaust gas with a SO_x removal efficiency of 86% and a target efficiency of 97%.
- Demonstrate full fluidic, electrical and control of the membrane system and seamless integration of the MSS on the Baie St. Paul (CSL vessel) within the scheduled dry dock window.
- Demonstrate ceramic membrane durability and longevity during a six-month at sea trial within the Emission Control Area achieving the minimum required efficiency confirming compliance with IMO MARPOL regulations.



Results:

- The MSS was able to demonstrate a minimum of 86% SO_x removal efficiency and a target efficiency of 97%.
- Full fluidic, electrical and control of the membrane system and seamless integration of the MSS on the Baie St. Paul (CSL vessel) were achieved.
- Environment Canada verified scrubber performance and ceramic membrane durability. Compliance to MARPOL regulations was achieved.



Project Impacts:

- Due to scheduling conflicts, the tests on board the CSL vessel were limited and therefore, the environmental benefits from the demonstration project were not quantified.
- The rollout is expected to result in cumulative GHG emissions reductions of 656 kt CO₂e in Canada and 1,796 kt CO₂e in the Rest of World (ROW) from 2017-2025.
- With the rollout, cumulative CAC reductions of 749 t SO_x, 3,182 t NO_x, 600 t PM, 425 t CO and 158 t VOC in are expected in Canada from 2017-2025. Cumulative CAC reductions of 2,048 t SO_x, 8,705 t NO_x, 1,641 t PM, 1,161 t CO and 432 t VOCs are expected in the ROW.
- In addition, a cumulative reduction in polycyclic aromatic hydrocarbon (PAH) emissions to water of 32 t in Canada and 88 t in the ROW are expected with the rollout.



Path to Market:

- Between 2015 and 2020, Ionada plans to focus primarily on the retrofit market, targeting owner/operators looking for systems under 10 MW.
- With zero wastewater discharge, vessels can sail into any port.
- Focus will be on promoting the fact that the Ionada system is based on a low CAPEX and a payback period of under two years.
- Leasing options will provide reduced risk to clients.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Agrisoma Biosciences Inc.

Round 15-2009A

Sector:



Agriculture

Project

Completion Date:
December 2015*

Market Impact Report Due:
December 2017

Eligible

Project Costs:
\$11,031,621

SDTC Funding:
\$3,275,000

Leveraged Funding:
\$7,756,621

Consortium Members:

Agrisoma
BioSciences Inc.
National Research
Council – Plant
Biotechnology
Institute

Environmental Benefits:

PRIMARY



Clean Soil

SECONDARY



Climate Change



Clean Air



Clean Water

**Project related activities were completed in December 2015; however, final project reporting was completed in 2016.*

Project Title:

Dedicated Biodiesel Oilseeds for Biofuel Manufacturing

Project Description:

Agrisoma focused on the development of Brassica carinata (B. carinata) oilseeds (sold under the brand name Resonance™) with high yields of optimized oil profiles that can be grown on marginal land. The oil produced from B. carinata is a sustainable, high quality feedstock for the production of premium, renewable, bio-based fuels such as diesel and jet fuels. Using non-genetically (non-GM) modified approaches, the project demonstrated the use of B. carinata oilseed for the production and demonstration of renewable diesel with enhanced profiles from field trials. A co-product from the extraction of the oil is a high quality protein meal used as animal feed.

Objectives:

- Produce proprietary non-GM oilseed varieties with the following features:
 - Optimized oil profiles in seed for renewable fuel manufacturing.
 - Enhanced yield of optimized oils.
 - Ability to grow B. carinata on marginal land and provide enhanced yields per hectare while maintaining or decreasing fertilizer inputs relative to current varieties.
 - Conversion of recovered oil into fuels.
 - Approved utilization of meal as a co-product for animal feed.
- Demonstrate conversion of oil into renewable diesel and demonstrate displacement of fossil-based, P-50 diesel in a power generator set.

Results:

- Optimized oil chemistry with a higher seed oil content and stable composition was achieved from non-GM varieties developed using advanced breeding techniques such as doubled haploidy (DH).
- Despite difficult weather conditions, preliminary trials of multiple varieties showed a similar or better yield than current commercial varieties of B. carinata.
- While the best lines yielded as well or better than commercial varieties, challenging growth conditions encountered at several trial sites will necessitate additional rounds of small plot and larger commercial scale cultivation to identify best commercial candidate lines.
- Due to the small plot trials, the volume of oil generated was insufficient to complete the fuel manufacturing and its evaluation.
- Agrisoma's processing conditions successfully produced a meal co-product with glucosinolate levels equivalent or lower than canola meal and with higher levels of protein.
- While yields were insufficient to test the renewable diesel, it was determined to be an excellent diesel replacement and a demonstration is still anticipated.

Project Impacts:

- The demonstration project resulted in a GHG emission reduction of 7.7 t CO₂e, along with reductions in CAC emissions, soil quality, and land use benefits compared to the baseline of Resonance™.

Path to Market:

- Agrisoma has been commercializing its Resonance™ seed for the past three years, with sales in Canada, the US and Uruguay. The seed of Brassica carinata DH varieties, including those evaluated during the project as well as newer DH varieties are currently undergoing additional rounds of preliminary and advanced yield and agronomy testing in trials carried out in North and South America. It is anticipated that the best locally adapted candidate lines will be available for commercial release in the near future.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Petroleum Technology Research Centre Inc. (PTRC) - Aqistore

Round 12–2007B

Sector:



Energy
Exploration
and Production

Project

Completion Date:
December 2015*

Market Impact

Report Due:
December 2017

Eligible

Project Costs:
\$31,604,009

SDTC Funding:
\$5,000,000

Leveraged

Funding:
\$26,604,009

Consortium

Members:

Petroleum
Technology
Research
Centre Inc.
Enbridge Inc.
SaskEnergy Inc.
Saskatchewan
Power Corp.
Schlumberger
Carbon Services

Environmental Benefit:



**Climate
Change**

Project Title:

CO₂ Capture, Transport and Storage in Deep Saline Aquifers

Project Description:

The Petroleum Technology Research Centre (PTRC) and its consortium members demonstrated the feasibility of storing CO₂ in deep saline aquifers—geological formations with storage capacity over ten times larger than depleted oil reservoirs—in the Western Canadian Sedimentary Basin. The salty water contained in deep saline aquifers is not suitable for drinking or agriculture, making the geological formations an ideal large-scale storage solution for large, stationary, industrial CO₂ emitters. The Aqistore project at SaskPower's Boundary Dam represents the first large-scale (400 t/d) application of saline aquifer storage of CO₂ in North America and the second largest in the world.

Objectives:

- Demonstrate that CO₂ saline aquifer storage is a safe, workable solution for emissions reduction.
- Develop a transportable, integrated suite of measuring, monitoring and verification (MMV) technologies for carbon storage in a saline aquifer.
- Foster an environment for creating essential linkages between financial institutions developing domestic trading schemes, regulators designing an appropriate regulatory environment, industry implementing the technology and the public learning about the technology.

Results:

- PTRC demonstrated that CO₂ saline aquifer storage is safe and results in GHG emission reductions.
- PTRC demonstrated a host of MMV technologies including surface and shallow sub-surface monitoring, a seismic program, well logging and testing and sampling, and a down-hole monitoring with casing-conveyed instruments. These technologies are applicable to any large, industrial stationary emitter across Canada and worldwide.
- PTRC developed a communications plan and formed a steering committee to disseminate literature and information regarding the project for the public, landowners/users, and other stakeholders such as legislators and members of large GHG emitting industries.

Project Impacts:

- The demonstration project, as part of the full-scale commercial Carbon Capture Utilization Storage (CCUS) operation including the CO₂ capture plant at Boundary Dam resulted in absolute average GHG emission reductions of 53.1 kt CO₂e, 7.3 t NO_x, and 94 t SO₂/y compared to a release of CO₂ from a coal-fired power plant. The project technology will result in some emissions including particulate matter of 459 t, 0.07 t VOCs and 1.5 t CO due to the increased electricity consumption required for the carbon capture technology.

Path to Market:

- The Aqistore project was not focused on the development or sale of a commercial technology; it is a knowledge-sharing carbon capture and storage technology development that is applicable for any CO₂-point-source applications across the industrial heartland. Ongoing knowledge-sharing initiatives include industry conference presentations and the publication of academic reports.

**Project related activities were completed in December 2015; however, final project reporting was completed in 2016.*



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

BioAmber Sarnia Inc.

Round 18–2010B

Sector:



Energy Utilization

Project

Completion Date:

March 2016

Market Impact

Report Due:

March 2018

Eligible

Project Costs:

\$43,697,404

SDTC Funding:

\$14,513,650

Leveraged

Funding:

\$29,183,754

Consortium

Members:

BioAmber

Sarnia Inc.

BioAmber

Canada Inc.

BioAmber Inc.

BioAmber

International S.a.r.l.

Mitsui & Co. Ltd.

Environmental

Benefit:



**Climate
Change**

Project Title:

Succinic Acid Downstream Purification

Project Description:

BioAmber Sarnia (BAS), a joint venture between BioAmber Inc. (BioAmber) and Mitsui & Co., has developed and demonstrated a novel bio-based technology which ferments glucose into succinic acid (SA) using their proprietary yeast, a more environmentally friendly and more economical process than petroleum-based SA production. BioAmber's technology platform combines industrial biotechnology, innovative purification and chemical catalysis to convert renewable feedstocks into chemicals for use in a variety of everyday products. BioAmber is currently the only company producing bio-based succinic acid (SA) at a commercial scale. The commercial SA plant in Sarnia, Ontario, is on track to achieve a nameplate production capacity of 30,000 t of SA/y in 2017.

Objectives:

- To demonstrate the economic viability of the process at scale, by proving out the variable cost and efficiency of succinic acid production using the innovative downstream process.
- To demonstrate product purity and quality attainable using the innovative conversion technology at a significant scale; targets include high purity succinic acid (99.8%) on a dry basis.
- To provide large quantities of commercial purity/quality samples to customers to generate demand for the construction of commercial scale (100,000 MT/y to 200,000 MT/y) plants.
- To develop the technology/process package in Canada for the construction of commercial scale plants implementing a platform with the capacity for expansion into chemical intermediates such as butanediol (BDO) and tetrahydrofuran (THF).

Results:

- Based on the ~50% production capacity achieved during start-up, variable costs for yeast-based SA production are trending towards targets as production volumes increase.
- Subsequent operation of the plant has produced a succinic acid product that meets customer requirements.
- As of mid-2016, over 2000 t SA have been provided to customers. BioAmber has several off-take agreements from the facility and is in the process of negotiating expanded agreements to account for additional off-take from future larger facilities.
- BioAmber has been working to develop new and emerging markets for SA (e.g., coatings, part of biodegradable plastics), SA as a replacement for adipic acid (e.g., textiles, shoe soles), and as replacement for maleic anhydride (i.e., BDO and THF).

Project Impacts:

- The demonstration project led to GHG emissions reductions of 24.8 kt CO₂e and CAC emissions reductions of NO_x, CO and VOCs (below 1 t each).
- For Canada, it is estimated that market rollout between 2016 and 2029 will result in GHG emissions reductions of 18.6 Mt CO₂e and CAC emissions reductions of 8.6 kt NO_x, 36.7 kt CO and 46.1 kt VOCs. The average GHG emission reduction intensity for Canada is calculated as 17.4 t CO₂e /t SA.
- For the Rest of World (ROW), it is expected that between 2017 and 2029, market rollout will result in GHG emissions reductions of 10.9 Mt CO₂e, as well as CAC emissions reductions of 5.3 kt NO_x, 23 kt CO and 29 kt VOCs. The average GHG emission reduction intensity for the ROW is calculated as 16.6 t CO₂e/t SA.

Path to Market:

- In April 2015 BioAmber entered into a technology license with Johnson Matthey Davy Technologies. The licensing package will enable BioAmber to construct and operate a 200,000 t-per-year city plant that uses bio-succinic acid as the feedstock to produce ~70 kt of 1,4 BDO, 60 kt of succinic acid and 24 kt of THF. BioAmber has also secured the right to license the JM Davy technology for two additional BDO/THF plants.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Cooledge Lighting Inc.

Round 18-2010B

Sector:



Energy Utilization

Project

Completion Date:

March 2016

Market Impact

Report Due:

March 2018

Eligible

Project Costs:

\$12,998,540

SDTC Funding:

\$4,469,000

Leveraged

Funding:

\$8,529,540

Consortium

Members:

Cooledge Lighting Inc.
British Columbia Hydro and Power Authority

The Governors of the University of British Columbia

Environmental

Benefits:

PRIMARY



Climate Change

SECONDARY



Clean Air



Clean Water



Clean Soil

Project Title:

MicroLED Lighting System Demonstration

Project Description:

Commercial buildings in Canada are the largest consumers of broad area lighting, which accounts for 10% of that sector's total energy demand. Cooledge aimed to replace the conventional fluorescent fixtures used for broad-area lighting in commercial buildings with cost competitive MicroLED luminaires that are more energy efficient, mercury free and can provide better quality lighting and new design possibilities. The result has been a set of indoor and outdoor products that include an interconnecting 1'x1' tile and 2" and 4" lighting strips that, at the end of the process development within the SDTC project, have been incorporated in a number of applications including display, ceiling, wall and perimeter lighting.

Objectives:

- Demonstrate prototype light units that meet market requirements, particularly a luminous efficacy of 100 lm/W.
- Install and evaluate prototype light units at UBC and BC Hydro.
- Complete product certification and qualification.
- Meet cost target of \$20/klm.
- Have two initial channel partners in place.

Results:

- The full size prototypes were evaluated to show that they met or exceeded most market requirements (e.g., efficacy of greater than 100 lm/W, CCT of approximately 3500K and CRI of approximately 83).
- Six demonstration units were installed at UBC and four at BC Hydro.
- Received UL certification for the light sheet and 50 W and 90 W driver. Product validation and qualification were completed and the light sheet is currently commercially available.
- A cost model was developed showing a product cost below \$20/klm.
- Cooledge had manufacturing agreements in place with three channel partners, two of which had already released products incorporating their light sheet.

Project Impacts:

- The GHG emission reduction intensity associated with the indoor application was 14.5 kg CO₂e per troffer per year. The GHG emission reduction intensity associated with the outdoor application was 8.8 kg CO₂e per troffer per year.
- The demonstration also resulted in significant reductions in CAC emissions and mercury sent to landfill.
- The rollout of Cooledge's indoor application is expected to result in cumulative GHG emission reductions of 12 kt CO₂e in Canada and 559 kt CO₂e in the Rest of World (ROW) from 2012/13-2024.
- The rollout of Cooledge's outdoor application is expected to result in cumulative GHG emission reductions of 3 kt CO₂e in Canada and 216 kt CO₂e in the ROW from 2016-2024.

Path to Market:

- The go-to-market strategy is focused on opportunities for large luminous surfaces:
 - For interior applications, these include ceilings, walls and large illuminated displays.
 - For exterior applications these include facades, canopies and entrances.
- The key market segments Cooledge targets are retail, hospitality, office and scened environments.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Corvus Energy Ltd.

Round 17-2010A
Sector:


Transportation

Project
Completion Date:

May 2016

Market Impact
Report Due:

May 2018

Eligible
Project Costs:

\$1,765,052

(Pending final audit)
SDTC Funding:

\$582,467

Leveraged
Funding:

\$1,182,585

Consortium
Members:

 Corvus
Energy Ltd.

Wärsilä Norway AS

Environmental
Benefits:

PRIMARY


Clean Air

SECONDARY


 Climate
Change

Project Title:

Corvus-Wärsilä Folgefonn Ferry and Shore Power

Project Description:

Corvus Energy and Wärsilä Corp. retrofitted and sea trialed an electric ferry in Norway. They designed and built a 1,053-kWh battery system and an energy-management system for the Folgefonn ferry, as well as a 468-kWh battery for a newly designed on-shore charging system. The consortium conducted sea trials of the ferry in which performance data on the battery, propulsion-drive/train systems and shore-power charging system were collected within a commissioning, crew-training program. The system functioned in hybrid and fully electric modes for the regular operation of the ferry.

Objectives:

- Design and build a 1,053 kWh on-board battery system for the ferry and a 468 kWh battery system for on-shore charging.
- Demonstrate a production cost of less than \$1,600/kWh for the battery systems.
- Retrofit the Folgefonn ferry with two 900 kW electric motors, the on-board battery system and power management system.
- Operate the ferry in full electric mode for six months on its regular route: 27 crossings per day at a transit speed of 11 knots.
- Recharge the on-board battery system in less than 20 minutes with the on-shore charging system.
- Reach ZERO emission operation by charging the on-shore system with wind/solar power.

Results:

- Corvus and their consortium completed system design for the on-board battery system and the on-shore charging system.
- The cost target of \$959/kWh was achieved.
- The on-board battery and power management systems were installed on the Folgefonn ferry and integrated with the existing motors.
- The ferry operated for 30 days during the project (regular route) in hybrid mode, with a diesel engine operating in parallel with the battery system. It has remained in operation since the end of the project.
- The project successfully demonstrated charging of the battery packs with shore power. However, the transfer of energy from shore was difficult to stabilize when done rapidly and during movement of the ferry.
- The ferry operated in full electric mode 20% of the time (ZERO emission operation) and in hybrid mode for the remainder of the route.

Project Impacts:

- The ferry demonstration resulted in a GHG emission reduction of 25 t CO₂e. Reductions in CAC emissions were negligible.
- The rollout of the hybrid ferry technology is expected to result in cumulative GHG emission reductions of 76 kt CO₂e in Canada and 577 kt CO₂e in the Rest of World (ROW) from 2017-2026.
- The rollout is also expected to result in reductions in CAC emissions. Cumulative CAC reductions in Canada from 2017-2026 are expected to be 1,415 t NO_x, 59 t SO_x, 100 t PM, and 4 t VOC. CAC reductions in the ROW over the same period are expected to be 19,604 t NO_x, 2,652 t SO_x, 1,379 t PM, and 59 t VOC.

Path to Market:

- Corvus is focusing on two large market opportunities: fully electric ferries and offshore vessels with dynamic positioning. Corvus has increased the use in fully electric mode of the Folgefonn ferry and has converted another ferry to fully electric based on the lessons learned from the project. They are developing an extensible, modular and scalable platform enabling an energy dense, low cost product (Orca Energy) and a high-power, low-cost product capable of higher charge and discharge rates (Orca Power). They have formed key partnerships with major players in the supply chain, such as Siemens and Wärsilä, to better access the market.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

GaN Systems Inc.

Round 24-2013B
Sector:


Transportation

Project
Completion Date:

March 2016

Market Impact
Report Due:

March 2018

Eligible
Project Costs:

\$6,974,548

SDTC Funding:

\$2,187,971

Leveraged
Funding:

\$4,786,577

Consortium
Members:

GaN Systems Inc.

Delta-Q

Technologies

Environmental
Benefits:

PRIMARY


**Climate
Change**

SECONDARY



Clean Air

Project Title:

Low-cost Gallium Nitride (GaN) Power Devices for High Efficiency Industrial Battery Chargers

Project Description:

GaN Systems has developed and demonstrated the core GaN-on-Si technology and tailored device designs to the battery-charger application. The technology consists of a lateral, high-electron-mobility transistor (HEMT) built onto an epitaxial film of gallium nitride on a passive substrate. GaN Systems' partner, Delta Q, developed a new generation of battery chargers for electrical vehicles, beginning with the 1200W charger targeted for this project. The new design introduces bridgeless power factor correction (PFC) AC-DC topology, a move that is enabled by the use of GaN HEMTs. The technology is scalable to 9kW. The increase in efficiency associated with using GaN cuts waste-heat generation in half compared to the same design implemented in silicon, which reduces the cost of operation and maintenance of the battery charger and provides an opportunity to reduce the charger's size and weight.

Objectives:

- Develop and build GaN power transistors and drivers optimized for use in a battery charger for Hybrid Electrical Vehicles/Electrical Vehicles (HEV/EV).
- Develop and build a demonstration of a 30% smaller and 25% lighter 1200W power-factor-corrected battery charger system with market leading power conversion efficiency of greater than 94%. Validate its performance in comparison with conventional technology.
- Install and demonstrate the battery charger system in host vehicles in collaboration with two prospective early adopters: Club Car (Ingersoll Rand) and Polaris.

Results:

- GaN power transistors and drivers were developed, built and tested.
- GaN Systems' partner, Delta-Q, developed a new generation of battery chargers for electrical vehicles, beginning with the 1200W charger targeted for this project. The new design introduces bridgeless power factor correction (PFC) AC-DC topology, a move that is enabled by the use of GaN HEMTs. The charger is 39% smaller and 44% lighter. Its power conversion efficient ranges between 90% and 93%.
- Chargers were demonstrated in host vehicles from Club Car, Polaris and Genie. The Club Car ran ~30 charge cycles on a life test pack, and testing efficiency, power, and charge time over a wide range of input voltages and ambient temperatures. No issues were observed, and the charger delivered thermal performance well above specifications in worst-case conditions (i.e., 65°C, 100 Vac input).

Project Impacts:

- The GaN-on-Si technology has the potential to reduce GHG and CAC emissions in Canada and the Rest of World:
 - Cumulative GHG reductions for 2017-2025 are estimated to be 4,459 kt CO₂e.
 - For the same period, cumulative reductions are estimated at 4,224 t SO_x, 6,759 t NO_x, 567 t PM, 185 kt CO and 6,038 t VOCs.

Path to Market:

- The demonstration has shown the reliability of the GaN transistors.
- GaN Systems has collaborated with the most trusted high volume, high quality suppliers in the industry, ensuring rigorous testing and qualifying of their products.
- They have engaged with more than 1,200 customers in all applicable GaN segments and signed global distributor agreements with over a dozen major players in the industry.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

'Namgis First Nation

Round 18-2010B

Sector:



Agriculture

Project

Completion Date:

June 2016

Market Impact

Report Due:

June 2018

Eligible

Project Costs:

\$16,005,099

SDTC Funding:

\$5,650,000

Leveraged

Funding:

\$10,355,099

Consortium

Members:

'Namgis
First Nation
SOS Marine
Conservation
Foundation
Tides Canada
Salmon
Aquaculture
Innovation Fund

Environmental

Benefit:



Clean Water

Project Title:

Land-Based Atlantic Salmon Recirculating Aquaculture System (RAS) Project

Project Description:

The Food and Agriculture Organization estimates that human fish consumption will reach 183 million metric tonnes by 2030, two thirds of which will come from aquaculture. The vulnerability of farmed salmon to disease, sea lice, and poor water quality and the risks that open, net-pen aquaculture poses for wild Pacific salmon has driven the development of innovative rearing technologies to reduce or eliminate these risks. The 'Namgis First Nation demonstrated a land-based Recirculating Aquaculture System (RAS) for the production of Atlantic salmon at a pilot facility on Vancouver Island. The facility aimed to isolate the salmon-rearing process from the marine environment, while creating optimum conditions for salmon growth and demonstrating an alternative to the current net-cage practices that are the focus of environmental concern. The optimized growing environment and the environmental isolation were predicted to produce salmon that can result in a sustainable business, while reducing the environmental impacts on oceans. The RAS technology benefits the environment by reducing the risk of disease and parasite transmission and by treating both the solid and liquid waste resulting from salmon rearing.

Objectives:

- Confirm and optimize biological and technical parameters for raising Atlantic salmon to market size in a land-based, recirculating aquaculture system.
- Validate operating costs and production parameters for a commercial-sized facility.
- Develop minimum site characteristics and economic factors for future commercial-scale facilities.

Results:

- Kuterra (owned by the 'Namgis) has collected extensive technical and operational information which has been shared with the industry through multiple workshops and publications.
- Kuterra validated the amount of water use, energy use, and land use (footprint) required by RAS facilities, and provided concrete operating cost data, water quality data, and descriptions of operational issues that will be invaluable to subsequent RAS developers/proponents.
- Kuterra's results and financial model for a 3000 MT RAS facility indicate that it should be possible to achieve investment grade returns growing Atlantic salmon at scale in a RAS.

Project Impacts:

- The demonstration project resulted in GHG reductions of 50 t CO₂e and some reductions in CAC and water contamination. Based on data obtained from the last four cohorts, Kuterra expects that between 2017 and 2026, its market rollout in Canada will result in GHG emissions reductions of 23 kt CO₂e and CAC emissions reductions of 1 kt CO.
- Market rollout will also prevent marine water contamination by reducing the release of 6 kt of nitrogen (N), 1 kt of phosphorous (P), 0.03 kt copper (Cu), 21 kt organic carbon (OC), and 0.9 billion sea lice. For the Rest of World (ROW), market rollout will result in GHG emissions reductions of 218 kt CO₂e and CAC emissions reductions of 10 kt CO.
- Market rollout in the ROW is also expected to prevent the release of the following contaminants into marine water: 63 kt N, 10 kt P, 0.3 kt Cu, 204 kt OC and 8.8 billion sea lice.

Path to Market:

- The goal of the 'Namgis project was to be an open-source operation in order to speed innovation in the sector and to encourage adoption of the technology both in Canada and globally. Today, independent from Kuterra, there are twelve facilities in the world (three in Canada) growing more than 5,600 MT of Atlantic salmon to market size annually in a RAS, with four more facilities under construction. Kuterra continues to seek investors, collaborate with other RAS producers, and to optimize rearing conditions as it continues to advocate for the adoption of this promising technology.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

GHGSat Inc.

Round 20–2011B

Sector:



Energy Utilization

Project

Completion Date:

July 2016

Market Impact

Report Due:

July 2018

Eligible

Project Costs:

\$7,092,025

SDTC Funding:

\$2,317,648

Leveraged

Funding:

\$4,774,377

Consortium

Members:

GHGSat Inc.

Xiphos Systems Corp.

MPB Communications Inc.

University of Toronto – Institute for Aerospace Studies - Space Flight Laboratory

Suncor Energy

The Boeing Company

Environmental

Benefits:

PRIMARY



Climate Change

SECONDARY



Clean Air

Project Title:

GHGSat

Project Description:

GHGSat's vision was to become the global reference for remote sensing of greenhouse gas (GHG) and air quality gas (AQG) emissions from industrial sites. Monitoring specific emissions from targeted, individual facilities using GHGSat technology enabled GHG and AQG measurement with up to 30% better accuracy at less than 20% of the cost of comparable alternatives. During the project, a GHGSat-D satellite was designed, manufactured, assembled and launched into a sun-synchronous, low-Earth orbit, where it detected and measured CO₂ (and CH₄ as a secondary GHG) for targeted industrial facilities.

Objectives:

- Verify and validate the performance of the GHGSat imaging spectrometer and nanosatellite.
- Certify the information products.
- Pre-market the information products.

Results:

- The satellite was successfully launched and commissioned in June 2016.
- The hyperspectral images captured by GHGSat show clear evidence of carbon dioxide and methane absorption in locations where elevated levels of those species are expected.
- GHGSat has actively engaged Alberta Environment and Parks (AEP) and Alberta Environmental Monitoring and Reporting Agency (AEMERA) through its oil sands project with COSIA, and AEP have issued guidance confirming that monitoring methods such as GHGSat can be used by operators. GHGSat has also signed agreements for over 20 pilot projects from key customers. Some of the publicly announced customers include Imperial Oil (Exxon), Shell, Suncor, Hydro Quebec, Manitoba Hydro, CNRL and the Canadian Department of National Defence.

Project Impacts:

- GHGSat's satellite is the first in the world capable of measuring air emissions from targeted industrial facilities. The satellite has a spatial resolution of less than 50 m, which enables measurements of individual sites, compared to 2 km to 3 km for current state-of-the-art satellites, which are designed for regional and global climate modelling.
- Based on estimates of industry's ability and motivation to implement emissions reduction programs facilitated by the accurate and near-real time data, GHGSat anticipates environmental benefits from the reduction of over 200 kt CO₂e by 2020, in addition to corresponding reductions of SO_x and NO_x of over 300 t and 30 t respectively.

Path to Market:

- In addition to commercial satellite imagery, GHGSat will offer technical services based on its own satellite imagery products, including but not limited to:
 - Estimates of site-specific emissions rates from targeted industrial facilities, using microscale inverse dispersion modelling techniques.
 - Source identification, using image processing techniques.
 - Leak detection, by using change detection techniques.
 - Regulatory enforcement, by monitoring emissions from targeted sites over sustained periods.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

EnerMotion Inc.

Round 16-2009B
Sector:


Transportation

Project
Completion Date:

September 2016

Market Impact
Report Due:

September 2018

Eligible
Project Costs:

\$3,030,356

SDTC Funding:

\$1,210,704

Leveraged
Funding:

\$1,819,652

Consortium
Members:

EnerMotion Inc.

Etalim Inc.

 J. D. Smith
and Sons Ltd.

Environmental
Benefits:

PRIMARY


**Climate
Change**

SECONDARY



Clean Air

Project Title:

Hybrid Power Energy Recovery Development and Demonstration Project

Project Description:

EnerMotion has developed the innovative Hybrid Power & Energy Recovery (HYPER™) technology, an Auxiliary Power Unit (APU) for over-the-road heavy trucks that is powered by the engine's waste exhaust heat. HYPER™ is a zero-emissions product, is easier and quicker to install than other APUs, reduces fuel consumption while a vehicle is stationary and in motion, is designed to outlast the life of the truck, is predominantly maintenance free and offers the best economic payback of all existing APU technologies.

The waste heat from the internal combustion engine (ICE) is captured by HYPER and—in its refrigeration mode—runs through a thermodynamic cycle where a solution is converted to below 0°C and then stored in a thermal tank. HYPER™ can also be used in a heating mode with both thermal conditions being stored in the thermal tank. On-demand hot and cold thermal conditions can also be delivered into the cab while the vehicle is in motion. The operator chooses a desired cabin/sleeper temperature with HYPER™ functioning autonomously, operating real time while in motion, and providing up to ten hours of climate control when the vehicle is at rest.

Objectives:

- Development and commercialization of the HYPER™ technology for the company's first target market—Class 8 heavy trucks.

Results:

- EnerMotion installed fourteen units on heavy trucks in its road trial demonstrations of the HYPER™ product and a HYPER™ unit for stationary demonstration. The 15 units shared many key components, with the absorption cycle module common to all units. HYPER™ users will save an average of 3.78 litres (1 gallon) per hour while idling (compared to running their main engine), resulting in cost savings, reduced engine wear, regulatory compliance and lower emissions.

Project Impacts:

- The demonstration project resulted in net GHG emission reductions of 23 t CO₂e/y compared to a business-as-usual truck operation.
- The HYPER™ System has the potential to reduce GHG and CAC emissions in Canada:
 - Estimated cumulative GHG reductions are 1,433 kt CO₂e if 37,869 units are built by 2026.
 - By 2026, estimated cumulative CAC reductions for Canada are 34,003 t NO_x, 1,806 t SO_x, 831 t TPM and 5,478 t CO.
- The HYPER™ System has the potential to reduce GHG and CAC emissions in the Rest of World (ROW):
 - Estimated cumulative GHG reductions are 11,167 kt CO₂e if 321,615 units are built by 2026.
 - By 2016, estimated cumulative CAC reductions for the ROW are 265,027 t NO_x, 14,076 t SO_x, 6,478 t TPM and 42,700 t CO.

Path to Market:

- HYPER™ is being positioned as an affordable way to improve profitability of trucking operations while also providing cabin comfort year round and meeting both fuel and emission regulations. To that end, EnerMotion is also developing a finance option for fleets and owner/operators that would provide a HYPER™ unit for no up-front capital cost to the purchaser, but would have them pay a monthly subscription fee for subscribing to a fuel saving system.
- The HYPER™ brand is evolving quickly and with more than two years of demonstration trials already completed, after-market adoption is well positioned. Parallel effort to integrate HYPER™ at the Original Equipment Manufacturing (OEM) level is progressing and with potential joint ventures looming on the horizon, HYPER™ will make a global impact.



SECTION 4: SD Tech Fund – Projects Completed or Reporting Market Impacts

Marine Exhaust Solutions Inc.

Round 12-2007B

Sector:



Transportation

Project

Completion Date:

September 2016

Market Impact

Report Due:

September 2018

Eligible

Project Costs:

\$6,917,672

SDTC Funding:

\$1,620,804

Leveraged

Funding:

\$5,296,868

Consortium

Members:

Marine Exhaust Solutions Inc.
Rederiet M.H. Simonsen ApS
The Cross Group Inc.

Environmental Benefits:

PRIMARY



Clean Air

SECONDARY



Climate Change

Project Title:

Demonstration of Marine Exhaust Solutions Exhaust Gas Cleaning System

Project Description:

In response to the International Maritime Organization (IMO) restrictions on sulphur emissions from vessel operation, Marine Exhaust Solutions (MES) has developed and demonstrated an exhaust-gas-scrubbing technology for use in all marine vessels, most notably those operating on heavy fuel oil. The principle of operation of MES' EcoSilencer® is based on using a caustic soda solution as a scrubbing medium. Inside each EcoSilencer®, exhaust gas is sprayed by the scrubbing water. In the spraying process, SO₂, soot and particulate matter are removed from the exhaust gas. Removed sludge (i.e., soot, solids and oils) are diverted into a holding tank for onshore disposal, while the treated water that is of acceptable discharge quality is discharged overboard. The EcoSilencer® technology has demonstrated removal rates of 99.9%, 75% and 90% for SO_x, NO_x and PM, respectively, for heavy fuel oil. The project involved the design of a system for a 3.25-megawatt engine, installed on the MH Simonsen-Orasund based in Denmark and involved a demonstration period of over 200 operating hours. This led to the final certification of the scrubbing system EcoSilencer® C3 by the Class society of the ship, namely DNV-GL which confirms that the scrubbing system complies fully and in all aspects with the MARPOL Annex VI regulations.

Objectives:

- Demonstrate the EcoSilencer® EGCS (Exhaust Gas Cleaning System) as a means of reducing CAC emissions from marine vessels using heavy fuel oil and meeting upcoming IMO regulations.
- Reduce sulphur emissions from the exhaust stream by 99%.

Results:

- MES completed the design and testing of the Ecosilencer® and installed its unit on board the MH Simonsen-Orasund vessel.
- A certification was awarded by DNV-GL for complying with MARPOL regulations for on-board scrubbing systems following a one-month sea trial period. The sulphur reduction target was achieved.

Project Impacts:

- The demonstration project achieved CAC reductions of 0.18 t SO_x, 6.98 t NO_x, 0.16 t PM and 0.32 t VOCs. The parasitic load of the Ecosilencer® unit results in an increase in vessel fuel use, and, therefore, an increase in GHG emissions. The demonstration project resulted in additional GHG emissions of 7.84 t CO₂e.
- Market rollout of MES' technology between 2017 and 2026 is expected to result in CAC cumulative reductions of 76 kt SO_x, 890 kt NO_x, 17 kt PM and 0.3 kt VOCs in Canada, and 142 kt SO_x, 1,651 kt NO_x, 31 kt PM and 0.5 kt VOCs in the Rest of World (ROW). Market rollout between 2017 and 2026 is expected to result in a cumulative increase in GHG emissions of 3,593 kt CO₂e in Canada and 6,673 kt CO₂e in the ROW.

Path to Market:

- MES is making the product as easy as possible to buy, install and operate and as such, is developing a plan to make the installations more modularized (plug-and-play) with the goal of reducing the system's footprint and simplifying the design to deliver the kit in three to four preassembled pieces that would require minimal intervention by the ship's crew.
- MES will pursue a targeted approach to the commercialization of their product to ships of specific sizes that operate mostly in the ECA (Emission Control Areas) and will adjust the pricing of the technology so that it remains attractive even when the low sulphur fuel price is low.



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Active Projects

*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 & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Round 29-2016A							
AFCC Automotive Fuel Cell Cooperation Corp.	\$10,000,000	11.3%	\$78,370,069	88.7%	\$0	0.0%	\$88,370,069
Canfor Pulp Ltd.	\$13,050,000	33.3%	\$26,166,511	66.7%	\$0	0.0%	\$39,216,511
Gbatteries Energy Canada Inc.	\$1,185,000	39.5%	\$1,265,080	42.2%	\$550,000	18.3%	\$3,000,080
Round 28-2015B							
Advonex International	\$4,250,960	33.0%	\$8,630,737	67.0%	\$0	0.0%	\$12,881,697
Aeponyx Inc.*	\$1,900,000	33.8%	\$2,488,654	44.3%	\$1,228,308	21.9%	\$5,616,961
Axine Water	\$2,000,000	40.0%	\$2,998,093	60.0%	\$0	0.0%	\$4,998,093
DarkVision*	\$3,000,000	32.4%	\$6,250,764	67.6%	\$0	0.0%	\$9,250,764
Enerkem Alberta Biofuels LP*	\$10,350,000	22.9%	\$29,882,813	66.1%	\$5,000,000	11.1%	\$45,232,813
e-Zn Inc.*	\$700,000	45.6%	\$147,700	9.6%	\$687,345	44.8%	\$1,535,045
Farmers Edge Corp.*	\$6,107,563	33.0%	\$12,377,310	67.0%	\$0	0.0%	\$18,484,873
Group NanoXplore Inc.	\$3,300,000	33.0%	\$6,700,681	67.0%	\$0	0.0%	\$10,000,681
Hatch	\$561,200	33.0%	\$1,139,700	67.0%	\$0	0.0%	\$1,700,900
Illusense	\$1,600,000	33.3%	\$2,409,936	50.1%	\$800,000	16.6%	\$4,809,936
Opus One Solutions Energy Corp.*	\$5,353,500	35.4%	\$9,768,350	64.6%	\$0	0.0%	\$15,121,850
Rockport Networks Inc.*	\$4,635,000	34.3%	\$3,242,614	24.0%	\$5,632,239	41.7%	\$13,509,853
Saltworks Technologies Inc.	\$4,000,000	33.3%	\$8,000,000	66.7%	\$0	0.0%	\$12,000,000
Sepro Mineral Systems	\$440,000	32.9%	\$899,088	67.1%	\$0	0.0%	\$1,339,088
Round 27-2015A							
ARDA Power*	\$400,000	35.6%	\$723,550	64.4%	\$0	0.0%	\$1,123,550
ASE Smart Energy Inc.*	\$300,000	42.3%	\$289,148	40.7%	\$120,540	17.0%	\$709,688



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Cellufuel Inc.*	\$2,152,693	33.0%	\$4,370,637	67.0%	\$0	0.0%	\$6,523,330
Comet Biorefining, Inc.*	\$10,890,000	27.0%	\$24,427,895	60.6%	\$5,000,000	12.4%	\$40,317,895
DoodleLabs*	\$2,879,925	32.8%	\$4,479,837	51.0%	\$1,418,000	16.2%	\$8,777,762
FORGE-Sombra Corp.*	\$4,201,814	35.4%	\$7,675,166	64.6%	\$0	0.0%	\$11,876,980
General Fusion Inc.*	\$12,748,560	32.7%	\$23,108,802	59.3%	\$3,114,000	8.0%	\$38,971,362
Imtex Membranes Corp.	\$3,336,960	33.0%	\$6,775,435	67.0%	\$0	0.0%	\$10,112,395
Loop Energy Inc.*	\$7,500,000	32.4%	\$11,238,149	48.5%	\$4,425,920	19.1%	\$23,164,070
Nano One Materials Corp.*	\$2,081,297	34.8%	\$3,895,635	65.2%	\$0	0.0%	\$5,976,932
Netlift Transport Social Inc.*	\$448,000	33.3%	\$774,082	57.5%	\$123,940	9.2%	\$1,346,022
NextGrid Inc.* **	\$300,000	39.8%	\$453,306	60.2%	\$0	0.0%	\$753,306
Nsolv Corp.	\$13,000,000	15.4%	\$46,311,075	54.9%	\$25,000,000	29.7%	\$84,311,075
QD Solar Inc.*	\$2,550,000	31.6%	\$4,515,050	56.0%	\$1,000,000	12.4%	\$8,065,050
Quantiam Technologies	\$4,250,000	26.2%	\$11,980,148	73.8%	\$0	0.0%	\$16,230,148
Ronin8 Technologies Ltd.*	\$300,000	20.2%	\$1,184,313	79.8%	\$0	0.0%	\$1,484,313
Sherbrooke OEM Ltd.*	\$1,275,000	31.9%	\$2,718,316	68.1%	\$0	0.0%	\$3,993,316
Smart Pipe Company Canada Inc.	\$2,363,709	33.0%	\$4,799,047	67.0%	\$0	0.0%	\$7,162,756
Syscor Controls & Automation Inc.*	\$1,793,838	35.6%	\$1,439,348	28.6%	\$1,802,108	35.8%	\$5,035,294
Teck Resources Ltd.*	\$2,673,652	33.0%	\$5,428,323	67.0%	\$0	0.0%	\$8,101,975
Terrestrial Energy Inc.*	\$5,739,167	31.7%	\$8,092,388	44.7%	\$4,264,247	23.6%	\$18,095,802
Round 26-2014B							
Alliance Magnésium Inc.*	\$3,000,000	31.6%	\$4,568,085	48.2%	\$1,912,500	20.2%	\$9,480,585
CO ₂ Solutions Inc.*	\$2,442,000	31.1%	\$2,409,375	30.7%	\$3,000,000	38.2%	\$7,851,375
DMF Medical Inc.*	\$686,575	42.0%	\$804,000	49.2%	\$145,000	8.9%	\$1,635,575
Hydrogenics Corp. **	\$2,500,000	32.8%	\$5,125,890	67.2%	\$0	0.0%	\$7,625,890
Pyrowave Inc.*	\$1,048,474	33.5%	\$2,081,853	66.5%	\$0	0.0%	\$3,130,327



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Quest Rare Minerals Ltd.*	\$4,934,504	33.1%	\$5,740,771	38.5%	\$4,250,000	28.5%	\$14,925,275
Sigma Energy Storage Inc.*	\$2,736,068	32.3%	\$2,739,321	32.4%	\$2,992,080	35.3%	\$8,467,469
Thetis Environmental Inc.*	\$1,400,000	47.0%	\$1,006,043	33.8%	\$570,000	19.2%	\$2,976,043
Round 25-2014A							
CHAR Technologies* **	\$750,000	31.2%	\$1,173,402	48.8%	\$480,000	20.0%	\$2,403,402
CrossChasm Technologies Inc.*	\$430,000	35.6%	\$778,556	64.4%	\$0	0.0%	\$1,208,556
Field Upgrading Ltd.*	\$5,450,000	24.3%	\$8,352,089	37.3%	\$8,585,700	38.3%	\$22,387,789
Fractal Systems Inc.*	\$3,700,000	32.3%	\$7,771,324	67.7%	\$0	0.0%	\$11,471,324
OTI Lumionics Inc.*	\$5,668,675	32.8%	\$9,398,204	54.4%	\$2,205,360	12.8%	\$17,272,239
SIGMA DEVTECH Inc.	\$3,100,000	29.6%	\$5,967,875	56.9%	\$1,422,255	13.6%	\$10,490,130
SWITCH Materials Inc.*	\$2,500,000	24.2%	\$7,813,892	75.8%	\$0	0.0%	\$10,313,892
West Fraser Mills Ltd.*	\$6,100,000	32.8%	\$9,481,707	51.0%	\$3,000,000	16.1%	\$18,581,707
Round 24-2013B							
CelluForce Inc.*	\$4,004,254	30.9%	\$8,809,449	68.1%	\$129,398	1.0%	\$12,943,101
Grafoid Inc.*	\$8,120,646	32.4%	\$15,777,905	62.9%	\$1,170,725	4.7%	\$25,069,276
Miovision Technologies Inc.*	\$1,400,000	19.0%	\$5,955,499	81.0%	\$0	0.0%	\$7,355,499
OpenHydro Technology Canada Ltd.*	\$6,352,500	18.9%	\$27,233,449	81.1%	\$0	0.0%	\$33,585,949
Polar Sapphire Ltd.*	\$2,650,000	33.8%	\$5,187,919	66.2%	\$0	0.0%	\$7,837,919
Questor Technology Inc.*	\$1,977,878	35.5%	\$3,598,825	64.5%	\$0	0.0%	\$5,576,703
Terramera, Inc.*	\$2,284,581	38.5%	\$3,645,805	61.5%	\$0	0.0%	\$5,930,386
Round 23-2013A							
BRIC Engineered Systems Inc.*	\$710,000	32.2%	\$1,497,430	67.8%	\$0	0.0%	\$2,207,430
Carbon Engineering Ltd.*	\$3,300,000	31.8%	\$3,753,088	36.2%	\$3,312,893	32.0%	\$10,365,981
Electro Kinetic Solutions Inc.*	\$2,116,140	17.4%	\$7,773,127	63.8%	\$2,300,000	18.9%	\$12,189,267
Green Power Labs Inc.*	\$1,604,531	29.6%	\$1,398,932	25.8%	\$2,415,420	44.6%	\$5,418,883



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Inventys Thermal Technologies Inc.	\$3,100,000	21.3%	\$6,877,735	47.3%	\$4,562,512	31.4%	\$14,540,247
Morgan Solar Inc.*	\$2,067,778	31.7%	\$2,600,494	39.9%	\$1,850,000	28.4%	\$6,518,272
Nemaska Lithium Inc.*	\$12,870,000	32.2%	\$17,112,606	42.8%	\$10,000,000	25.0%	\$39,982,606
Pure Technologies Ltd.*	\$1,300,000	33.0%	\$1,890,000	47.9%	\$755,000	19.1%	\$3,945,000
Saltworks Technologies Inc.*	\$2,500,000	33.3%	\$5,000,000	66.7%	\$0	0.0%	\$7,500,000
Sysgaz Inc.*	\$2,205,539	34.6%	\$719,471	11.3%	\$3,455,000	54.2%	\$6,380,010
ZincNyx Energy Solutions*	\$2,900,000	29.1%	\$6,870,000	68.9%	\$200,000	2.0%	\$9,970,000
Round 22-2012B							
HiFi Engineering Inc.*	\$2,000,000	33.7%	\$3,926,220	66.3%	\$0	0.0%	\$5,926,220
Luxmux Technology Corp.*	\$980,350	32.5%	\$1,049,367	34.8%	\$985,542	32.7%	\$3,015,259
Macrotek Inc.*	\$2,253,700	38.4%	\$3,612,580	61.6%	\$0	0.0%	\$5,866,280
Solantro Semiconductor Corp.*	\$3,800,000	33.0%	\$7,716,019	67.0%	\$0	0.0%	\$11,516,019
Ubiquity Solar Inc.*	\$3,122,445	31.2%	\$3,921,356	39.2%	\$2,965,000	29.6%	\$10,008,801
Unit Electrical Engineering Ltd*	\$300,000	32.9%	\$611,235	67.1%	\$0	0.0%	\$911,235
Vive Crop Protection Inc.*	\$3,723,504	33.7%	\$7,326,695	66.3%	\$0	0.0%	\$11,050,199
Round 21-2012A							
Airex Energy Inc.*	\$2,700,000	32.4%	\$3,008,030	36.1%	\$2,631,092	31.6%	\$8,339,122
Borealis GeoPower Inc.*	\$2,379,962	29.1%	\$5,807,383	70.9%	\$0	0.0%	\$8,187,345
Diacarbon Energy*	\$2,100,000	19.3%	\$8,805,476	80.7%	\$0	0.0%	\$10,905,476
Dundee Sustainable Technologies*	\$5,000,000	25.2%	\$14,817,466	74.8%	\$0	0.0%	\$19,817,466
Nortek Air Solutions Canada*	\$2,671,129	21.8%	\$9,041,944	73.9%	\$515,789	4.2%	\$12,228,862
NuWave Research Inc.*	\$3,430,000	39.7%	\$4,117,690	47.7%	\$1,081,440	12.5%	\$8,629,130
Polystyvert Inc.*	\$1,980,000	29.1%	\$4,612,269	67.9%	\$204,972	3.0%	\$6,797,241
R.I.I. North America Inc.*	\$6,453,754	26.0%	\$16,583,327	66.7%	\$1,817,793	7.3%	\$24,854,873
Yava Technologies Inc.*	\$399,123	32.6%	\$824,479	67.4%	\$0	0.0%	\$1,223,602



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Round 20-2011B							
Agri-Neo Inc.*	\$2,500,000	28.5%	\$4,887,595	55.8%	\$1,375,000	15.7%	\$8,762,595
Atlantis Operations (Canada) Ltd.*	\$5,000,000	32.7%	\$10,296,788	67.3%	\$0	0.0%	\$15,296,788
MEG Energy Corp.*	\$13,000,000	6.0%	\$184,488,811	84.8%	\$20,000,000	9.2%	\$217,488,811
Minesense Technologies Ltd.*	\$4,435,794	30.9%	\$8,875,108	61.8%	\$1,059,525	7.4%	\$14,370,427
New Flyer Industries ULC Canada*	\$3,400,000	34.1%	\$4,537,418	45.5%	\$2,042,986	20.5%	\$9,980,404
Round 19-2011A							
Hydrostor Inc.*	\$2,971,011	31.9%	\$2,891,791	31.0%	\$3,455,529	37.1%	\$9,318,331
Round 18-2010B							
Nova Green Inc.*	\$1,098,905	33.9%	\$970,000	29.9%	\$1,177,356	36.3%	\$3,246,261
Logistik Unicorp*	\$1,012,828	33.4%	\$1,331,641	44.0%	\$685,029	22.6%	\$3,029,498
Paradigm Shift Technologies Inc.*	\$1,955,250	34.3%	\$3,744,347	65.7%	\$0	0.0%	\$5,699,597
Northex Environnement Inc.*	\$1,552,354	32.0%	\$2,464,251	50.8%	\$832,125	17.2%	\$4,848,730
Round 17-2010A							
CRB Innovations Inc.*	\$5,362,500	26.1%	\$10,208,476	49.6%	\$5,000,000	24.3%	\$20,570,976
eCAMION*	\$5,435,749	35.1%	\$10,056,623	64.9%	\$0	0.0%	\$15,492,372
Temporal Power Ltd.*	\$5,247,236	35.0%	\$9,744,868	65.0%	\$0	0.0%	\$14,992,104
Round 16-2009B							
Etalim Inc.*	\$2,936,530	33.3%	\$3,207,146	36.3%	\$2,680,223	30.4%	\$8,823,899
MARA Renewables Corp.*	\$5,950,303	33.3%	\$11,527,699	64.5%	\$390,776	2.2%	\$17,868,777
Quadrogen Power Systems*	\$2,910,145	39.1%	\$3,477,831	46.7%	\$1,053,245	14.2%	\$7,441,221
TOTAL	\$369,590,553	24.9%	\$944,823,798	63.7%	\$168,833,911	11.4%	\$1,483,248,263



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Completed Projects

Note: Amounts are based on actual disbursements at project completion

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Round 24-2013B							
GaN Systems Inc.	\$2,187,971	31.4%	\$4,330,555	62.1%	\$456,022	6.5%	\$6,974,548
Ionada Inc.	\$1,394,495	28.6%	\$3,047,267	62.4%	\$440,000	9.0%	\$4,881,762
Ranovus Inc.	\$7,898,681	30.9%	\$15,227,861	59.6%	\$2,419,755	9.5%	\$25,546,297
Round 23-2013A							
GreenMantra Technologies	\$2,007,450	31.6%	\$4,353,435	68.4%	\$0	0.0%	\$6,360,885
Round 20-2011B							
Effenco Development Inc.	\$2,080,188	32.4%	\$1,826,926	28.5%	\$2,503,882	39.1%	\$6,410,996
GHGSat Inc.	\$2,317,648	32.7%	\$2,656,296	37.5%	\$2,118,081	29.9%	\$7,092,025
semiosBIO Technologies Inc.	\$4,980,000	31.1%	\$10,923,807	68.1%	\$130,000	0.8%	\$16,033,807
Whale Shark Environmental Technologies Ltd.	\$829,266	42.3%	\$939,158	47.9%	\$191,165	9.8%	\$1,959,589
Round 19-2011A							
Accelerated Systems Inc.	\$1,400,000	35.0%	\$2,600,624	65.0%	\$0	0.0%	\$4,000,624
CVTCORP Transmission Inc.	\$1,027,887	30.9%	\$1,777,683	53.4%	\$521,403	15.7%	\$3,326,973
EcoSynthetix Corp.	\$600,000	33.7%	\$451,849	25.4%	\$728,322	40.9%	\$1,780,171
Pure Technologies Ltd.	\$1,000,000	32.0%	\$1,831,138	58.7%	\$290,000	9.3%	\$3,121,138
Vision Ecoproducts Ltd.	\$3,252,342	28.9%	\$4,599,309	40.8%	\$3,421,296	30.3%	\$11,272,947
Round 18-2010B							
BioAmber Sarnia Inc.	\$14,513,650	33.2%	\$23,783,754	54.4%	\$5,400,000	12.4%	\$43,697,404
CarbonCure Technologies	\$1,492,000	34.7%	\$2,114,042	49.2%	\$690,140	16.1%	\$4,296,182
Cooledge Lighting	\$4,469,000	34.4%	\$0	0.0%	\$8,529,540	65.6%	\$12,998,540
'Namgis First Nation	\$5,650,000	35.3%	\$9,007,524	56.3%	\$1,347,575	8.4%	\$16,005,099



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Nsolv Corp.	\$10,000,000	18.5%	\$28,141,727	52.0%	\$15,943,880	29.5%	\$54,085,607
Shipstone Corp.	\$2,813,498	46.8%	\$3,204,544	53.2%	\$0	0.0%	\$6,018,042
Solantro Semiconductor Corp.	\$2,049,234	26.0%	\$5,692,637	72.4%	\$125,000	1.6%	\$7,866,871
TM4	\$3,135,371	20.4%	\$4,469,334	29.1%	\$7,772,936	50.5%	\$15,377,641
Round 17-2010A							
Ballard Power Systems	\$7,061,620	33.6%	\$13,932,537	66.4%	\$0	0.0%	\$20,994,157
Corvus Energy Ltd.	\$582,467	33.0%	\$1,182,585	67.0%	\$0	0.0%	\$1,765,052
Echologics Engineering Inc.	\$1,051,926	32.7%	\$1,794,785	55.8%	\$370,679	11.5%	\$3,217,390
FibraCast	\$1,947,736	33.0%	\$2,662,860	45.1%	\$1,291,633	21.9%	\$5,902,229
S2G Biochemicals Inc.	\$2,616,952	33.9%	\$3,851,969	49.9%	\$1,251,336	16.2%	\$7,720,257
SWITCH Materials Inc.	\$2,363,621	29.4%	\$4,089,113	50.8%	\$1,594,045	19.8%	\$8,046,780
Tyne Engineering Inc.	\$1,534,097	30.1%	\$2,356,943	46.2%	\$1,210,508	23.7%	\$5,101,548
Westport Innovations	\$2,302,834	20.6%	\$8,869,411	79.4%	\$0	0.0%	\$11,172,245
Woodland Biofuels Inc.	\$4,275,000	33.1%	\$4,625,000	35.9%	\$4,000,000	31.0%	\$12,900,000
Round 16-2009B							
EnerMotion Inc.	\$1,210,704	40.0%	\$1,259,652	41.6%	\$560,000	18.5%	\$3,030,356
Inventys Thermal Technologies Inc.	\$1,598,001	40.8%	\$1,957,239	50.0%	\$359,707	9.2%	\$3,914,947
InvoDane Engineering Ltd.	\$2,467,125	24.6%	\$7,567,625	75.4%	\$0	0.0%	\$10,034,750
Isowater Corp.	\$1,020,000	42.9%	\$1,132,662	47.7%	\$222,595	9.4%	\$2,375,257
Johnson Matthey Battery Materials Ltd.	\$4,700,508	27.8%	\$12,210,547	72.2%	\$0	0.0%	\$16,911,055
Lakeshore EMPC Two LP	\$1,037,669	41.6%	\$1,456,728	58.4%	\$0	0.0%	\$2,494,397
MPT Mustard Products & Technologies Inc.	\$1,840,294	31.0%	\$3,484,725	58.7%	\$611,414	10.3%	\$5,936,433
Tenova Goodfellow Inc.	\$1,822,513	29.5%	\$4,346,389	70.5%	\$0	0.0%	\$6,168,902
Round 15-2009A							
Agrisoma Biosciences Inc.	\$3,275,000	29.7%	\$7,006,034	63.5%	\$750,587	6.8%	\$11,031,621



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Automotive Fuel Cell Cooperation Corp.	\$11,506,305	22.2%	\$40,253,953	77.8%	\$0	0.0%	\$51,760,258
Ballard Power Systems	\$6,905,887	21.3%	\$25,546,584	78.7%	\$0	0.0%	\$32,452,471
Electrovaya Corp.	\$8,524,171	29.6%	\$15,946,485	55.4%	\$4,318,351	15.0%	\$28,789,007
Entropex Ltd.	\$6,330,000	25.3%	\$14,521,709	58.0%	\$4,172,680	16.7%	\$25,024,389
Morgan Solar Inc.	\$2,351,580	21.1%	\$8,191,860	73.4%	\$620,181	5.6%	\$11,163,621
NutraCanada	\$1,900,000	20.1%	\$5,512,146	58.3%	\$2,050,000	21.7%	\$9,462,146
Pulse Energy Inc.	\$2,556,801	28.9%	\$4,327,413	48.9%	\$1,962,868	22.2%	\$8,847,082
RER Hydro Ltd.	\$2,760,000	14.0%	\$14,322,725	72.4%	\$2,700,000	13.6%	\$19,782,725
SBI BioEnergy Inc.	\$2,175,495	18.6%	\$3,192,205	27.4%	\$6,300,364	54.0%	\$11,668,063
Terragon Environmental Technologies Inc.	\$3,174,000	39.6%	\$2,239,827	28.0%	\$2,592,598	32.4%	\$8,006,425
Round 14-2008B							
Alcoa Ltd.	\$170,958	28.5%	\$428,887	71.5%	\$0	0.0%	\$599,845
Canadian Pallet Council	\$1,058,755	43.6%	\$1,369,583	56.4%	\$0	0.0%	\$2,428,338
Duopar Technologies Inc.	\$2,597,696	38.5%	\$3,938,462	58.3%	\$217,359	3.2%	\$6,753,517
Eco-Ag Initiatives Inc. (Desviar)	\$1,948,000	33.6%	\$3,455,615	59.7%	\$388,000	6.7%	\$5,791,615
Imtex Membranes Corp.	\$1,250,406	22.5%	\$1,390,747	25.0%	\$2,916,206	52.5%	\$5,557,359
Lignol Innovations Ltd.	\$6,370,076	34.2%	\$7,021,385	37.7%	\$5,246,146	28.1%	\$18,637,607
MEG Energy Corp.	\$4,270,000	23.5%	\$12,472,245	68.7%	\$1,400,000	7.7%	\$18,142,245
Produits Enuchem Inc.	\$595,000	39.7%	\$904,904	60.3%	\$0	0.0%	\$1,499,904
Saltworks Technologies Inc.	\$2,612,638	32.4%	\$3,595,900	44.6%	\$1,855,484	23.0%	\$8,064,022
Soane Energy (Canada) Inc.	\$537,471	28.4%	\$1,357,069	71.6%	\$0	0.0%	\$1,894,540
Statoil Hydro Canada Ltd.	\$6,000,000	12.9%	\$40,651,875	87.1%	\$0	0.0%	\$46,651,875
SunSelect Produce (Delta) Inc.	\$1,672,425	23.1%	\$3,323,501	45.9%	\$2,240,000	31.0%	\$7,235,926
Sunwell Technologies Inc.	\$2,779,849	39.0%	\$4,340,464	61.0%	\$0	0.0%	\$7,120,313
Titanium Corp.	\$6,292,635	29.1%	\$13,554,184	62.6%	\$1,795,970	8.3%	\$21,642,789



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Xogen Technologies Inc.	\$1,974,104	43.6%	\$2,453,769	54.2%	\$100,001	2.2%	\$4,527,874
Round 13-2008A							
A.U.G. Signals Ltd.	\$2,019,455	34.3%	\$3,869,886	65.7%	\$0	0.0%	\$5,889,341
dPoint Technologies Inc.	\$1,378,254	39.3%	\$2,130,441	60.7%	\$0	0.0%	\$3,508,695
EcoSynthetix Corp.	\$1,679,331	33.0%	\$1,612,596	31.7%	\$1,796,955	35.3%	\$5,088,882
General Fusion Inc.	\$13,897,455	23.9%	\$44,180,136	76.0%	\$60,000	0.1%	\$58,137,591
Greenfield Specialty Alcohols	\$3,927,964	28.9%	\$5,357,854	39.4%	\$4,321,167	31.8%	\$13,606,985
Innovente Inc.	\$2,730,526	46.2%	\$1,503,129	25.4%	\$1,675,100	28.3%	\$5,908,755
Integran Technologies Inc.	\$1,481,328	33.2%	\$2,236,794	50.1%	\$746,400	16.7%	\$4,464,522
Nexterra Systems Corp.	\$5,518,777	27.2%	\$11,014,887	54.4%	\$3,730,000	18.4%	\$20,263,664
Paragon Soil and Environmental Consulting Inc.	\$230,879	43.8%	\$296,243	56.2%	\$0	0.0%	\$527,122
Sun Central	\$2,345,208	30.3%	\$3,043,712	39.3%	\$2,359,523	30.5%	\$7,748,443
Vive Crop Protection Inc.	\$3,954,706	35.8%	\$2,911,011	26.4%	\$4,172,886	37.8%	\$11,038,603
Round 12-2007B							
Atlantec BioEnergy Corp.	\$1,833,482	26.3%	\$4,769,998	68.3%	\$376,629	5.4%	\$6,980,109
GaN Systems Inc.	\$1,500,000	25.8%	\$4,304,880	74.2%	\$0	0.0%	\$5,804,880
Himark Biogas Inc.	\$3,331,976	28.2%	\$8,501,932	71.8%	\$0	0.0%	\$11,833,908
Integran Technologies Inc.	\$5,616,635	32.7%	\$11,411,024	66.4%	\$170,000	1.0%	\$17,197,659
Marine Exhaust Solutions Inc.	\$1,620,804	23.4%	\$5,296,868	76.6%	\$0	0.0%	\$6,917,672
Pathogen Detection Systems Inc.	\$2,671,627	31.1%	\$3,388,328	39.4%	\$2,539,045	29.5%	\$8,599,000
Petroleum Technology Research Centre Inc.	\$5,000,000	15.8%	\$17,604,009	55.7%	\$9,000,000	28.5%	\$31,604,009
Pure Technologies Ltd.	\$795,000	31.7%	\$1,133,335	45.2%	\$580,000	23.1%	\$2,508,335
Verdant Power Canada ULC	\$487,324	40.6%	\$472,178	39.3%	\$240,844	20.1%	\$1,200,346
Western Hydrogen Ltd.	\$4,162,653	33.7%	\$8,195,092	66.3%	\$0	0.0%	\$12,357,745



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Round 11-2007A							
bstNRG.com Inc.	\$1,588,703	43.3%	\$2,080,561	56.7%	\$0	0.0%	\$3,669,264
Corporation HET - Horizon Environnement Technologies	\$1,509,807	23.4%	\$4,431,589	68.8%	\$500,000	7.8%	\$6,441,396
Effenco Development Inc.	\$1,074,955	28.3%	\$2,093,388	55.1%	\$633,456	16.7%	\$3,801,799
Fuseforward International Inc.	\$400,000	26.2%	\$679,343	44.6%	\$444,578	29.2%	\$1,523,921
General Electric Canada	\$3,903,394	33.3%	\$7,818,509	66.7%	\$0	0.0%	\$11,721,903
MSR Innovations Inc.	\$680,839	46.2%	\$456,929	31.0%	\$335,629	22.8%	\$1,473,397
St-Jean Photochemicals	\$1,506,082	30.7%	\$1,256,988	25.6%	\$2,139,386	43.6%	\$4,902,456
TM4	\$3,818,787	30.9%	\$7,272,737	58.8%	\$1,286,000	10.4%	\$12,377,524
Round 10-2006B							
Advanced Lithium Power Inc.	\$1,400,000	25.3%	\$3,734,876	67.5%	\$400,000	7.2%	\$5,534,876
Calisolar Inc.	\$4,074,505	26.0%	\$10,022,872	64.0%	\$1,559,432	10.0%	\$15,656,809
CVTCORP Transmission Inc.	\$2,131,950	27.9%	\$3,892,915	50.9%	\$1,625,000	21.2%	\$7,649,865
Fifth Light Technology Ltd.	\$3,911,300	30.5%	\$7,225,340	56.3%	\$1,700,000	13.2%	\$12,836,640
Middle Bay Sustainable Aquaculture Institute	\$3,591,444	32.0%	\$7,638,883	68.0%	\$0	0.0%	\$11,230,327
SiREM ULC	\$318,304	32.8%	\$652,135	67.2%	\$0	0.0%	\$970,439
Terragon Environmental Technologies Inc.	\$1,592,500	38.9%	\$1,787,094	43.6%	\$718,190	17.5%	\$4,097,783
TM4	\$622,542	18.6%	\$1,824,460	54.5%	\$900,000	26.9%	\$3,347,002
Round 9-2006A							
Dynamic Systems Inc.	\$738,531	36.4%	\$1,289,550	63.6%	\$0	0.0%	\$2,028,081
Enerkem Inc.	\$2,660,476	15.5%	\$14,486,785	84.5%	\$0	0.0%	\$17,147,261
General Electric Canada	\$2,485,395	33.3%	\$783,047	10.5%	\$4,187,741	56.2%	\$7,456,183
Milligan Biofuels Inc.	\$7,004,493	24.9%	\$21,117,230	75.0%	\$19,892	0.1%	\$28,141,614



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Round 8-2005B							
ARISE Technologies Corp.	\$6,439,037	32.8%	\$13,192,174	67.2%	\$0	0.0%	\$19,631,211
BESTECH (Boudreau-Espley-Pitre Corp.)	\$1,448,000	32.2%	\$3,046,502	67.8%	\$0	0.0%	\$4,494,502
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
EcoVu Analytics Inc.	\$1,035,555	32.7%	\$1,957,513	61.8%	\$172,647	5.5%	\$3,165,715
Hydrogenics Corp.	\$2,248,493	28.4%	\$5,668,736	71.6%	\$0	0.0%	\$7,917,229
Maritime Innovation	\$979,800	38.5%	\$1,128,392	44.4%	\$435,565	17.1%	\$2,543,757
New Energy Corp. Inc.	\$2,000,000	31.4%	\$1,633,467	25.6%	\$2,741,058	43.0%	\$6,374,525
Nutriloc Ingredients Corp.	\$847,319	35.2%	\$822,781	34.2%	\$734,393	30.5%	\$2,404,493
Ostara Nutrient Recovery Technologies Inc.	\$375,760	21.1%	\$682,959	38.4%	\$718,910	40.4%	\$1,777,628
Power Measurement Ltd.	\$2,960,871	32.5%	\$5,893,795	64.7%	\$250,000	2.7%	\$9,104,666
Pure Technologies Ltd.	\$2,200,000	32.2%	\$3,858,424	56.4%	\$782,138	11.4%	\$6,840,562
Tantalus Systems Corp.	\$2,981,310	29.5%	\$7,121,213	70.5%	\$0	0.0%	\$10,102,523
Unicell Ltd.	\$756,155	21.3%	\$1,960,041	55.2%	\$833,828	23.5%	\$3,550,024
Wind Smart Inc.	\$1,082,738	40.1%	\$980,258	36.3%	\$639,618	23.7%	\$2,702,614
Round 7-2005A							
EcoSmart Foundation Inc.	\$1,499,143	48.8%	\$1,453,483	47.3%	\$119,389	3.9%	\$3,072,015
Nsolv Corp.	\$4,155,843	26.3%	\$11,650,516	73.7%	\$0	0.0%	\$15,806,359
PDT	\$1,191,107	34.1%	\$2,296,365	65.8%	\$1,910	0.1%	\$3,489,382
Petroleum Technology Research Centre Inc.	\$3,168,990	33.0%	\$5,854,010	61.0%	\$580,000	6.0%	\$9,603,000
Plasco Trail Road Inc.	\$9,494,466	13.3%	\$53,077,190	74.6%	\$8,572,538	12.0%	\$71,144,194
Vaperma Inc.	\$5,049,958	33.3%	\$8,169,915	53.9%	\$1,930,000	12.7%	\$15,149,873
Round 6-2004B							
Angstrom Power Inc.	\$169,752	13.4%	\$978,519	77.5%	\$115,000	9.1%	\$1,263,271
Clean Current Power Systems Inc.	\$1,582,000	33.0%	\$3,213,500	67.0%	\$0	0.0%	\$4,795,500



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Electrovaya Corp.	\$1,859,530	33.0%	\$3,775,410	67.0%	\$0	0.0%	\$5,634,940
Leapfrog Lighting Inc.	\$3,724,663	31.0%	\$3,805,820	31.7%	\$4,486,251	37.3%	\$12,016,734
Prairie Pulp and Paper Inc.	\$1,237,290	35.1%	\$1,989,235	56.5%	\$295,000	8.4%	\$3,521,525
Pratt & Whitney Canada Corp.	\$5,368,257	32.0%	\$10,831,080	64.6%	\$576,463	3.4%	\$16,775,800
Science Applications International Corp. (SAIC Canada)	\$1,009,588	20.8%	\$246,143	5.1%	\$3,590,824	74.1%	\$4,846,555
Sunarc of Canada Inc.	\$545,357	30.0%	\$730,538	40.2%	\$543,327	29.9%	\$1,819,222
University of British Columbia	\$2,408,702	33.0%	\$3,776,993	51.7%	\$1,113,403	15.3%	\$7,299,098
Round 5-2004A							
Atlantic Hydrogen Inc.	\$2,096,948	30.4%	\$3,220,266	46.7%	\$1,576,334	22.9%	\$6,893,548
Atlantic Packaging Products Ltd.	\$2,268,430	28.5%	\$5,690,974	71.5%	\$0	0.0%	\$7,959,404
Great Northern Power Corp.	\$551,462	20.6%	\$2,004,388	74.8%	\$125,000	4.7%	\$2,680,850
M.A. Turbo/Engine Ltd.	\$152,844	46.0%	\$179,760	54.0%	\$0	0.0%	\$332,604
Tenova Goodfellow Inc.	\$3,322,440	30.0%	\$6,337,963	57.2%	\$1,417,145	12.8%	\$11,077,548
Round 4-2003B							
Biox Corp.	\$5,000,000	11.3%	\$35,423,977	79.7%	\$4,000,000	9.0%	\$44,423,977
Fifth Light Technology Ltd.	\$3,036,000	33.0%	\$3,914,000	42.5%	\$2,250,000	24.5%	\$9,200,000
Lignol Innovations Ltd.	\$6,240,816	30.7%	\$9,369,986	46.1%	\$4,715,120	23.2%	\$20,325,922
Nanox Inc.	\$1,774,548	40.0%	\$1,249,748	28.2%	\$1,413,500	31.9%	\$4,437,796
Sacré-Davey Engineering Inc.	\$5,727,711	32.4%	\$6,208,370	35.1%	\$5,745,629	32.5%	\$17,681,710
Synodon Inc.	\$1,056,790	23.1%	\$2,748,329	60.1%	\$767,752	16.8%	\$4,572,871
Whitefox Technologies Canada Ltd.	\$2,608,545	37.4%	\$4,374,554	62.6%	\$0	0.0%	\$6,983,099
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
Hydrogenics Corp.	\$1,350,419	44.0%	\$1,327,716	43.3%	\$391,000	12.7%	\$3,069,135



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Paradigm Environmental Technologies Inc.	\$250,000	20.7%	\$653,804	54.1%	\$305,000	25.2%	\$1,208,804
Plug Power Canada Inc.	\$2,000,000	22.2%	\$6,026,000	66.8%	\$1,000,000	11.1%	\$9,026,000
Quantiam Technologies	\$1,450,000	14.7%	\$5,487,819	55.7%	\$2,907,000	29.5%	\$9,844,819
Saskatchewan Power Corp.	\$2,414,610	21.7%	\$8,714,998	78.2%	\$20,000	0.2%	\$11,149,608
Round 2-2002B							
Enerkem Inc.	\$720,573	32.0%	\$1,316,047	58.4%	\$216,798	9.6%	\$2,253,418
Ensyn Technologies Inc.	\$2,000,000	22.5%	\$3,295,871	37.0%	\$3,600,000	40.5%	\$8,895,871
Highmark Renewables Inc.	\$1,000,000	14.2%	\$3,801,570	53.9%	\$2,254,675	32.0%	\$7,056,245
Mikro-Tek Inc.	\$500,400	14.4%	\$2,982,950	85.6%	\$0	0.0%	\$3,483,350
Radient Technologies Inc.	\$840,000	46.4%	\$721,912	39.8%	\$250,000	13.8%	\$1,811,912
University of New Brunswick	\$257,826	35.5%	\$325,228	44.8%	\$142,457	19.6%	\$725,511
West Lorne Bio-Oil Co-Generation LP	\$5,000,000	40.9%	\$7,015,947	57.4%	\$200,000	1.6%	\$12,215,947
Zenon Environmental Inc.	\$1,760,000	33.0%	\$3,574,000	67.0%	\$0	0.0%	\$5,334,000
Round 1-2002A							
Bio-Terre Systems Inc.	\$864,375	37.5%	\$800,974	34.7%	\$639,651	27.8%	\$2,305,000
Carmanah Technologies Inc.	\$466,167	22.9%	\$1,568,895	77.1%	\$0	0.0%	\$2,035,062
CO ₂ Solutions Inc.	\$1,000,000	17.0%	\$1,614,557	27.5%	\$3,267,001	55.5%	\$5,881,558
Westport Innovations	\$1,000,000	32.1%	\$1,565,376	50.2%	\$550,000	17.7%	\$3,115,376
TOTAL	\$447,612,746	26.9%	\$991,099,844	59.6%	\$224,352,366	13.5%	\$1,663,064,957



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Early Termination Projects

Note: Amounts are based on actual disbursements at project completion

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Round 21-2012A							
RB Energy Inc.	\$333,444	28.9%	\$818,727	71.1%	\$0	0.0%	\$1,152,171
Western Hydrogen Ltd.	\$676,816	34.2%	\$1,301,735	65.8%	\$0	0.0%	\$1,978,551
Round 20-2011B							
Power Measurement Ltd.	\$0	0.0%	\$0	100.0%	\$0	0.0%	\$0
Solar Ship Inc.	\$2,180,000	35.3%	\$2,637,893	42.7%	\$1,366,313	22.1%	\$6,184,205
Round 19-2011A							
RER Hydro Ltd.	\$3,779,966	51.5%	\$565,451	7.7%	\$3,000,000	40.8%	\$7,345,417
Round 18-2010B							
PAVAC Industries Inc.	\$3,549,865	33.7%	\$6,976,755	66.3%	\$0	0.0%	\$10,526,620
Round 17-2010A							
Mining Technologies International Inc.	\$51,937	24.9%	\$156,636	75.1%	\$0	0.0%	\$208,573
NIMTech Inc.	\$326,778	96.1%	\$13,427	3.9%	\$0	0.0%	\$340,205
Round 16-2009B							
3XR Inc.	\$516,976	28.9%	\$646,068	36.1%	\$624,524	34.9%	\$1,787,568
6574262 Canada Inc. (ICUS)	\$102,400	33.7%	\$201,554	66.3%	\$0	0.0%	\$303,954
Gestion TechnoCap Inc., SpaceWatts Division	\$756,000	31.0%	\$1,074,508	44.0%	\$610,000	25.0%	\$2,440,508
Spartan Bioscience Inc.	\$173,992	37.7%	\$287,389	62.3%	\$0	0.0%	\$461,381
Round 15-2009A							
Exro Technologies Inc.	\$881,235	22.0%	\$3,119,807	78.0%	\$0	0.0%	\$4,001,042
HTEC Hydrogen Technology & Energy Corp.	\$348,162	30.3%	\$585,053	51.0%	\$214,947	18.7%	\$1,148,162
PV Labs Inc.	\$965,253	32.7%	\$1,987,791	67.3%	\$0	0.0%	\$2,953,044



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
Round 14-2008B							
ThermalFrost Inc.	\$639,659	62.0%	\$391,618	38.0%	\$0	0.0%	\$1,031,277
Round 13-2008A							
Alterna Energy Inc.	\$564,443	43.7%	\$725,813	56.3%	\$0	0.0%	\$1,290,256
Performance Plants Inc.	\$651,400	33.5%	\$1,293,076	66.5%	\$0	0.0%	\$1,944,476
Round 12-2007B							
Aboriginal Cogeneration Corp.	\$1,369,354	26.5%	\$3,795,178	73.5%	\$0	0.0%	\$5,164,532
Alstom Hydro Canada Inc.	\$1,396,351	29.3%	\$3,370,581	70.7%	\$0	0.0%	\$4,766,932
BioDiesel Reactor Technologies Inc.	\$477,714	43.6%	\$422,168	38.5%	\$195,793	17.9%	\$1,095,675
Lancaster Wind Systems	\$566,194	34.6%	\$1,071,006	65.4%	\$0	0.0%	\$1,637,200
Sixtron Advanced Materials	\$1,331,823	20.6%	\$5,132,979	79.4%	\$0	0.0%	\$6,464,802
Round 11-2007A							
Biothermica Technologies Inc.	\$78,726	35.1%	\$81,018	36.1%	\$64,458	28.7%	\$224,202
EnviroTower Inc.	\$291,356	31.4%	\$637,500	68.6%	\$0	0.0%	\$928,856
Ferrinov Inc.	\$1,083,366	19.9%	\$3,809,358	70.1%	\$542,251	10.0%	\$5,434,975
Round 10-2006B							
Biogénie S.R.D.C. Inc.	\$230,137	30.7%	\$518,367	69.3%	\$0	0.0%	\$748,504
Early Warning Inc.	\$2,068,041	33.7%	\$2,984,118	48.6%	\$1,085,296	17.7%	\$6,137,455
HTC Pureenergy Inc.	\$535,414	35.4%	\$976,304	64.6%	\$0	0.0%	\$1,511,718
Nova Scotia Power Inc.	\$4,650,000	39.7%	\$7,054,996	60.3%	\$0	0.0%	\$11,704,996
NxtGen Emission Controls Inc.	\$2,265,194	24.2%	\$7,078,533	75.8%	\$0	0.0%	\$9,343,727
Turbo Trac Systems ULC Inc.	\$188,934	31.4%	\$412,575	68.6%	\$0	0.0%	\$601,509
Round 9-2006A							
Biothermica Technologies Inc.	\$200,487	33.4%	\$400,000	66.6%	\$0	0.0%	\$600,487
Magenn Power Inc.	\$691,119	12.7%	\$4,205,462	77.4%	\$539,000	9.9%	\$5,435,581



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
MinMiner Oilsands Inc.	\$3,435,372	27.2%	\$8,500,573	67.3%	\$700,000	5.5%	\$12,635,945
Zenon Membrane Solutions	\$619,860	35.8%	\$1,111,128	64.2%	\$0	0.0%	\$1,730,988
Round 8-2005B							
Bio Vision Technology Inc.	\$749,848	28.7%	\$1,183,727	45.4%	\$675,000	25.9%	\$2,608,575
Cerestech Inc.	\$751,627	32.3%	\$1,575,390	67.7%	\$0	0.0%	\$2,327,017
Mechtronix Systems Inc.	\$1,423,427	27.9%	\$1,450,817	28.4%	\$2,233,320	43.7%	\$5,107,563
Round 7-2005A							
AirScience Technologies Inc.	\$375,895	28.2%	\$956,224	71.8%	\$0	0.0%	\$1,332,119
Dépôt Rive-Nord Inc.	\$0	0.0%	\$0	100.0%	\$0	0.0%	\$0
Envirogain Inc.	\$957,623	43.3%	\$1,252,582	56.7%	\$0	0.0%	\$2,210,205
Maratek Environmental Inc.	\$915,205	28.1%	\$1,240,905	38.1%	\$1,100,000	33.8%	\$3,256,110
NETistix Technologies Corp.	\$471,199	40.3%	\$698,007	59.7%	\$0	0.0%	\$1,169,206
Nexterra Energy Corp.	\$1,159,518	33.0%	\$1,052,281	29.9%	\$1,301,893	37.1%	\$3,513,692
Round 5-2004A							
Alternative Green Energy Systems Inc.	\$517,041	29.3%	\$1,244,887	70.7%	\$0	0.0%	\$1,761,928
Xantrex Technology Inc.	\$1,213,614	33.0%	\$2,464,004	67.0%	\$0	0.0%	\$3,677,618
Round 4-2003B							
DeCloet Greenhouse Manufacturing Ltd.	\$176,434	31.7%	\$325,387	58.4%	\$55,000	9.9%	\$556,821
NxtPhase T&D Corp.	\$887,598	24.6%	\$2,727,097	75.4%	\$0	0.0%	\$3,614,695
Round 3-2003A							
Railpower Technologies Corp.	\$584,079	35.7%	\$800,521	49.0%	\$250,000	15.3%	\$1,634,600
Round 2-2002B							
IBC Technologies Inc.	\$168,785	28.0%	\$416,903	69.2%	\$16,420	2.7%	\$602,108
Round 1-2002A							
Mabarex Inc.	\$225,000	40.9%	\$300,000	54.5%	\$25,000	4.5%	\$550,000



SECTION 5: SD Tech Fund – Funding Summary for Projects Approved since Inception

Lead Organization	Approved SDTC Funding	% of Eligible Project Costs	Eligible Recipient Funding Contribution	% of Eligible Project Costs	Other Government & Academia Funding	% of Eligible Project Costs	Total Eligible Project Costs
NOVA Chemicals Corp.	\$320,000	33.5%	\$636,575	66.5%	\$0	0.0%	\$956,575
Suncor Energy	\$889,132	25.0%	\$1,826,418	51.4%	\$840,119	23.6%	\$3,555,669
TOTAL	\$49,763,793	31.2%	\$94,496,869	59.2%	\$15,439,334	9.7%	\$159,699,996



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

SDTC Eligible Projects announced for funding in Fiscal Year 2016/2017 and since the commencement of the Foundation's funding activities and the amount of funding announced, sorted by category: 1) technology areas (i.e., hydrogen economy, clean fossil fuels); 2) priority technology areas (i.e., unconventional oil and gas, distributed power generation, energy efficiency for industry and communities, and next generation technologies with potential longer-term benefits for Canada); and 3) environmental benefits (i.e., climate change, clean air, clean water, clean soil).

Hydrogen Economy Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 29 - 2016A	AFCC Automotive Fuel Cell Cooperation Corp.	\$88,370,069	\$10,000,000
Round 27 - 2015A	Loop Energy Inc.	\$23,164,070	\$7,500,000
Round 26 - 2014B	Hydrogenics Corp.	\$7,625,890	\$2,500,000
Round 21 - 2012A	Western Hydrogen Ltd.	\$1,978,551	\$676,816
Round 17 - 2010A	Ballard Power Systems	\$20,994,157	\$7,061,620
Round 16 - 2009B	Quadrogen Power Systems	\$7,441,221	\$2,910,145
Round 16 - 2009B	Isowater Corp.	\$2,375,257	\$1,020,000
Round 15 - 2009A	HTEC Hydrogen Technology & Energy Corp.	\$1,148,162	\$348,162
Round 15 - 2009A	Automotive Fuel Cell Cooperation	\$51,760,258	\$11,506,305
Round 15 - 2009A	Ballard Power Systems	\$32,452,471	\$6,905,887
Round 12 - 2007B	Western Hydrogen Ltd.	\$12,357,745	\$4,162,653
Round 10 - 2006B	HTC Pureenergy Inc.	\$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	Sacré-Davey Engineering Inc.	\$17,681,710	\$5,727,711
Round 3 - 2003A	Plug Power Canada Inc.	\$9,026,000	\$2,000,000
Round 3 - 2003A	Hydrogenics Corp.	\$3,069,135	\$1,350,419
19 PROJECTS		\$298,362,581	\$69,096,220



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Clean Fossil Fuel Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 29 - 2016A	Canfor Pulp Ltd.	\$39,216,511	\$13,050,000
Round 28 - 2015B	DarkVision	\$9,250,764	\$3,000,000
Round 27 - 2015A	Nsolv Corp.	\$84,311,075	\$13,000,000
Round 26 - 2014B	Hydrogenics Corp.	\$7,625,890	\$2,500,000
Round 25 - 2014A	Field Upgrading Ltd.	\$22,387,789	\$5,450,000
Round 25 - 2014A	Fractal Systems Inc.	\$11,471,324	\$3,700,000
Round 23 - 2013A	Inventys Thermal Technologies Inc.	\$14,540,247	\$3,100,000
Round 23 - 2013A	Carbon Engineering Ltd.	\$10,365,981	\$3,300,000
Round 23 - 2013A	Electro Kinetic Solutions Inc.	\$12,189,267	\$2,116,140
Round 23 - 2013A	Saltworks Technologies Inc.	\$7,500,000	\$2,500,000
Round 22 - 2012B	HiFi Engineering Inc.	\$5,926,220	\$2,000,000
Round 22 - 2012B	Luxmux Technology Corp.	\$3,015,259	\$980,350
Round 21 - 2012A	Western Hydrogen Ltd.	\$1,978,551	\$676,816
Round 21 - 2012A	R.I.I. North America Inc.	\$24,854,873	\$6,453,754
Round 20 - 2011B	MEG Energy Corp.	\$217,488,811	\$13,000,000
Round 18 - 2010B	Nsolv Corp.	\$54,085,607	\$10,000,000
Round 16 - 2009B	InvoDane Engineering Ltd.	\$10,034,750	\$2,467,125
Round 16 - 2009B	Inventys Thermal Technologies Inc.	\$3,914,947	\$1,598,001
Round 14 - 2008B	Titanium Corp. Inc.	\$21,642,789	\$6,292,635
Round 14 - 2008B	Statoil Hydro Canada Ltd.	\$46,651,875	\$6,000,000
Round 14 - 2008B	MEG Energy Corp.	\$18,142,245	\$4,270,000
Round 14 - 2008B	Soane Energy (Canada) Inc.	\$1,894,540	\$537,471
Round 13 - 2008A	Paragon Soil and Environmental Consulting Inc.	\$527,122	\$230,879
Round 12 - 2007B	Western Hydrogen Ltd.	\$12,357,745	\$4,162,653
Round 12 - 2007B	Petroleum Technology Research Centre Inc.	\$31,604,009	\$5,000,000
Round 10 - 2006B	Turbo Trac Systems ULC Inc.	\$601,509	\$188,934
Round 9 - 2006A	MinMiner Oilsands Inc.	\$12,635,945	\$3,435,372
Round 7 - 2005A	Petroleum Technology Research Centre Inc.	\$9,603,000	\$3,168,990
Round 7 - 2005A	PDT	\$3,489,382	\$1,191,107
Round 7 - 2005A	Nsolv Corp.	\$15,806,359	\$4,155,843
Round 4 - 2003B	Synodon Inc.	\$4,572,871	\$1,056,790
Round 1 - 2002A	CO ₂ Solutions Inc.	\$5,881,558	\$1,000,000
Round 1 - 2002A	Suncor Energy	\$3,555,669	\$889,132
33 PROJECTS		\$729,124,484	\$130,471,992



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Priority Technology Area: Unconventional Oil and Gas Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 29 - 2016A	Acceleware Ltd.	\$16,084,100	\$5,000,000
Round 29 - 2016A	Agar Canada Corp. Ltd.	\$1,720,000	\$500,000
Round 29 - 2016A	Calscan Energy Ltd.	\$3,347,968	\$982,000
Round 29 - 2016A	Forward Water Technologies	\$1,500,000	\$500,000
Round 29 - 2016A	Fossil Water Corp.	\$1,450,000	\$475,000
Round 29 - 2016A	Ground Effects Environmental Services Inc.	\$3,467,000	\$500,000
Round 29 - 2016A	Purlucid Treatment Solutions Inc.	\$16,539,314	\$3,225,000
Round 29 - 2016A	Saltworks Technologies Inc.	\$1,500,000	\$500,000
Round 29 - 2016A	waterStrider Treatment Inc.	\$1,570,000	\$500,000
Round 28 - 2015B	DarkVision	\$9,250,764	\$3,000,000
Round 27 - 2015A	Nsolv Corp.	\$84,311,075	\$13,000,000
Round 27 - 2015A	Smart Pipe Company Canada Inc.	\$7,162,756	\$2,363,709
Round 27 - 2015A	Syscor Controls & Automation Inc.	\$5,035,294	\$1,793,838
Round 25 - 2014A	CHAR Technologies	\$2,403,402	\$750,000
Round 24 - 2013B	CelluForce Inc.	\$12,943,101	\$4,004,254
Round 23 - 2013A	Electro Kinetic Solutions Inc.	\$12,189,267	\$2,116,140
Round 23 - 2013A	Pure Technologies Ltd.	\$3,945,000	\$1,300,000
Round 23 - 2013A	Saltworks Technologies Inc.	\$7,500,000	\$2,500,000
18 PROJECTS		\$191,919,041	\$43,009,941

Note: Projects prior to 2013A were not categorized for Priority Technology Areas as it was not required under previous Funding Agreements



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Priority Technology Area: Distributed Power Generation Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 29 - 2016A	Gbatteries Energy Canada Inc.	\$3,000,080	\$1,185,000
Round 29 - 2016A	Heliene Inc.	\$3,176,000	\$1,450,000
Round 28 - 2015B	Opus One Solutions Energy Corp.	\$15,121,850	\$5,353,500
Round 27 - 2015A	ARDA Power	\$1,123,550	\$400,000
Round 27 - 2015A	General Fusion Inc.	\$38,971,362	\$12,748,560
Round 27 - 2015A	NextGrid Inc.	\$753,306	\$300,000
Round 27 - 2015A	QD Solar Inc.	\$8,065,050	\$2,550,000
Round 27 - 2015A	Terrestrial Energy Inc.	\$18,095,802	\$5,739,167
Round 26 - 2014B	Sigma Energy Storage Inc.	\$8,467,469	\$2,736,068
Round 24 - 2013B	OpenHydro Technology Canada Ltd.	\$33,585,949	\$6,352,500
Round 24 - 2013B	Questor Technology Inc.	\$5,576,703	\$1,977,878
Round 23 - 2013A	Morgan Solar Inc.	\$6,518,272	\$2,067,778
Round 23 - 2013A	ZincNyx Energy Solutions	\$9,970,000	\$2,900,000
13 PROJECTS		\$152,425,394	\$45,760,451

Note: Projects prior to 2013A were not categorized for Priority Technology Areas as it was not required under previous Funding Agreements



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Priority Technology Area: Energy Efficiency for Industries and Communities Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 29 - 2016A	Magpie Mines Inc.	\$10,080,377	\$3,943,593
Round 29 - 2016A	Mariner Partners Inc.	\$3,633,416	\$1,211,139
Round 29 - 2016A	Ranovus Inc.	\$17,107,341	\$5,500,000
Round 28 - 2015B	Aeponyx Inc.	\$5,616,961	\$1,900,000
Round 28 - 2015B	Axine Water	\$4,998,093	\$2,000,000
Round 28 - 2015B	Group NanoXplore Inc.	\$10,000,681	\$3,300,000
Round 28 - 2015B	Rockport Networks Inc.	\$13,509,853	\$4,635,000
Round 28 - 2015B	Sepro Mineral Systems	\$1,339,088	\$440,000
Round 27 - 2015A	ASE Smart Energy Inc.	\$709,688	\$300,000
Round 27 - 2015A	DoodleLabs	\$8,777,762	\$2,879,925
Round 27 - 2015A	Imtex Membranes Corp.	\$10,112,395	\$3,336,960
Round 27 - 2015A	Quantiam Technologies	\$16,230,148	\$4,250,000
Round 27 - 2015A	Ronin8 Technologies Ltd.	\$1,484,313	\$300,000
Round 27 - 2015A	Sherbrooke OEM Ltd.	\$3,993,316	\$1,275,000
Round 27 - 2015A	Teck Resources Ltd.	\$8,101,975	\$2,673,652
Round 26 - 2014B	Alliance Magnésium inc.	\$9,480,585	\$3,000,000
Round 26 - 2014B	Pyrowave Inc	\$3,130,327	\$1,048,474
Round 26 - 2014B	Quest Rare Minerals Ltd.	\$14,925,275	\$4,934,504
Round 26 - 2014B	Thetis Environmental Inc.	\$2,976,043	\$1,400,000
Round 25 - 2014A	OTI Lumionics Inc.	\$17,272,239	\$5,668,675
Round 24 - 2013B	Grafoid Inc.	\$25,069,276	\$8,120,646
Round 24 - 2013B	Polar Sapphire Ltd.	\$7,837,919	\$2,650,000
Round 24 - 2013B	Ranovus Inc.	\$25,546,297	\$7,898,681
Round 23 - 2013A	Green Power Labs Inc.	\$5,418,883	\$1,604,531
Round 23 - 2013A	Nemaska Lithium Inc.	\$39,982,606	\$12,870,000
25 PROJECTS		\$267,334,856	\$87,140,779

Note: Projects prior to 2013A were not categorized for Priority Technology Areas as it was not required under previous Funding Agreements



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Priority Technology Area: Next-generation Technologies with Potential for Longer-Term Benefits Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 29 - 2016A	AFCC Automotive Fuel Cell Cooperation Corp.	\$88,370,069	\$10,000,000
Round 29 - 2016A	CarbonCure Technologies Inc.	\$1,485,654	\$510,000
Round 29 - 2016A	Canfor Pulp Ltd.	\$39,216,511	\$13,050,000
Round 28 - 2015B	e-Zn Inc.	\$1,535,045	\$700,000
Round 28 - 2015B	Hatch	\$1,700,900	\$561,200
Round 28 - 2015B	Illusense	\$4,809,936	\$1,600,000
Round 28 - 2015B	Advonex International	\$12,881,697	\$4,250,960
Round 28 - 2015B	Enerkem Alberta Biofuels LP	\$45,232,813	\$10,350,000
Round 27 - 2015A	Loop Energy Inc.	\$23,164,070	\$7,500,000
Round 27 - 2015A	Nano One Materials Corp.	\$5,976,932	\$2,081,297
Round 27 - 2015A	Netlift Transport Social Inc.	\$1,346,022	\$448,000
Round 27 - 2015A	Cellufuel Inc.	\$6,523,330	\$2,152,693
Round 27 - 2015A	Comet Biorefining Inc.	\$40,317,895	\$10,890,000
Round 27 - 2015A	FORGE-Sombra Corp.	\$11,876,980	\$4,201,814
Round 26 - 2014B	CO ₂ Solutions Inc.	\$7,851,375	\$2,442,000
Round 25 - 2014A	SWITCH Materials Inc.	\$10,313,892	\$2,500,000
Round 25 - 2014A	CrossChasm Technologies Inc.	\$1,208,556	\$430,000
Round 25 - 2014A	SIGMA DEVTECH Inc.	\$10,490,130	\$3,100,000
Round 25 - 2014A	West Fraser Mills Ltd.	\$18,581,707	\$6,100,000
Round 24 - 2013B	GaN Systems Inc.	\$6,974,548	\$2,187,971
Round 24 - 2013B	Ionada Inc.	\$4,881,762	\$1,394,495
Round 23 - 2013A	BRIC Engineered Systems Inc.	\$2,207,430	\$710,000
Round 23 - 2013A	Sysgaz Inc.	\$6,380,010	\$2,205,539
Round 23 - 2013A	Carbon Engineering Ltd.	\$10,365,981	\$3,300,000
Round 23 - 2013A	Inventys Thermal Technologies Inc.	\$14,540,247	\$3,100,000
25 PROJECTS		\$378,233,493	\$95,765,969

Note: Projects prior to 2013A were not categorized for Priority Technology Areas as it was not required under previous Funding Agreements



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Climate Change Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 29 - 2016A	Canfor Pulp Ltd.	\$39,216,511	\$13,050,000
Round 29 - 2016A	AFCC Automotive Fuel Cell Cooperation Corp.	\$88,370,069	\$10,000,000
Round 29 - 2016A	BioLiNE Corp.	\$2,831,241	\$903,083
Round 29 - 2016A	Heliene Inc.	\$3,176,000	\$1,450,000
Round 29 - 2016A	Purlucid Treatment Solutions Inc.	\$16,539,314	\$3,225,000
Round 29 - 2016A	CarbonCure Technologies Inc.	\$1,485,654	\$510,000
Round 29 - 2016A	Mariner Partners Inc.	\$3,633,416	\$1,211,139
Round 29 - 2016A	Magpie Mines Inc.	\$10,080,377	\$3,943,593
Round 29 - 2016A	Calscan Energy Ltd.	\$3,347,968	\$982,000
Round 29 - 2016A	Acceleware Ltd.	\$16,084,100	\$5,000,000
Round 29 - 2016A	Gbatteries Energy Canada Inc.	\$3,000,080	\$1,185,000
Round 29 - 2016A	Ranovus Inc.	\$17,107,341	\$5,500,000
Round 28 - 2015B	DarkVision	\$9,250,764	\$3,000,000
Round 28 - 2015B	Rockport Networks Inc.	\$13,509,853	\$4,635,000
Round 28 - 2015B	Aeponyx Inc.	\$5,616,961	\$1,900,000
Round 28 - 2015B	e-Zn Inc.	\$1,535,045	\$700,000
Round 28 - 2015B	Advonex International	\$12,881,697	\$4,250,960
Round 28 - 2015B	Illusense	\$4,809,936	\$1,600,000
Round 28 - 2015B	Hatch	\$1,700,900	\$561,200
Round 28 - 2015B	Opus One Solutions Energy Corp.	\$15,121,850	\$5,353,500
Round 28 - 2015B	Group NanoXplore Inc.	\$10,000,681	\$3,300,000
Round 28 - 2015B	Farmers Edge Corp.	\$18,484,873	\$6,107,563
Round 28 - 2015B	Enerkem Alberta Biofuels LP	\$45,232,813	\$10,350,000
Round 27 - 2015A	Loop Energy Inc.	\$23,164,070	\$7,500,000
Round 27 - 2015A	Quantiam Technologies	\$16,230,148	\$4,250,000
Round 27 - 2015A	DoodleLabs	\$8,777,762	\$2,879,925
Round 27 - 2015A	Ronin8 Technologies Ltd.	\$1,484,313	\$300,000
Round 27 - 2015A	Imtex Membranes Corp.	\$10,112,395	\$3,336,960
Round 27 - 2015A	NextGrid Inc.	\$753,306	\$300,000
Round 27 - 2015A	Cellufuel Inc.	\$6,523,330	\$2,152,693
Round 27 - 2015A	Terrestrial Energy Inc.	\$18,095,802	\$5,739,167
Round 27 - 2015A	Comet Biorefining Inc.	\$40,317,895	\$10,890,000
Round 27 - 2015A	General Fusion Inc.	\$38,971,362	\$12,748,560
Round 27 - 2015A	FORGE-Sombra Corp.	\$11,876,980	\$4,201,814
Round 27 - 2015A	ASE Smart Energy Inc.	\$709,688	\$300,000
Round 27 - 2015A	Netlift Transport Social Inc.	\$1,346,022	\$448,000
Round 27 - 2015A	QD Solar Inc.	\$8,065,050	\$2,550,000
Round 27 - 2015A	Nano One Materials Corp.	\$5,976,932	\$2,081,297
Round 27 - 2015A	Smart Pipe Company Canada Inc.	\$7,162,756	\$2,363,709
Round 27 - 2015A	ARDA Power	\$1,123,550	\$400,000



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Climate Change Projects *(continued)*

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 26 - 2014B	Hydrogenics Corp.	\$7,625,890	\$2,500,000
Round 26 - 2014B	CO ₂ Solutions Inc.	\$7,851,375	\$2,442,000
Round 26 - 2014B	Alliance Magnésium Inc.	\$9,480,585	\$3,000,000
Round 26 - 2014B	Thetis Environmental Inc.	\$2,976,043	\$1,400,000
Round 26 - 2014B	Quest Rare Minerals Ltd.	\$14,925,275	\$4,934,504
Round 26 - 2014B	DMF Medical Inc.	\$1,635,575	\$686,575
Round 26 - 2014B	Pyrowave Inc.	\$3,130,327	\$1,048,474
Round 26 - 2014B	Sigma Energy Storage Inc.	\$8,467,469	\$2,736,068
Round 25 - 2014A	Field Upgrading Ltd.	\$22,387,789	\$5,450,000
Round 25 - 2014A	Fractal Systems Inc.	\$11,471,324	\$3,700,000
Round 25 - 2014A	SWITCH Materials Inc.	\$10,313,892	\$2,500,000
Round 25 - 2014A	SIGMA DEVTECH Inc.	\$10,490,130	\$3,100,000
Round 25 - 2014A	CrossChasm Technologies Inc.	\$1,208,556	\$430,000
Round 25 - 2014A	West Fraser Mills Ltd.	\$18,581,707	\$6,100,000
Round 25 - 2014A	OTI Lumionics Inc.	\$17,272,239	\$5,668,675
Round 24 - 2013B	Ranovus Inc.	\$25,546,297	\$7,898,681
Round 24 - 2013B	Miovision Technologies Inc.	\$7,355,499	\$1,400,000
Round 24 - 2013B	Polar Sapphire Ltd.	\$7,837,919	\$2,650,000
Round 24 - 2013B	GaN Systems Inc.	\$6,974,548	\$2,187,971
Round 24 - 2013B	Grafoid Inc.	\$25,069,276	\$8,120,646
Round 24 - 2013B	OpenHydro Technology Canada Ltd.	\$33,585,949	\$6,352,500
Round 23 - 2013A	Inventys Thermal Technologies Inc.	\$14,540,247	\$3,100,000
Round 23 - 2013A	Carbon Engineering Ltd.	\$10,365,981	\$3,300,000
Round 23 - 2013A	Green Power Labs Inc.	\$5,418,883	\$1,604,531
Round 23 - 2013A	ZincNyx Energy Solutions	\$9,970,000	\$2,900,000
Round 23 - 2013A	Pure Technologies Ltd.	\$3,945,000	\$1,300,000
Round 23 - 2013A	Nemaska Lithium Inc.	\$39,982,606	\$12,870,000
Round 23 - 2013A	Sysgaz Inc.	\$6,380,010	\$2,205,539
Round 23 - 2013A	Morgan Solar Inc.	\$6,518,272	\$2,067,778
Round 22 - 2012B	Luxmux Technology Corp.	\$3,015,259	\$980,350
Round 22 - 2012B	Solantro Semiconductor Corp.	\$11,516,019	\$3,800,000
Round 22 - 2012B	Ubiquity Solar Inc.	\$10,008,801	\$3,122,445
Round 22 - 2012B	Unit Electrical Engineering Ltd.	\$911,235	\$300,000
Round 21 - 2012A	Western Hydrogen Ltd.	\$1,978,551	\$676,816
Round 21 - 2012A	R.I.I. North America Inc.	\$24,854,873	\$6,453,754
Round 21 - 2012A	NuWave Research Inc.	\$8,629,130	\$3,430,000
Round 21 - 2012A	Airex Energy Inc.	\$8,339,122	\$2,700,000
Round 21 - 2012A	Nortek Air Solutions Canada	\$12,228,862	\$2,671,129
Round 21 - 2012A	RB Energy Inc.	\$1,152,171	\$333,444
Round 21 - 2012A	Borealis GeoPower Inc.	\$8,187,345	\$2,379,962



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Climate Change Projects *(continued)*

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 21 - 2012A	Diacarbon Energy	\$10,905,476	\$2,100,000
Round 20 - 2011B	MEG Energy Corp.	\$217,488,811	\$13,000,000
Round 20 - 2011B	Solar Ship Inc.	\$6,184,205	\$2,180,000
Round 20 - 2011B	Atlantis Operations (Canada) Ltd.	\$15,296,788	\$5,000,000
Round 20 - 2011B	GHGSat Inc.	\$7,092,025	\$2,317,648
Round 20 - 2011B	Power Measurement Ltd.	\$0	\$0
Round 20 - 2011B	Effenco Development Inc.	\$6,410,996	\$2,080,188
Round 19 - 2011A	Hydrostor Inc.	\$9,318,331	\$2,971,011
Round 19 - 2011A	CVTCORP Transmission Inc.	\$3,326,973	\$1,027,887
Round 19 - 2011A	EcoSynthetix Corp.	\$1,780,171	\$600,000
Round 19 - 2011A	RER Hydro Ltd.	\$7,345,417	\$3,779,966
Round 19 - 2011A	Accelerated Systems Inc.	\$4,000,624	\$1,400,000
Round 19 - 2011A	Vision Ecoproducts Ltd.	\$11,272,947	\$3,252,342
Round 18 - 2010B	Nsolv Corp.	\$54,085,607	\$10,000,000
Round 18 - 2010B	Cooledge Lighting	\$12,998,540	\$4,469,000
Round 18 - 2010B	CarbonCure Technologies Inc.	\$4,296,182	\$1,492,000
Round 18 - 2010B	Paradigm Shift Technologies Inc.	\$5,699,597	\$1,955,250
Round 18 - 2010B	TM4	\$15,377,641	\$3,135,371
Round 18 - 2010B	Solantra Semiconductor Corp.	\$7,866,871	\$2,049,234
Round 18 - 2010B	Logistik Unicorp	\$3,029,498	\$1,012,828
Round 18 - 2010B	Nova Green Inc.	\$3,246,261	\$1,098,905
Round 18 - 2010B	Shipstone Corp.	\$6,018,042	\$2,813,498
Round 18 - 2010B	BioAmber Sarnia Inc.	\$43,697,404	\$14,513,650
Round 17 - 2010A	Ballard Power Systems	\$20,994,157	\$7,061,620
Round 17 - 2010A	Woodland Biofuels Inc.	\$12,900,000	\$4,275,000
Round 17 - 2010A	S2G Biochemicals Inc.	\$7,720,257	\$2,616,952
Round 17 - 2010A	NIMTech Inc.	\$340,205	\$326,778
Round 17 - 2010A	SWITCH Materials Inc.	\$8,046,780	\$2,363,621
Round 17 - 2010A	Westport Innovations	\$11,172,245	\$2,302,834
Round 17 - 2010A	CRB Innovations Inc.	\$20,570,976	\$5,362,500
Round 17 - 2010A	eCAMION	\$15,492,372	\$5,435,749
Round 17 - 2010A	Temporal Power Ltd.	\$14,992,104	\$5,247,236
Round 16 - 2009B	InvoDane Engineering Ltd.	\$10,034,750	\$2,467,125
Round 16 - 2009B	Inventys Thermal Technologies Inc.	\$3,914,947	\$1,598,001
Round 16 - 2009B	Quadrogen Power Systems	\$7,441,221	\$2,910,145
Round 16 - 2009B	Tenova Goodfellow Inc.	\$6,168,902	\$1,822,513
Round 16 - 2009B	Johnson Matthey Battery Materials Ltd.	\$16,911,055	\$4,700,508
Round 16 - 2009B	MARA Renewables Corp.	\$17,868,777	\$5,950,303
Round 16 - 2009B	Etalim Inc.	\$8,823,899	\$2,936,530
Round 16 - 2009B	EnerMotion Inc.	\$3,030,356	\$1,210,704



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Climate Change Projects *(continued)*

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 16 - 2009B	Gestion TechnoCap Inc., SpaceWatts Division	\$2,440,508	\$756,000
Round 15 - 2009A	HTEC Hydrogen Technology & Energy Corp.	\$1,148,162	\$348,162
Round 15 - 2009A	Automotive Fuel Cell Cooperation Corp.	\$51,760,258	\$11,506,305
Round 15 - 2009A	Ballard Power Systems	\$32,452,471	\$6,905,887
Round 15 - 2009A	Exro Technologies Inc.	\$4,001,042	\$881,235
Round 15 - 2009A	Pulse Energy Inc.	\$8,847,082	\$2,556,801
Round 15 - 2009A	Morgan Solar Inc.	\$11,163,621	\$2,351,580
Round 15 - 2009A	RER Hydro Ltd.	\$19,782,725	\$2,760,000
Round 15 - 2009A	Electrovaya Corp.	\$28,789,007	\$8,524,171
Round 14 - 2008B	MEG Energy Corp.	\$18,142,245	\$4,270,000
Round 14 - 2008B	SunSelect Produce (Delta) Inc.	\$7,235,926	\$1,672,425
Round 14 - 2008B	Imtex Membranes Corp.	\$5,557,359	\$1,250,406
Round 14 - 2008B	Lignol Innovations Ltd.	\$18,637,607	\$6,370,076
Round 14 - 2008B	Sunwell Technologies Inc.	\$7,120,313	\$2,779,849
Round 13 - 2008A	Sun Central	\$7,748,443	\$2,345,208
Round 13 - 2008A	Nexterra Systems Corp.	\$20,263,664	\$5,518,777
Round 13 - 2008A	Greenfield Specialty Alcohols	\$13,606,985	\$3,927,964
Round 13 - 2008A	General Fusion Inc.	\$58,137,591	\$13,897,455
Round 13 - 2008A	dPoint Technologies Inc.	\$3,508,695	\$1,378,254
Round 13 - 2008A	EcoSynthetix Corp.	\$5,088,882	\$1,679,331
Round 13 - 2008A	Alterna Energy Inc.	\$1,290,256	\$564,443
Round 12 - 2007B	Western Hydrogen Ltd.	\$12,357,745	\$4,162,653
Round 12 - 2007B	Petroleum Technology Research Centre Inc.	\$31,604,009	\$5,000,000
Round 12 - 2007B	Alstom Hydro Canada Inc.	\$4,766,932	\$1,396,351
Round 12 - 2007B	Verdant Power Canada ULC	\$1,200,346	\$487,324
Round 12 - 2007B	Lancaster Wind Systems	\$1,637,200	\$566,194
Round 12 - 2007B	Integran Technologies Inc.	\$17,197,659	\$5,616,635
Round 12 - 2007B	GaN Systems Inc.	\$5,804,880	\$1,500,000
Round 12 - 2007B	Sixtron Advanced Materials	\$6,464,802	\$1,331,823
Round 11 - 2007A	Effenco Development Inc.	\$3,801,799	\$1,074,955
Round 11 - 2007A	bstNRG.com Inc.	\$3,669,264	\$1,588,703
Round 11 - 2007A	St-Jean Photochemicals	\$4,902,456	\$1,506,082
Round 11 - 2007A	Biothermica Technologies Inc.	\$224,202	\$78,726
Round 11 - 2007A	MSR Innovations Inc.	\$1,473,397	\$680,839
Round 11 - 2007A	TM4	\$12,377,524	\$3,818,787
Round 10 - 2006B	Turbo Trac Systems ULC Inc.	\$601,509	\$188,934
Round 10 - 2006B	HTC Pureenergy Inc.	\$1,511,718	\$535,414
Round 10 - 2006B	Calisolar Inc.	\$15,656,809	\$4,074,505
Round 10 - 2006B	Nova Scotia Power Inc.	\$11,704,996	\$4,650,000
Round 10 - 2006B	TM4	\$3,347,002	\$622,542



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Climate Change Projects *(continued)*

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 10 - 2006B	Fifth Light Technology Ltd.	\$12,836,640	\$3,911,300
Round 9 - 2006A	General Electric Canada	\$7,456,183	\$2,485,395
Round 9 - 2006A	Magenn Power Inc.	\$5,435,581	\$691,119
Round 9 - 2006A	Enerkem Inc.	\$17,147,261	\$2,660,476
Round 9 - 2006A	Biothermica Technologies Inc.	\$600,487	\$200,487
Round 9 - 2006A	Milligan Biofuels Inc.	\$28,141,614	\$7,004,493
Round 8 - 2005B	Wind Smart Inc.	\$2,702,614	\$1,082,738
Round 8 - 2005B	Power Measurement Ltd.	\$9,104,666	\$2,960,871
Round 8 - 2005B	Tantalus Systems Corp.	\$10,102,523	\$2,981,310
Round 8 - 2005B	Bio Vision Technology Inc.	\$2,608,575	\$749,848
Round 8 - 2005B	Cerestech Inc.	\$2,327,017	\$751,627
Round 8 - 2005B	Mechtronix Systems Inc.	\$5,107,563	\$1,423,427
Round 8 - 2005B	New Energy Corp. Inc.	\$6,374,525	\$2,000,000
Round 8 - 2005B	BESTECH (Boudreau-Espley-Pitre Corp.)	\$4,494,502	\$1,448,000
Round 8 - 2005B	ARISE Technologies Corp.	\$19,631,211	\$6,439,037
Round 8 - 2005B	Nutriloc Ingredients Corp.	\$2,404,493	\$847,319
Round 7 - 2005A	Petroleum Technology Research Centre Inc.	\$9,603,000	\$3,168,990
Round 7 - 2005A	PDT	\$3,489,382	\$1,191,107
Round 7 - 2005A	Nsolv Corp.	\$15,806,359	\$4,155,843
Round 7 - 2005A	AirScience Technologies Inc.	\$1,332,119	\$375,895
Round 7 - 2005A	EcoSmart Foundation Inc.	\$3,072,015	\$1,499,143
Round 7 - 2005A	Vaperma Inc.	\$15,149,873	\$5,049,958
Round 7 - 2005A	Nexterra Energy Corp.	\$3,513,692	\$1,159,518
Round 7 - 2005A	Dépôt Rive-Nord Inc.	\$0	\$0
Round 7 - 2005A	NETistix Technologies Corp.	\$1,169,206	\$471,199
Round 7 - 2005A	Envirogain Inc.	\$2,210,205	\$957,623
Round 7 - 2005A	Plasco Trail Road Inc.	\$71,144,194	\$9,494,466
Round 6 - 2004B	Angstrom Power Inc.	\$1,263,271	\$169,752
Round 6 - 2004B	Prairie Pulp and Paper Inc.	\$3,521,525	\$1,237,290
Round 6 - 2004B	Clean Current Power Systems Inc.	\$4,795,500	\$1,582,000
Round 6 - 2004B	Sunarc of Canada Inc.	\$1,819,222	\$545,357
Round 6 - 2004B	Science Applications International Corp. (SAIC Canada)	\$4,846,555	\$1,009,588
Round 6 - 2004B	University of British Columbia	\$7,299,098	\$2,408,702
Round 5 - 2004A	Atlantic Hydrogen Inc.	\$6,893,548	\$2,096,948
Round 5 - 2004A	Tenova Goodfellow Inc.	\$11,077,548	\$3,322,440
Round 5 - 2004A	Xantrex Technology Inc.	\$3,677,618	\$1,213,614
Round 5 - 2004A	Atlantic Packaging Products Ltd.	\$7,959,404	\$2,268,430
Round 5 - 2004A	Great Northern Power Corp.	\$2,680,850	\$551,462
Round 5 - 2004A	Alternative Green Energy Systems Inc.	\$1,761,928	\$517,041
Round 4 - 2003B	Synodon Inc.	\$4,572,871	\$1,056,790



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Climate Change Projects *(continued)*

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 4 - 2003B	Lignol Innovations Ltd.	\$20,325,922	\$6,240,816
Round 4 - 2003B	Fifth Light Technology Ltd.	\$9,200,000	\$3,036,000
Round 4 - 2003B	NxtPhase T&D Corp.	\$3,614,695	\$887,598
Round 4 - 2003B	Whitefox Technologies Canada Ltd.	\$6,983,099	\$2,608,545
Round 4 - 2003B	DeCloet Greenhouse Manufacturing Ltd.	\$556,821	\$176,434
Round 3 - 2003A	Paradigm Environmental Technologies Inc.	\$1,208,804	\$250,000
Round 3 - 2003A	Quantiam Technologies	\$9,844,819	\$1,450,000
Round 3 - 2003A	Blue-Zone Technologies Ltd.	\$8,335,521	\$2,700,000
Round 2 - 2002B	IBC Technologies Inc.	\$602,108	\$168,785
Round 2 - 2002B	Highmark Renewables Inc.	\$7,056,245	\$1,000,000
Round 2 - 2002B	University of New Brunswick	\$725,511	\$257,826
Round 2 - 2002B	Mikro-Tek Inc.	\$3,483,350	\$500,400
Round 2 - 2002B	Radiant Technologies Inc.	\$1,811,912	\$840,000
Round 2 - 2002B	Zenon Environmental Inc.	\$5,334,000	\$1,760,000
Round 2 - 2002B	Enerkem Inc.	\$2,253,418	\$720,573
Round 2 - 2002B	Ensyn Technologies Inc.	\$8,895,871	\$2,000,000
Round 2 - 2002B	West Lorne Bio-Oil Co-Generation LP	\$12,215,947	\$5,000,000
Round 1 - 2002A	CO ₂ Solutions Inc.	\$5,881,558	\$1,000,000
Round 1 - 2002A	Suncor Energy	\$3,555,669	\$889,132
Round 1 - 2002A	Carmanah Technologies Inc.	\$2,035,062	\$466,167
Round 1 - 2002A	Bio-Terre Systems Inc.	\$2,305,000	\$864,375
Round 1 - 2002A	NOVA Chemicals Corp.	\$956,575	\$320,000
Round 1 - 2002A	Mabarex Inc.	\$550,000	\$225,000
223 PROJECTS		\$2,538,893,688	\$660,125,953



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Clean Air Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 27 - 2015A	Teck Resources Ltd.	\$8,101,975	\$2,673,652
Round 25 - 2014A	CHAR Technologies	\$2,403,402	\$750,000
Round 24 - 2013B	Ionada Inc.	\$4,881,762	\$1,394,495
Round 24 - 2013B	Questor Technology Inc.	\$5,576,703	\$1,977,878
Round 22 - 2012B	Macrotek Inc.	\$5,866,280	\$2,253,700
Round 20 - 2011B	New Flyer Industries ULC Canada	\$9,980,404	\$3,400,000
Round 18 - 2010B	PAVAC Industries Inc.	\$10,526,620	\$3,549,865
Round 17 - 2010A	Corvus Energy Ltd.	\$1,765,052	\$582,467
Round 17 - 2010A	Mining Technologies International Inc.	\$208,573	\$51,937
Round 14 - 2008B	Thermalfrost Inc.	\$1,031,277	\$639,659
Round 14 - 2008B	Alcoa Ltd.	\$599,845	\$170,958
Round 14 - 2008B	Canadian Pallet Council	\$2,428,338	\$1,058,755
Round 13 - 2008A	Integran Technologies Inc.	\$4,464,522	\$1,481,328
Round 12 - 2007B	Marine Exhaust Solutions Inc.	\$6,917,672	\$1,620,804
Round 11 - 2007A	General Electric Canada	\$11,721,903	\$3,903,394
Round 10 - 2006B	Advanced Lithium Power Inc.	\$5,534,876	\$1,400,000
Round 10 - 2006B	CVTCORP Transmission Inc.	\$7,649,865	\$2,131,950
Round 10 - 2006B	NxtGen Emission Controls Inc.	\$9,343,727	\$2,265,194
Round 9 - 2006A	Dynamic Systems Inc.	\$2,028,081	\$738,531
Round 8 - 2005B	Hydrogenics Corp.	\$7,917,229	\$2,248,493
Round 8 - 2005B	Unicell Ltd.	\$3,550,024	\$756,155
Round 7 - 2005A	Maratek Environmental Inc.	\$3,256,110	\$915,205
Round 6 - 2004B	Leapfrog Lighting Inc.	\$12,016,734	\$3,724,663
Round 6 - 2004B	Electrovaya Corp.	\$5,634,940	\$1,859,530
Round 6 - 2004B	Pratt & Whitney Canada Corp.	\$16,775,800	\$5,368,257
Round 5 - 2004A	M.A. Turbo/Engine Ltd.	\$332,604	\$152,844
Round 4 - 2003B	Sacré-Davey Engineering Inc.	\$17,681,710	\$5,727,711
Round 4 - 2003B	Biox Corp.	\$44,423,977	\$5,000,000
Round 4 - 2003B	Nanox Inc.	\$4,437,796	\$1,774,548
Round 3 - 2003A	Plug Power Canada Inc.	\$9,026,000	\$2,000,000
Round 3 - 2003A	Hydrogenics Corp.	\$3,069,135	\$1,350,419
Round 3 - 2003A	Saskatchewan Power Corp.	\$11,149,608	\$2,414,610
Round 3 - 2003A	Railpower Technologies Corp.	\$1,634,600	\$584,079
Round 1 - 2002A	Westport Innovations	\$3,115,376	\$1,000,000
34 PROJECTS		\$245,052,521	\$66,921,081



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Clean Water Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 29 - 2016A	Saltworks Technologies Inc.	\$1,500,000	\$500,000
Round 29 - 2016A	Ground Effects Environmental Services Inc.	\$3,467,000	\$500,000
Round 29 - 2016A	Fossil Water Corp.	\$1,450,000	\$475,000
Round 29 - 2016A	Forward Water Technologies	\$1,500,000	\$500,000
Round 29 - 2016A	Swirltex	\$1,194,831	\$397,500
Round 29 - 2016A	waterStrider Treatment Inc.	\$1,570,000	\$500,000
Round 29 - 2016A	Agar Canada Corp. Ltd.	\$1,720,000	\$500,000
Round 29 - 2016A	SewerVUE Technology Corp.	\$494,126	\$161,376
Round 28 - 2015B	Sepro Mineral Systems	\$1,339,088	\$440,000
Round 28 - 2015B	Axine Water	\$4,998,093	\$2,000,000
Round 28 - 2015B	Saltworks Technologies Inc.	\$12,000,000	\$4,000,000
Round 27 - 2015A	Nsolv Corp.	\$84,311,075	\$13,000,000
Round 24 - 2013B	CelluForce Inc.	\$12,943,101	\$4,004,254
Round 23 - 2013A	Electro Kinetic Solutions Inc.	\$12,189,267	\$2,116,140
Round 23 - 2013A	Saltworks Technologies Inc.	\$7,500,000	\$2,500,000
Round 23 - 2013A	BRIC Engineered Systems Inc.	\$2,207,430	\$710,000
Round 20 - 2011B	Whale Shark Environmental Technologies Ltd.	\$1,959,589	\$829,266
Round 19 - 2011A	Pure Technologies Ltd.	\$3,121,138	\$1,000,000
Round 18 - 2010B	'Namgis First Nation	\$16,005,099	\$5,650,000
Round 17 - 2010A	Tyne Engineering Inc.	\$5,101,548	\$1,534,097
Round 17 - 2010A	Echologics Engineering Inc.	\$3,217,390	\$1,051,926
Round 17 - 2010A	FibraCast	\$5,902,229	\$1,947,736
Round 16 - 2009B	Isowater Corp.	\$2,375,257	\$1,020,000
Round 16 - 2009B	3XR Inc.	\$1,787,568	\$516,976
Round 16 - 2009B	Spartan Bioscience Inc.	\$461,381	\$173,992
Round 15 - 2009A	SBI BioEnergy Inc.	\$11,668,063	\$2,175,495
Round 15 - 2009A	PV Labs Inc.	\$2,953,044	\$965,253
Round 15 - 2009A	Terragon Environmental Technologies Inc.	\$8,006,425	\$3,174,000
Round 14 - 2008B	Titanium Corp. Inc.	\$21,642,789	\$6,292,635
Round 14 - 2008B	Statoil Hydro Canada Ltd.	\$46,651,875	\$6,000,000
Round 14 - 2008B	Soane Energy (Canada) Inc	\$1,894,540	\$537,471
Round 14 - 2008B	Saltworks Technologies Inc.	\$8,064,022	\$2,612,638
Round 14 - 2008B	Xogen Technologies Inc.	\$4,527,874	\$1,974,104
Round 13 - 2008A	A.U.G. Signals Ltd.	\$5,889,341	\$2,019,455
Round 12 - 2007B	Pure Technologies Ltd.	\$2,508,335	\$795,000
Round 12 - 2007B	BioDiesel Reactor Technologies Inc.	\$1,095,675	\$477,714
Round 12 - 2007B	Himark Biogas Inc.	\$11,833,908	\$3,331,976
Round 12 - 2007B	Pathogen Detection Systems Inc.	\$8,599,000	\$2,671,627
Round 11 - 2007A	Fuseforward International Inc.	\$1,523,921	\$400,000
Round 11 - 2007A	EnviroTower Inc.	\$928,856	\$291,356



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Clean Water Projects *(continued)*

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 11 - 2007A	Corporation HET - Horizon Environnement Technologies	\$6,441,396	\$1,509,807
Round 10 - 2006B	Early Warning Inc.	\$6,137,455	\$2,068,041
Round 10 - 2006B	SiREM ULC	\$970,439	\$318,304
Round 10 - 2006B	Middle Bay Sustainable Aquaculture Institute	\$11,230,327	\$3,591,444
Round 9 - 2006A	Zenon Membrane Solutions	\$1,730,988	\$619,860
Round 8 - 2005B	Ostara Nutrient Recovery Technologies Inc.	\$1,777,628	\$375,760
Round 8 - 2005B	Pure Technologies Ltd.	\$6,840,562	\$2,200,000
Round 8 - 2005B	Chinook Mobile Heating and De-icing Inc.	\$7,378,282	\$3,063,766
Round 8 - 2005B	EcoVu Analytics Inc.	\$3,165,715	\$1,035,555
Round 8 - 2005B	Maritime Innovation	\$2,543,757	\$979,800
50 PROJECTS		\$376,319,427	\$95,509,324



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Clean Soil Projects

Round	Lead Organization	Total Eligible Project Costs	SDTC Announced Funding
Round 29 - 2016A	E2Metrix Inc.	\$6,241,891	\$2,059,824
Round 29 - 2016A	FlyScan Systems Inc.	\$4,514,993	\$1,825,000
Round 27 - 2015A	Sherbrooke OEM Ltd.	\$3,993,316	\$1,275,000
Round 27 - 2015A	Syscor Controls & Automation Inc.	\$5,035,294	\$1,793,838
Round 24 - 2013B	Terramera Inc.	\$5,930,386	\$2,284,581
Round 23 - 2013A	GreenMantra Technologies	\$6,360,885	\$2,007,450
Round 22 - 2012B	HiFi Engineering Inc.	\$5,926,220	\$2,000,000
Round 22 - 2012B	Vive Crop Protection Inc.	\$11,050,199	\$3,723,504
Round 21 - 2012A	Yava Technologies Inc.	\$1,223,602	\$399,123
Round 21 - 2012A	Dundee Sustainable Technologies	\$19,817,466	\$5,000,000
Round 21 - 2012A	Polystyvert Inc.	\$6,797,241	\$1,980,000
Round 20 - 2011B	Minesense Technologies Ltd.	\$14,370,427	\$4,435,794
Round 20 - 2011B	Agri-Neo Inc.	\$8,762,595	\$2,500,000
Round 20 - 2011B	semiosBIO Technologies Inc.	\$16,033,807	\$4,980,000
Round 18 - 2010B	Northex Environnement Inc.	\$4,848,730	\$1,552,354
Round 16 - 2009B	MPT Mustard Products & Technologies Inc.	\$5,936,433	\$1,840,294
Round 16 - 2009B	6574262 Canada Inc. (ICUS)	\$303,954	\$102,400
Round 16 - 2009B	Lakeshore EMPC Two LP	\$2,494,397	\$1,037,669
Round 15 - 2009A	Agrisoma Biosciences Inc.	\$11,031,621	\$3,275,000
Round 15 - 2009A	Entropex Ltd.	\$25,024,389	\$6,330,000
Round 15 - 2009A	NutraCanada	\$9,462,146	\$1,900,000
Round 14 - 2008B	Eco-Ag Initiatives Inc. (Desviar)	\$5,791,615	\$1,948,000
Round 14 - 2008B	Duopar Technologies Inc.	\$6,753,517	\$2,597,696
Round 14 - 2008B	Produits Enuchem Inc.	\$1,499,904	\$595,000
Round 13 - 2008A	Paragon Soil and Environmental Consulting Inc.	\$527,122	\$230,879
Round 13 - 2008A	Vive Crop Protection Inc.	\$11,038,603	\$3,954,706
Round 13 - 2008A	Innovente Inc.	\$5,908,755	\$2,730,526
Round 13 - 2008A	Performance Plants Inc.	\$1,944,476	\$651,400
Round 12 - 2007B	Aboriginal Cogeneration Corp.	\$5,164,532	\$1,369,354
Round 12 - 2007B	Atlantec BioEnergy Corp.	\$6,980,109	\$1,833,482
Round 11 - 2007A	Ferrinov Inc.	\$5,434,975	\$1,083,366
Round 10 - 2006B	Terragon Environmental Technologies Inc.	\$4,097,783	\$1,592,500
Round 10 - 2006B	Biogénie S.R.D.C. Inc.	\$748,504	\$230,137
Round 9 - 2006A	MinMiner Oilsands Inc.	\$12,635,945	\$3,435,372
34 PROJECTS		\$243,685,833	\$74,554,249



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Position in the Innovation Spectrum

SDTC supports projects through the early stages of demonstration and development, typically starting around Technology Readiness Level (TRL) 3 or 4, and ending at TRL 7 or 8. Through these stages, the basic principles and concepts have been formulated and the concept needs to be demonstrated experimentally. At this stage, the commercial application and path to market is not yet clear, and cleantech entrepreneurs have a difficult time attracting the usual investors who tend to support later-stage development and commercialization (i.e., TRL 7 and higher).

The TRL scale is a very useful tool for classifying the types of projects that would benefit from SDTC funding, and as a methodology for SDTC to measure and report on the advancement of clean technologies as they advance along the TRL spectrum.

Project Start and End Positions in the Innovation Spectrum

TRL	START			END		
	# of projects	SDTC \$	Total Eligible Costs \$	# of Projects	SDTC \$	Total Eligible Costs \$
4	16	\$67,920,859	\$294,483,105	3	\$16,432,034	\$66,784,215
5	31	\$94,857,865	\$326,024,127	2	\$1,787,877	\$7,451,899
6	23	\$65,259,784	\$213,360,984	9	\$22,394,162	\$77,032,505
7	5	\$17,246,375	\$63,642,867	26	\$85,515,357	\$336,201,627
8	0	\$0	\$0	33	\$115,046,674	\$400,623,387
9	0	\$0	\$0	2	\$4,108,780	\$9,417,450
TOTAL	75	\$245,284,884	\$897,511,083	75	\$245,284,884	\$897,511,083

**Includes only completed projects from 2008A+ (TRL Start for projects 2007B and earlier unavailable)*



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Technology Readiness Levels²

Technology Readiness Levels (TRLs) are a measure to evaluate the maturity of an evolving innovation. This scale, developed to assist in evaluating the maturity of goods and/or services for the Build in Canada Innovation Program (BCIP), broadly evaluates all goods and/or services while recognizing that not all development cycles are the same. This is not a linear process and many goods and/or services, may skip or quickly address certain stages of readiness.

- 9 Level 9:** Actual technology proven through successful deployment in an operational setting. At this level there is actual application of the technology in its final form and under real-life conditions, such as those encountered in operational test and evaluations. Activities include using the innovation under operational conditions.
- 8 Level 8:** Actual technology completed and qualified through tests and demonstrations. At this level the technology has been proven to work in its final form and under expected conditions. Activities include developmental testing and evaluation of whether it will meet operational requirements.
- 7 Level 7:** Prototype ready for demonstration in an appropriate operational environment. At this level the prototype should be at planned operational level and is ready for demonstration of an actual prototype in an operational environment. Activities include prototype field testing.
- 6 Level 6:** System/subsystem model or prototype demonstration in a simulated environment. At this level a model or prototype is developed that represents a near desired configuration. Activities include testing in a simulated operational environment or laboratory.
- 5 Level 5:** Component and/or validation in a simulated environment. At this level the basic technological components are integrated for testing in a simulated environment. Activities include laboratory integration of components.
- 4 Level 4:** Component and/or validation in a laboratory environment. At this level basic technological components are integrated to establish that they will work together. Activities include integration of “ad hoc” hardware in the laboratory.
- 3 Level 3:** Analytical and experimental critical function and/or proof of concept. At this level active research and development is initiated. Activities might include components that are not yet integrated or representative.
- 2 Level 2:** Technology concept and/or application formulated. At this level invention begins. Once the basic principles are observed, practical applications can be invented. Activities are limited to analytical studies.
- 1 Level 1:** Basic principles of concept are observed and reported. At this level scientific research begins to translated into applied research and development. Activities might include paper studies of a technology’s basic properties.

² Public Works and Government Services Canada description of Technology Readiness Levels:

buyandsell.gc.ca/initiatives-and-programs/build-in-canada-innovation-program-bcip/program-specifics/technology-readiness-levels



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Follow-on Financing

A total of \$2.18 billion total follow-on financing has been secured by SDTC-funded companies. The asset types of follow-on financing received are detailed below.

ASSET TYPE	
Type of Follow-on Financing	Sum of Follow-on Financing
Debt / Asset Finance	\$145,618,917
Private Equity	\$570,508,686
Private Investment in Public Equity	\$190,934,506
Public Finance	\$824,600,000
Venture Capital	\$445,695,140
GRAND TOTAL	\$2,177,357,250

Follow-on Financing Methodology

Follow-on financing represents additional investments received by SDTC's eligible recipients from the private sector and is used to move the project towards commercialization after the SDTC demonstration phase has been completed. This financing represents a "second leverage" since it is in addition to the financing already in place for the SDTC project phase, which includes investment from SDTC and leverage from initial co-funding partners.

The source of data collections for the financial deals in the cleantech market place are: Thompson Reuters, Bloomberg and Cleantech Group.

Job Creation

SDTC portfolio companies report a total of 9,437 jobs direct and indirectly attributed to SDTC-supported cleantech projects (5,302 direct, and 4,135 indirect).



Job Creation Methodology

SDTC-funded project proponents are polled by their SDTC Project Managers during their quarterly update calls. The following data is collected:

- Number of full time employees (FTEs) and/or contractors working for the ER at project start
- Number of FTEs and/or contractors working on the SDTC-funded project at the project start
- Number of FTEs and/or contractors working at the ER currently
- Number of FTEs and/or contractors working on the SDTC funded project currently
- Number of FTEs the SDTC funding has created since the project started
- Inquiry if the company expects a change in FTE employees/ contractors working on activities related to the SDTC funded technology in the next 24 months
- Confirmation of approximately how many FTE employees and/or contractors are expected to be hired in the next 24 months

This data is collected and entered into the SDTC CRM Data Management system by the Project Managers.

On a quarterly basis, the Data and Reporting Coordinator extracts the employment data and ensures the project-management team has validated the numbers.

The Data and Reporting Coordinator then takes the validated data and updates a master employment sheet. This master sheet has been coded to only count the job data that can be directly attributable to SDTC's funding. SDTC is careful not to take credit for jobs which are not the result of SDTC funding.

The grand total is the direct jobs attributable to SDTC. For indirect jobs, a multiplier of 0.78 based on Statistics Canada/Analytica Clean Tech is added.

The direct and indirect job numbers are then added together to represent the employment contribution of SDTC's entire portfolio.



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Project Impacts

The SD Tech Fund allocates 80% of funding to projects that have climate change mitigation and clean air as the primary environmental benefit. The remaining 20% is allocated to clean soil and clean water projects.

At the end of Fiscal Year 2016/2017, SDTC has approved \$727 M in funding to projects that address climate change and clean air where:

- 90% has been allocated to projects that address primarily climate change and 10% has been allocated to projects that address clean water and clean soil benefits, respectively.

Since expanding the scope of environmental benefits in 2006, SDTC has allocated \$170 M to projects that primarily address water and soil environmental benefits.

While projects are classified by a primary benefit, most projects actually result in multiple environmental benefits. The attribution to a specific primary environmental impact should be understood in the context of the following. Of the total portfolio of portfolio of 347 funded projects:

-  91% have climate change benefits;
-  74% have clean air benefits;
-  41% have soil or water benefits; and,
-  87% of all SDTC funded projects have more than one environmental benefit.

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

Environmental benefits are realized when clean technologies are commercialized and deployed. For this reason, environmental benefits are associated with product sales and revenue figures. The expected annual revenues for SDTC-funded technologies in market at the end of 2016 are \$1.87 billion. The forecast for 2022, for the same pool of projects grows to \$6.4 billion annually. These values include only those projects that are reported to be in-market or projected to be in the market by the start of fiscal year 2016/2017.

Revenue reports and forecasts are based on market rollout reports provided by the funded organization (preferably), or by publicly-available market data for companies that disclose their financial and sales figures publicly.

The preferred vehicle for these reports are ad hoc questionnaires submitted to SDTC after project completion. Those sales and revenue reports for past years are taken at face value. Future sales and revenues and projects not reported directly to SDTC are subject to a discount factor ranging from 10% to 65% to account for this uncertainty.



Climate change

The estimated GHG reductions from a total of 91 SDTC projects in the market and reporting GHG benefits, at the end of 2016 are 10.1 Megatonnes of CO₂ equivalents emission reductions (CO₂e). As market presence grows, the forecasted emission reductions for 2022 range between 56 Mt CO₂e and 100 Mt CO₂e. This forecast is calculated based on the expected emission reductions per unit multiplied by the number of units forecasted to be deployed in the year. These numbers are also discounted on two major uncertainties: market rollout and technology performance. Market rollout discount is based on the estimated probability of the sales forecasted by the funded technology becoming real, and ranges from 5% to 100% likelihood depending on the perceived market risk by SDTC. Technology performance discounting is based on SDTC's assessment of the likelihood of a technology achieving its claimed environmental performance. That discount is assessed to each specific technology application and ranges from no discount for proven market-ready units to 35% discount for technologies that are in advanced prototype phase and require more development for market entry by the time a project is concluded. Normally, SDTC doesn't fund technologies at earlier technological stages.



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception



Clean Air

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.

With regard to clean air impacts, a total of 49 projects have been identified as providers of clean air benefits in 2016. The actual environmental and human health impacts of CACs depend on population density and air shed concentrations in areas where they are emitted, and so merely reporting the emission reductions in amounts of pollutant does not fully reflect the actual benefits from these projects.

Using the input and validation from external environmental experts, SDTC has established a conservative methodology to quantify the benefits from clean air projects in terms of abated health impacts on human populations. This is based on Environment Canada's 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. Based on this approach, SDTC has modeled the impact of the 49 projects with clean air benefits, which report a reduction of health-related costs of \$18.8 million in 2016, and a forecasted reduction of \$121 million in 2022. This forecast is discounted for market rollout and technology performance uncertainties as described in the GHG section above.



Soil / Water

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

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

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

In 2016, a total of 19 projects reported water benefits. These were quantified to have a positive impact valued at \$45.1 million. By the year 2022, the portfolio of SDTC projects with water impacts is estimated to achieve a benefit value of approximately \$71 million.

SDTC has recently implemented methodologies for estimating the benefits of 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. In 2016, 19 SDTC projects achieved soil benefits. These are quantified at \$72.5 million. In the year 2022, the portfolio of SDTC projects with soil benefits is estimated to have benefits valued at \$93 million. The discounting methodology for the forecast uncertainty is similar to the air pollutant methodology above.

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.



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception



Annual GHG Reduction Forecast by Sector (ktonnes CO₂e)

SDTC Sector	2016	2017	2018	2019	2020	2021	2022
Agriculture	197	522	621	795	981	1,199	1,462
Energy Production and Exploration	3,037	3,776	4,242	4,525	4,660	4,924	5,214
Energy Utilization	2,008	3,180	5,013	7,520	9,392	11,471	14,252
Forestry	808	832	873	909	1,026	1,115	1,205
Power Generation	24	37	56	83	121	165	224
Transportation	3,741	4,802	5,803	8,243	12,022	15,633	21,639
Waste Management	338	410	471	560	680	829	1,018
TOTAL	10,154	13,558	17,078	22,635	28,881	35,336	45,013



Clean Air Benefits Forecast (CAD)

SDTC Sector	2016	2017	2018	2019	2020	2021	2022
Agriculture	\$6,275	\$41,130	\$224,317	\$697,344	\$890,490	\$1,040,146	\$1,357,493
Energy Production and Exploration	\$51,519	\$482,930	\$1,829,644	\$3,841,525	\$6,661,993	\$10,629,721	\$15,383,563
Energy Utilization	\$14,374,091	\$14,928,272	\$16,586,110	\$17,641,329	\$23,706,669	\$31,328,103	\$46,159,455
Forestry	\$-	\$-	\$-	\$-	\$-	\$-	\$-
Power Generation	\$1,004,915	\$1,201,313	\$1,323,193	\$1,827,123	\$3,216,595	\$4,621,351	\$6,171,813
Transportation	\$2,784,899	\$2,957,452	\$4,207,074	\$8,687,949	\$16,614,206	\$30,865,496	\$51,676,321
Waste Management	\$6,987	\$16,163	\$65,750	\$150,942	\$256,303	\$374,684	\$481,971
TOTAL	\$18,228,687	\$19,627,259	\$24,236,089	\$32,846,212	\$51,346,255	\$78,859,501	\$121,230,615



Clean Water Benefit Estimates (CAD)

SDTC Sector	2016	2017	2018	2019	2020	2021	2022
Energy Utilization	\$539,451	\$565,045	\$629,249	\$674,305	\$774,336	\$824,467	\$917,132
Transportation	\$-	\$407	\$407	\$813	\$813	\$1,220	\$1,220
Power Generation	\$-	\$-	\$-	\$-	\$-	\$-	\$-
Agriculture	\$307,631	\$356,262	\$409,678	\$2,899,443	\$5,350,865	\$7,793,568	\$9,640,636
Waste Management	\$44,013,933	\$45,295,226	\$46,807,172	\$49,489,074	\$52,160,448	\$54,865,218	\$57,701,054
Forestry	\$76,795	\$77,833	\$107,541	\$163,997	\$211,051	\$260,768	\$312,475
Energy Exploration and Production	\$228,351	\$303,466	\$428,885	\$1,427,130	\$1,685,678	\$2,033,960	\$2,433,460
TOTAL	\$45,166,160	\$46,598,239	\$48,382,931	\$54,654,762	\$60,183,191	\$65,779,201	\$71,005,977



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception



Clean Soil Benefit Estimates (CAD)

SDTC Sector	2016	2017	2018	2019	2020	2021	2022
Energy Utilization	\$424,639	\$452,862	\$500,204	\$572,903	\$2,105,599	\$2,930,900	\$3,105,340
Transportation	\$-	\$178	\$264	\$527	\$700	\$1,071	\$1,308
Power Generation	\$-	\$-	\$-	\$-	\$-	\$-	\$-
Agriculture	\$3,046,027	\$3,156,597	\$3,329,869	\$3,852,398	\$4,496,811	\$5,252,588	\$6,113,058
Waste Management	\$69,071,859	\$69,897,464	\$71,753,921	\$74,297,423	\$77,531,775	\$79,010,706	\$83,964,632
Forestry	\$18,540	\$29,520	\$44,249	\$48,266	\$48,266	\$75,046	\$128,606
Energy Exploration & Production	\$-	\$3,416	\$5,987	\$24,673	\$32,385	\$49,132	\$57,435
TOTAL	\$72,561,065	\$73,540,036	\$75,634,495	\$78,796,189	\$84,215,535	\$87,319,442	\$93,370,378



Annual Revenue Forecast by Sector (CAD)

SDTC Sector	2016	2017	2018	2019	2020	2021	2022
Agriculture	\$455,000	\$520,000	\$450,000	\$500,000	\$550,000	\$600,000	\$650,000
Energy Production and Exploration	\$148,241,200	\$282,440,960	\$482,841,023	\$480,471,792	\$361,297,862	\$360,697,862	\$361,347,862
Energy Utilization	\$565,195,357	\$84,523,044	\$954,823,236	\$1,218,338,238	\$1,563,319,815	\$1,747,692,240	\$2,115,282,615
Forestry	\$49,887,500	\$66,292,500	\$46,805,000	\$45,593,750	\$48,218,750	\$57,386,250	\$73,136,250
Power Generation	\$147,030,000	\$163,065,875	\$166,623,600	\$176,458,750	\$210,205,000	\$248,742,500	\$279,353,750
Transportation	\$928,516,706	\$1,288,728,683	\$1,963,468,781	\$2,336,178,363	\$3,094,323,140	\$3,339,282,290	\$3,441,522,088
Waste Management	\$28,946,250	\$32,977,165	\$51,802,165	\$89,662,165	\$167,707,165	\$167,752,165	\$167,797,165
TOTAL	\$1,868,272,013	\$2,618,548,227	\$3,666,813,804	\$4,347,203,058	\$5,445,621,731	\$5,922,153,306	\$6,439,089,730

Only projects deemed by SDTC to have entered the market are included in this report. Forecasted annual project revenues are subject to a discount based on the level of uncertainty for each specific project. Past project revenues formally reported to SDTC or those obtained through financial reports to investors (or similar official sources) are not discounted. All other forecasts are subject to variable discounts depending on the reliability of the source material, time elapsed since the release of the original report, and whether a specific product line has previously successfully entered the market.



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

SDTC Methodology for Reporting on Emission Reductions

Methodology at the Statement of Interest (SOI) Level

Reporting at the SOI level is based on applicant self-reported and unverified GHG emission reductions estimates. Some of the proponents supply calculations of GHG emission reductions and these estimates are used in tabulations. The SOI form requires applicants to indicate GHG emission reductions estimates in kilotonnes CO₂ and CO₂ equivalents over a ten year period.

These GHG emission reductions estimates, when reported by SDTC, are always classified as undiscounted and considered optimistic.

Methodology at the Full Proposal Level

At the Full Proposal level, applicants are required to submit a table indicating their individual per-unit technology impact (as a baseline), along with their anticipated market roll-out over a period of ten years. To account for the variety of technologies, market factors, and quality of proposals, a discounting factor is applied by SDTC to figures reported by applicants. These numbers are stated as discounted GHG emission reductions estimates. To avoid violating confidentiality agreements, proponent data is only shared with the external community in aggregate form.

The GHG emission reductions factors and calculation methodologies used are those determined by the Government of Canada so that SDTC is consistent with federal department reporting. SDTC provides applicants with assistance in producing estimates of GHG emission reductions estimates. It may refer applicants to GHG measurement and reporting experts in ENGO's or Sustainability Consultants, to undertake the calculations on their behalf. Note that applicant reported GHG emission reductions values are evaluated by technical experts during Gate Two of the Funding Allocation Process.

Methodology for Discounting GHG Emission Reductions Estimates

Completed projects have well developed and demonstrated technology performance parameters. Therefore, there is no discount applied to the per-unit environmental benefits of these technologies.

The most accurate data sources include Post Project Completion Questionnaires (PPCQ's) completed by project proponents to retroactively report successful sales. These are not discounted and are used as reported.

There are, however, some uncertainties from the market rollout figures. Projects do not report each and every sale and market deployment to SDTC as PPCQ's are only provided every two years on a voluntary basis. In the absence of these reports, SDTC will seek to find up-to-date information through media, marketing reports, financial statements, or other information sources where trustworthy sales figures can be tied to a specific SDTC project. For example, a company's annual financial statements may include product lines that are directly the result of the SDTC projects and so are considered "confirmed" sales. However, they also cite other sales that may be related to the SDTC funded project, but outside the direct scope of the funded project. Due to the uncertainty these are excluded in keeping with the principle of conservativeness.

In the absence of up-to-date, retroactive sales data, SDTC refers to project forecasts. The simplest sources are documents submitted to SDTC, such as company CA or market reports for final milestones. Forward-looking sales projections, including those for the current year, are discounted due to their uncertainty. Where a project has confirmed previous sales, the discount ranges from 25% to 75%, depending on the level of uncertainty perceived by SDTC. Non-completed projects with medium levels of uncertainty (standard) are discounted by 83% on their sales, while projects with high and very high risk are discounted from 90% to 99%.

In summary there are two different discount factors applied, one based on technology performance risk and the second based on market deployment. The technology performance risk for completed projects is zero, and therefore this parameter is undiscounted. With regard to the market rollout, projects that report successful market deployment in past years are not discounted. Unconfirmed sales (current or future years) are applied a discount between 25% and 99% based on SDTC's perception of likelihood.

Methodology for Discounting Future GHG Emission Reductions Estimates

These figures include adjustments for the uncertainty of projections by applying a discounting factor to individual projects. GHG emission reductions 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 emission reductions using a prescribed methodology based on accepted ISO and IPCC practices;
- Reviewing the reasonableness of projected GHG emissions reductions reported by applicants and, as new information is reported, adjusting projections and excluding projects on hold; and,
- Applying a discount rate. This discount rate is based on two major sources of uncertainty: technological performance and market deployment.



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

Technology Performance

SDTC funds unproven, high-risk technologies. Therefore, we apply an uncertainty factor to the expected performance of the technology. At the beginning of a project, we expect it to undergo numerous iterations and refinements; SDTC denominates this a non-validated technology, and, therefore an untested, “desktop” presentation of a technology will have its expected performance adjusted down by 35%.

As the project progresses, the performance discrepancy between the current version of the technology and the final product is expected to diminish. Normally, this stage also includes an adjustment to the original expected performance. Once a project presents significant technological progress on the field SDTC will change its status to validated, it is assessed by a third-party environmental consultant and its discount factor is reduced to 20%.

Finally, as a project is completed, SDTC receives a final assessment of the technology as it is expected to be deployed in the field. The performance of each unit is analyzed by an additional environmental consultant (two different experts), after all the iterations are finished. This technology is now considered to be confirmed, and is, thereby, termed undiscounted.

Market Roll-out

The second discount parameter refers to market rollout. This is similar to the methodology for completed projects presented above. SDTC funds projects with substantial risks and barriers to market entry. We consider four levels of market uncertainty:

Level of Market Uncertainty	Description
CERTAIN	This applies to confirmed sales (i.e., for completed projects). 0% discount—note that SDTC does not generally audit invoices, receipts, or other documentation that confirm sales. We trust that our proponents will report actual sales truthfully.
HIGH LIKELIHOOD	This applies to projects that SDTC deems to be very likely to deploy in the numbers forecasted. The discount ranges from 10% for completed projects with high reliability (e.g., standing orders reported) to 75% for non-completed projects that are perceived to be low risk. We apply the higher likelihood to short-term forecasts of projects that are already in the market (e.g., an increase in Westport’s deployment in 2014 and 2015).
MEDIUM LIKELIHOOD	This applies to most of the forward-looking sales estimates. Our basic discount parameters are 50% for completed projects and 87% (only 13% likelihood of sales) for projects in progress, based on work done by SDTC and Robinson Research for portfolio performance in 2005-2010. This reflects the high-risk nature of SDTC projects.
LOW LIKELIHOOD	Some projects have even higher risks of failure. For these, we apply a discount factor of 75% for completed projects, up to 90% to 99% for projects deemed to be high-risk. This is reserved for unusually problematic problems, or those which presented a very ambitious market rollout that SDTC considers very unlikely to be met or difficult to verify. Ecosmart is a good example: the structure of the consortium has made it very difficult to trace the actual deployment of this ambitious technology in a manner that would allow SDTC to quantify the extent to which it is being used.

Summary

These two discount parameters are used to evaluate the annual benefits forecasted by each project. SDTC has historically used a 93.5% discount rate (low likelihood of sales, non-validated technology equivalent to $0.1 \times 0.65 = 6.5\%$ likelihood of benefits materializing) on a project’s initial benefits estimate. However, current understanding tends to suggest that the market-entry risk is actually higher (i.e., less than one in ten of the sale units forecasted by a proponent at the initial presentation of a project take place as scheduled), while technology risk is lower since the SDTC team has a strong grasp on technological capabilities.

Methodology for Calculating and Discounting CAC Emission Reductions

SDTC-funded projects report clean air impacts in tonnes of criteria air contaminant (CAC) emissions reduced per year. This calculation includes the criteria air contaminants; particulate matter (PM), Nitrogen Oxides (NO_x), Sulfur Oxides (SO_x), and volatile organic compounds (VOCs).

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” alone does not give



SECTION 6: SD Tech Fund – Classification by Technology Area and Environmental Benefits since Inception

the full picture of the actual benefits from SDTC clean air projects. To show the benefits of these projects at the national level, SDTC has followed industry best practices to calculate avoided health-related impact costs.

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. This methodology is based on Environment Canada's regional air shed concentration measurements and modeling and Health Canada's Air Quality Benefit Assessment Tool (AQBAT), which allows a determination of the risk of health incidents in populations based on air shed concentration exposure.

The procedure is similar to the GHG benefit discount, but is adjusted by an extra parameter: the monetization of environmental damages caused by air pollutants. The methodology for this estimate is based on the Damage Function Approach (DFA) to monetize the impacts from individual pollutants. This approach follows a logical progression from emissions, through dispersion in the atmosphere and exposure, quantification of health impacts, and their valuation. This approach has been used consistently in Canada and globally to estimate damages associated with air pollution. For instance, Environment Canada used this method to quantify the benefits of the Regulatory Framework for Air Emissions.

These parameters have been devised by environmental experts, based on technology sector, exposure rates, and damage estimates. The most significant parameters are those related to morbidity and mortality, as these costs tend to constitute the majority of the unit-intensity effects calculated.

Similar to GHGs, these results have been discounted by a maximum 93.5% to account for market entry and uptake risk, subject to the same adjustments—when a project's technical capabilities are well understood its tech risk uncertainty is reduced, and the market rollout discount factors are adjusted or removed upon successful market entry.

Evaluation, Contracting, and Reporting

Projects approved for funding go through a rigorous contracting process which obligates the proponent to achieve set milestones before subsequent payment is issued. These milestones are indicators of progress towards creating GHG/CAC emissions impact—covering the performance of the technology, scaling of associated demonstration facilities, and ultimate rolling sales forecast based on actual units sold by region and year. Using internationally accepted standard methodologies (CAN/ISO 14064-1) for GHG emission reductions measurement, SDTC uses in-region baselines to determine the incremental improvement or acceleration of emissions reduction of a given approach. However, SDTC takes this baseline one step further by providing a rolling forecast based on sales projections. This bottom-up and sales-based approach enables SDTC to report GHG emission reductions impacts with a high degree of confidence. The source of error, therefore, is the confidence level placed in the benchmark itself. This benchmark data is typically provided in the form of tables from the industry in conjunction with Environment Canada and NRCan.



SECTION 7: SD Tech Fund – Classification of Projects by Region

Atlantic Provinces



Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 16 - 2009B	6574262 Canada Inc. (ICUS)	Newfoundland & Labrador	\$303,954	\$102,400
Round 12 - 2007B	Atlantec BioEnergy Corp.	Prince Edward Island	\$6,980,109	\$1,833,482
Round 5 - 2004A	Atlantic Hydrogen Inc.	New Brunswick	\$6,893,548	\$2,096,948
Round 20 - 2011B	Atlantis Operations (Canada) Ltd.	Nova Scotia	\$15,296,788	\$5,000,000
Round 8 - 2005B	Bio Vision Technology Inc.	Nova Scotia	\$2,608,575	\$749,848
Round 18 - 2010B	CarbonCure Technologies Inc.	Nova Scotia	\$4,296,182	\$1,492,000
Round 29 - 2016A	CarbonCure Technologies Inc.	Nova Scotia	\$1,485,654	\$510,000
Round 27 - 2015A	Cellufuel Inc.	Nova Scotia	\$6,523,330	\$2,152,693
Round 26 - 2014B	DMF Medical Inc.	Nova Scotia	\$1,635,575	\$686,575
Round 23 - 2013A	Green Power Labs Inc.	Nova Scotia	\$5,418,883	\$1,604,531
Round 16 - 2009B	MARA Renewables Corp.	Nova Scotia	\$17,868,777	\$5,950,303
Round 29 - 2016A	Mariner Partners Inc.	New Brunswick	\$3,633,416	\$1,211,139
Round 10 - 2006B	Nova Scotia Power Inc.	Nova Scotia	\$11,704,996	\$4,650,000
Round 24 - 2013B	OpenHydro Technology Canada Ltd.	Nova Scotia	\$33,585,949	\$6,352,500
Round 2 - 2002B	University of New Brunswick	New Brunswick	\$725,511	\$257,826
TOTAL			\$118,961,247	\$34,650,245



SECTION 7: SD Tech Fund – Classification of Projects by Region



Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 28 - 2015B	Aeponyx Inc.	Québec	\$5,616,961	\$1,900,000
Round 20 - 2011B	Agri-Neo Inc.	Québec	\$8,762,595	\$2,500,000
Round 15 - 2009A	Agrisoma Biosciences Inc.	Québec	\$11,031,621	\$3,275,000
Round 21 - 2012A	Airex Energy Inc.	Québec	\$8,339,122	\$2,700,000
Round 7 - 2005A	AirScience Technologies Inc.	Québec	\$1,332,119	\$375,895
Round 14 - 2008B	Alcoa Ltd.	Québec	\$599,845	\$170,958
Round 26 - 2014B	Alliance Magnésium Inc.	Québec	\$9,480,585	\$3,000,000
Round 12 - 2007B	Alstom Hydro Canada Inc.	Québec	\$4,766,932	\$1,396,351
Round 5 - 2004A	Alternative Green Energy Systems Inc.	Québec	\$1,761,928	\$517,041
Round 10 - 2006B	Biogénie S.R.D.C. Inc.	Québec	\$748,504	\$230,137
Round 1 - 2002A	Bio-Terre Systems Inc.	Québec	\$2,305,000	\$864,375
Round 9 - 2006A	Biothermica Technologies Inc.	Québec	\$600,487	\$200,487
Round 11 - 2007A	Biothermica Technologies Inc.	Québec	\$224,202	\$78,726
Round 24 - 2013B	CelluForce Inc.	Québec	\$12,943,101	\$4,004,254
Round 8 - 2005B	Cerestech Inc.	Québec	\$2,327,017	\$751,627
Round 1 - 2002A	CO ₂ Solutions Inc.	Québec	\$5,881,558	\$1,000,000
Round 26 - 2014B	CO ₂ Solutions Inc.	Québec	\$7,851,375	\$2,442,000
Round 11 - 2007A	Corporation HET - Horizon Environnement Technologies	Québec	\$6,441,396	\$1,509,807
Round 17 - 2010A	CRB Innovations Inc.	Québec	\$20,570,976	\$5,362,500
Round 10 - 2006B	CVTCORP Transmission Inc.	Québec	\$7,649,865	\$2,131,950
Round 19 - 2011A	CVTCORP Transmission Inc.	Québec	\$3,326,973	\$1,027,887
Round 7 - 2005A	Dépôt Rive-Nord Inc.	Québec	\$0	\$0
Round 21 - 2012A	Dundee Sustainable Technologies	Québec	\$19,817,466	\$5,000,000
Round 29 - 2016A	E2Metrix Inc.	Québec	\$6,241,891	\$2,059,824
Round 11 - 2007A	Effenco Development Inc.	Québec	\$3,801,799	\$1,074,955
Round 20 - 2011B	Effenco Development Inc.	Québec	\$6,410,996	\$2,080,188
Round 2 - 2002B	Enerkem Inc.	Québec	\$2,253,418	\$720,573
Round 9 - 2006A	Enerkem Inc.	Québec	\$17,147,261	\$2,660,476
Round 7 - 2005A	Envirogain Inc.	Québec	\$2,210,205	\$957,623
Round 11 - 2007A	Ferrinov Inc.	Québec	\$5,434,975	\$1,083,366
Round 29 - 2016A	FlyScan Systems Inc.	Québec	\$4,514,993	\$1,825,000
Round 25 - 2014A	Fractal Systems Inc.	Québec	\$11,471,324	\$3,700,000
Round 16 - 2009B	Gestion TechnoCap Inc., SpaceWatts Division	Québec	\$2,440,508	\$756,000
Round 20 - 2011B	GHGSat Inc.	Québec	\$7,092,025	\$2,317,648
Round 28 - 2015B	Group NanoXplore Inc.	Québec	\$10,000,681	\$3,300,000
Round 13 - 2008A	Innovent Inc.	Québec	\$5,908,755	\$2,730,526



SECTION 7: SD Tech Fund – Classification of Projects by Region

Québec (continued)

Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 16 - 2009B	Johnson Matthey Battery Materials Ltd.	Québec	\$16,911,055	\$4,700,508
Round 18 - 2010B	Logistik Unicorp	Québec	\$3,029,498	\$1,012,828
Round 1 - 2002A	Mabarex Inc.	Québec	\$550,000	\$225,000
Round 29 - 2016A	Magpie Mines Inc.	Québec	\$10,080,377	\$3,943,593
Round 12 - 2007B	Marine Exhaust Solutions Inc.	Québec	\$6,917,672	\$1,620,804
Round 8 - 2005B	Maritime Innovation	Québec	\$2,543,757	\$979,800
Round 8 - 2005B	Mechtronix Systems Inc.	Québec	\$5,107,563	\$1,423,427
Round 4 - 2003B	Nanox Inc.	Québec	\$4,437,796	\$1,774,548
Round 23 - 2013A	Nemaska Lithium Inc.	Québec	\$39,982,606	\$12,870,000
Round 27 - 2015A	Netlift Transport Social Inc.	Québec	\$1,346,022	\$448,000
Round 18 - 2010B	Northex Environnement Inc.	Québec	\$4,848,730	\$1,552,354
Round 15 - 2009A	NutraCanada	Québec	\$9,462,146	\$1,900,000
Round 21 - 2012A	Polystyvert Inc.	Québec	\$6,797,241	\$1,980,000
Round 14 - 2008B	Produits Enuchem Inc.	Québec	\$1,499,904	\$595,000
Round 3 - 2003A	Railpower Technologies Corp.	Québec	\$1,634,600	\$584,079
Round 15 - 2009A	RER Hydro Ltd.	Québec	\$19,782,725	\$2,760,000
Round 19 - 2011A	RER Hydro Ltd.	Québec	\$7,345,417	\$3,779,966
Round 27 - 2015A	Sherbrooke OEM Ltd.	Québec	\$3,993,316	\$1,275,000
Round 25 - 2014A	SIGMA DEVTECH Inc.	Québec	\$10,490,130	\$3,100,000
Round 26 - 2014B	Sigma Energy Storage Inc.	Québec	\$8,467,469	\$2,736,068
Round 12 - 2007B	Sixtron Advanced Materials	Québec	\$6,464,802	\$1,331,823
Round 11 - 2007A	St-Jean Photochemicals	Québec	\$4,902,456	\$1,506,082
Round 6 - 2004B	Sunarc of Canada Inc.	Québec	\$1,819,222	\$545,357
Round 23 - 2013A	Sysgaz Inc.	Québec	\$6,380,010	\$2,205,539
Round 10 - 2006B	Terragon Environmental Technologies Inc.	Québec	\$4,097,783	\$1,592,500
Round 15 - 2009A	Terragon Environmental Technologies Inc.	Québec	\$8,006,425	\$3,174,000
Round 10 - 2006B	TM4	Québec	\$3,347,002	\$622,542
Round 11 - 2007A	TM4	Québec	\$12,377,524	\$3,818,787
Round 18 - 2010B	TM4	Québec	\$15,377,641	\$3,135,371
Round 10 - 2006B	Turbo Trac Systems ULC Inc.	Québec	\$601,509	\$188,934
Round 7 - 2005A	Vaperma Inc.	Québec	\$15,149,873	\$5,049,958
TOTAL			\$471,060,735	\$138,137,043



SECTION 7: SD Tech Fund – Classification of Projects by Region

Ontario



Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 16 - 2009B	3XR Inc.	Ontario	\$1,787,568	\$516,976
Round 13 - 2008A	A.U.G. Signals Ltd.	Ontario	\$5,889,341	\$2,019,455
Round 19 - 2011A	Accelerated Systems Inc.	Ontario	\$4,000,624	\$1,400,000
Round 28 - 2015B	Advonex International	Ontario	\$12,881,697	\$4,250,960
Round 27 - 2015A	ARDA Power	Ontario	\$1,123,550	\$400,000
Round 8 - 2005B	ARISE Technologies Corp.	Ontario	\$19,631,211	\$6,439,037
Round 27 - 2015A	ASE Smart Energy Inc.	Ontario	\$709,688	\$300,000
Round 5 - 2004A	Atlantic Packaging Products Ltd.	Ontario	\$7,959,404	\$2,268,430
Round 8 - 2005B	BESTECH (Boudreau-Espley-Pitre Corp.)	Ontario	\$4,494,502	\$1,448,000
Round 18 - 2010B	BioAmber Sarnia Inc.	Ontario	\$43,697,404	\$14,513,650
Round 12 - 2007B	BioDiesel Reactor Technologies Inc.	Ontario	\$1,095,675	\$477,714
Round 29 - 2016A	BioLiNE Corp.	Ontario	\$2,831,241	\$903,083
Round 4 - 2003B	Biox Corp.	Ontario	\$44,423,977	\$5,000,000
Round 3 - 2003A	Blue-Zone Technologies Ltd.	Ontario	\$8,335,521	\$2,700,000
Round 23 - 2013A	BRIC Engineered Systems Inc.	Ontario	\$2,207,430	\$710,000
Round 10 - 2006B	Calisolar Inc.	Ontario	\$15,656,809	\$4,074,505
Round 14 - 2008B	Canadian Pallet Council	Ontario	\$2,428,338	\$1,058,755
Round 25 - 2014A	CHAR Technologies	Ontario	\$2,403,402	\$750,000
Round 8 - 2005B	Chinook Mobile Heating and De-icing Inc.	Ontario	\$7,378,282	\$3,063,766
Round 27 - 2015A	Comet Biorefining Inc.	Ontario	\$40,317,895	\$10,890,000
Round 25 - 2014A	CrossChasm Technologies Inc.	Ontario	\$1,208,556	\$430,000
Round 4 - 2003B	DeCloet Greenhouse Manufacturing Ltd.	Ontario	\$556,821	\$176,434
Round 27 - 2015A	DoodleLabs	Ontario	\$8,777,762	\$2,879,925
Round 14 - 2008B	Duopar Technologies Inc.	Ontario	\$6,753,517	\$2,597,696
Round 9 - 2006A	Dynamic Systems Inc.	Ontario	\$2,028,081	\$738,531
Round 10 - 2006B	Early Warning Inc.	Ontario	\$6,137,455	\$2,068,041
Round 17 - 2010A	eCAMION	Ontario	\$15,492,372	\$5,435,749
Round 17 - 2010A	Echologics Engineering Inc.	Ontario	\$3,217,390	\$1,051,926
Round 13 - 2008A	EcoSynthetix Corp.	Ontario	\$5,088,882	\$1,679,331
Round 19 - 2011A	EcoSynthetix Corp.	Ontario	\$1,780,171	\$600,000
Round 8 - 2005B	EcoVu Analytics Inc.	Ontario	\$3,165,715	\$1,035,555
Round 23 - 2013A	Electro Kinetic Solutions Inc.	Ontario	\$12,189,267	\$2,116,140
Round 6 - 2004B	Electrovaya Corp.	Ontario	\$5,634,940	\$1,859,530
Round 15 - 2009A	Electrovaya Corp.	Ontario	\$28,789,007	\$8,524,171
Round 16 - 2009B	EnerMotion Inc.	Ontario	\$3,030,356	\$1,210,704
Round 2 - 2002B	Ensyn Technologies Inc.	Ontario	\$8,895,871	\$2,000,000
Round 15 - 2009A	Entropex Ltd.	Ontario	\$25,024,389	\$6,330,000
Round 11 - 2007A	EnviroTower Inc.	Ontario	\$928,856	\$291,356



SECTION 7: SD Tech Fund – Classification of Projects by Region

Ontario (continued)

Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 28 - 2015B	e-Zn Inc.	Ontario	\$1,535,045	\$700,000
Round 17 - 2010A	FibraCast	Ontario	\$5,902,229	\$1,947,736
Round 4 - 2003B	Fifth Light Technology Ltd.	Ontario	\$9,200,000	\$3,036,000
Round 10 - 2006B	Fifth Light Technology Ltd.	Ontario	\$12,836,640	\$3,911,300
Round 27 - 2015A	FORGE-Sombra Corp.	Ontario	\$11,876,980	\$4,201,814
Round 29 - 2016A	Forward Water Technologies	Ontario	\$1,500,000	\$500,000
Round 12 - 2007B	GaN Systems Inc.	Ontario	\$5,804,880	\$1,500,000
Round 24 - 2013B	GaN Systems Inc.	Ontario	\$6,974,548	\$2,187,971
Round 29 - 2016A	Gbatteries Energy Canada Inc.	Ontario	\$3,000,080	\$1,185,000
Round 9 - 2006A	General Electric Canada	Ontario	\$7,456,183	\$2,485,395
Round 11 - 2007A	General Electric Canada	Ontario	\$11,721,903	\$3,903,394
Round 24 - 2013B	Grafoid Inc.	Ontario	\$25,069,276	\$8,120,646
Round 13 - 2008A	Greenfield Specialty Alcohols	Ontario	\$13,606,985	\$3,927,964
Round 23 - 2013A	GreenMantra Technologies	Ontario	\$6,360,885	\$2,007,450
Round 28 - 2015B	Hatch	Ontario	\$1,700,900	\$561,200
Round 29 - 2016A	Heliene Inc.	Ontario	\$3,176,000	\$1,450,000
Round 3 - 2003A	Hydrogenics Corp.	Ontario	\$3,069,135	\$1,350,419
Round 8 - 2005B	Hydrogenics Corp.	Ontario	\$7,917,229	\$2,248,493
Round 26 - 2014B	Hydrogenics Corp.	Ontario	\$7,625,890	\$2,500,000
Round 19 - 2011A	Hydrostor Inc.	Ontario	\$9,318,331	\$2,971,011
Round 14 - 2008B	Imtex Membranes Corp.	Ontario	\$5,557,359	\$1,250,406
Round 27 - 2015A	Imtex Membranes Corp.	Ontario	\$10,112,395	\$3,336,960
Round 12 - 2007B	Integran Technologies Inc.	Ontario	\$17,197,659	\$5,616,635
Round 13 - 2008A	Integran Technologies Inc.	Ontario	\$4,464,522	\$1,481,328
Round 16 - 2009B	InvoDane Engineering Ltd.	Ontario	\$10,034,750	\$2,467,125
Round 24 - 2013B	Ionada Inc.	Ontario	\$4,881,762	\$1,394,495
Round 16 - 2009B	Isowater Corp.	Ontario	\$2,375,257	\$1,020,000
Round 16 - 2009B	Lakeshore EMPC Two LP	Ontario	\$2,494,397	\$1,037,669
Round 6 - 2004B	Leapfrog Lighting Inc.	Ontario	\$12,016,734	\$3,724,663
Round 22 - 2012B	Macrotek Inc.	Ontario	\$5,866,280	\$2,253,700
Round 9 - 2006A	Magenn Power Inc.	Ontario	\$5,435,581	\$691,119
Round 7 - 2005A	Maratek Environmental Inc.	Ontario	\$3,256,110	\$915,205
Round 2 - 2002B	Mikro-Tek Inc.	Ontario	\$3,483,350	\$500,400
Round 17 - 2010A	Mining Technologies International Inc.	Ontario	\$208,573	\$51,937
Round 24 - 2013B	Miovision Technologies Inc.	Ontario	\$7,355,499	\$1,400,000
Round 15 - 2009A	Morgan Solar Inc.	Ontario	\$11,163,621	\$2,351,580
Round 23 - 2013A	Morgan Solar Inc.	Ontario	\$6,518,272	\$2,067,778
Round 7 - 2005A	NETistix Technologies Corp.	Ontario	\$1,169,206	\$471,199
Round 27 - 2015A	NextGrid Inc.	Ontario	\$753,306	\$300,000
Round 17 - 2010A	NIMTech Inc.	Ontario	\$340,205	\$326,778
Round 28 - 2015B	Opus One Solutions Energy Corp.	Ontario	\$15,121,850	\$5,353,500
Round 25 - 2014A	OTI Lumionics Inc.	Ontario	\$17,272,239	\$5,668,675
Round 18 - 2010B	Paradigm Shift Technologies Inc.	Ontario	\$5,699,597	\$1,955,250
Round 12 - 2007B	Pathogen Detection Systems Inc.	Ontario	\$8,599,000	\$2,671,627



SECTION 7: SD Tech Fund – Classification of Projects by Region

Ontario (continued)

Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 13 - 2008A	Performance Plants Inc.	Ontario	\$1,944,476	\$651,400
Round 7 - 2005A	Plasco Trail Road Inc.	Ontario	\$71,144,194	\$9,494,466
Round 24 - 2013B	Polar Sapphire Ltd.	Ontario	\$7,837,919	\$2,650,000
Round 6 - 2004B	Pratt & Whitney Canada Corp.	Ontario	\$16,775,800	\$5,368,257
Round 15 - 2009A	PV Labs Inc.	Ontario	\$2,953,044	\$965,253
Round 26 - 2014B	Pyrowave Inc.	Ontario	\$3,130,327	\$1,048,474
Round 27 - 2015A	QD Solar Inc.	Ontario	\$8,065,050	\$2,550,000
Round 26 - 2014B	Quest Rare Minerals Ltd.	Ontario	\$14,925,275	\$4,934,504
Round 24 - 2013B	Ranovus Inc.	Ontario	\$25,546,297	\$7,898,681
Round 29 - 2016A	Ranovus Inc.	Ontario	\$17,107,341	\$5,500,000
Round 21 - 2012A	RB Energy Inc.	Ontario	\$1,152,171	\$333,444
Round 28 - 2015B	Rockport Networks Inc.	Ontario	\$13,509,853	\$4,635,000
Round 6 - 2004B	Science Applications International Corp. (SAIC Canada)	Ontario	\$4,846,555	\$1,009,588
Round 10 - 2006B	SiREM ULC	Ontario	\$970,439	\$318,304
Round 18 - 2010B	Solantro Semiconductor Corp.	Ontario	\$7,866,871	\$2,049,234
Round 22 - 2012B	Solantro Semiconductor Corp.	Ontario	\$11,516,019	\$3,800,000
Round 20 - 2011B	Solar Ship Inc.	Ontario	\$6,184,205	\$2,180,000
Round 16 - 2009B	Spartan Bioscience Inc.	Ontario	\$461,381	\$173,992
Round 14 - 2008B	Sunwell Technologies Inc.	Ontario	\$7,120,313	\$2,779,849
Round 17 - 2010A	Temporal Power Ltd.	Ontario	\$14,992,104	\$5,247,236
Round 5 - 2004A	Tenova Goodfellow Inc.	Ontario	\$11,077,548	\$3,322,440
Round 16 - 2009B	Tenova Goodfellow Inc.	Ontario	\$6,168,902	\$1,822,513
Round 27 - 2015A	Terrestrial Energy Inc.	Ontario	\$18,095,802	\$5,739,167
Round 14 - 2008B	Thermalfrost Inc.	Ontario	\$1,031,277	\$639,659
Round 26 - 2014B	Thetis Environmental Inc	Ontario	\$2,976,043	\$1,400,000
Round 17 - 2010A	Tyne Engineering Inc.	Ontario	\$5,101,548	\$1,534,097
Round 22 - 2012B	Ubiquity Solar Inc.	Ontario	\$10,008,801	\$3,122,445
Round 8 - 2005B	Unicell Ltd.	Ontario	\$3,550,024	\$756,155
Round 12 - 2007B	Verdant Power Canada ULC	Ontario	\$1,200,346	\$487,324
Round 19 - 2011A	Vision Ecoproducts Ltd.	Ontario	\$11,272,947	\$3,252,342
Round 13 - 2008A	Vive Crop Protection Inc.	Ontario	\$11,038,603	\$3,954,706
Round 22 - 2012B	Vive Crop Protection Inc.	Ontario	\$11,050,199	\$3,723,504
Round 8 - 2005B	Wind Smart Inc.	Ontario	\$2,702,614	\$1,082,738
Round 17 - 2010A	Woodland Biofuels Inc.	Ontario	\$12,900,000	\$4,275,000
Round 14 - 2008B	Xogen Technologies Inc.	Ontario	\$4,527,874	\$1,974,104
Round 21 - 2012A	Yava Technologies Inc.	Ontario	\$1,223,602	\$399,123
Round 2 - 2002B	Zenon Environmental Inc.	Ontario	\$5,334,000	\$1,760,000
Round 9 - 2006A	Zenon Membrane Solutions	Ontario	\$1,730,988	\$619,860
TOTAL			\$1,044,024,364	\$306,666,101



SECTION 7: SD Tech Fund – Classification of Projects by Region

Prairie Provinces



Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 12 - 2007B	Aboriginal Cogeneration Corp.	Manitoba	\$5,164,532	\$1,369,354
Round 29 - 2016A	Acceleware Ltd.	Alberta	\$16,084,100	\$5,000,000
Round 29 - 2016A	Agar Canada Corp. Ltd.	Alberta	\$1,720,000	\$500,000
Round 21 - 2012A	Borealis GeoPower Inc.	Alberta	\$8,187,345	\$2,379,962
Round 11 - 2007A	bstNRG.com Inc.	Manitoba	\$3,669,264	\$1,588,703
Round 29 - 2016A	Calscan Energy Ltd.	Alberta	\$3,347,968	\$982,000
Round 23 - 2013A	Carbon Engineering Ltd.	Alberta	\$10,365,981	\$3,300,000
Round 14 - 2008B	Eco-Ag Initiatives Inc. (Desviar)	Alberta	\$5,791,615	\$1,948,000
Round 28 - 2015B	Enerkem Alberta Biofuels LP	Alberta	\$45,232,813	\$10,350,000
Round 28 - 2015B	Farmers Edge Corp.	Manitoba	\$18,484,873	\$6,107,563
Round 25 - 2014A	Field Upgrading Ltd.	Alberta	\$22,387,789	\$5,450,000
Round 29 - 2016A	Fossil Water Corp.	Alberta	\$1,450,000	\$475,000
Round 5 - 2004A	Great Northern Power Corp.	Alberta	\$2,680,850	\$551,462
Round 29 - 2016A	Ground Effects Environmental Services Inc.	Saskatchewan	\$3,467,000	\$500,000
Round 22 - 2012B	HiFi Engineering Inc.	Alberta	\$5,926,220	\$2,000,000
Round 2 - 2002B	Highmark Renewables Inc.	Alberta	\$7,056,245	\$1,000,000
Round 12 - 2007B	Himark Biogas Inc.	Alberta	\$11,833,908	\$3,331,976
Round 10 - 2006B	HTC Purenergy Inc.	Saskatchewan	\$1,511,718	\$535,414
Round 12 - 2007B	Lancaster Wind Systems	Alberta	\$1,637,200	\$566,194
Round 22 - 2012B	Luxmux Technology Corp.	Alberta	\$3,015,259	\$980,350
Round 14 - 2008B	MEG Energy Corp.	Alberta	\$18,142,245	\$4,270,000
Round 20 - 2011B	MEG Energy Corp.	Alberta	\$217,488,811	\$13,000,000
Round 9 - 2006A	Milligan Biofuels Inc.	Saskatchewan	\$28,141,614	\$7,004,493
Round 9 - 2006A	MinMiner Oilsands Inc.	Alberta	\$12,635,945	\$3,435,372
Round 16 - 2009B	MPT Mustard Products & Technologies Inc.	Saskatchewan	\$5,936,433	\$1,840,294
Round 8 - 2005B	New Energy Corp. Inc.	Alberta	\$6,374,525	\$2,000,000
Round 20 - 2011B	New Flyer Industries ULC Canada	Manitoba	\$9,980,404	\$3,400,000
Round 21 - 2012A	Nortek Air Solutions Canada	Saskatchewan	\$12,228,862	\$2,671,129
Round 1 - 2002A	NOVA Chemicals Corp.	Alberta	\$956,575	\$320,000
Round 18 - 2010B	Nova Green Inc.	Alberta	\$3,246,261	\$1,098,905
Round 7 - 2005A	Nsolv Corp.	Alberta	\$15,806,359	\$4,155,843
Round 18 - 2010B	Nsolv Corp.	Alberta	\$54,085,607	\$10,000,000
Round 27 - 2015A	Nsolv Corp.	Alberta	\$84,311,075	\$13,000,000
Round 13 - 2008A	Paragon Soil and Environmental Consulting Inc.	Alberta	\$527,122	\$230,879
Round 7 - 2005A	Petroleum Technology Research Centre Inc.	Saskatchewan	\$9,603,000	\$3,168,990
Round 12 - 2007B	Petroleum Technology Research Centre Inc.	Saskatchewan	\$31,604,009	\$5,000,000



SECTION 7: SD Tech Fund – Classification of Projects by Region

Prairie Provinces *(continued)*

Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 6 - 2004B	Prairie Pulp and Paper Inc.	Manitoba	\$3,521,525	\$1,237,290
Round 8 - 2005B	Pure Technologies Ltd.	Alberta	\$6,840,562	\$2,200,000
Round 12 - 2007B	Pure Technologies Ltd.	Alberta	\$2,508,335	\$795,000
Round 19 - 2011A	Pure Technologies Ltd.	Alberta	\$3,121,138	\$1,000,000
Round 23 - 2013A	Pure Technologies Ltd.	Alberta	\$3,945,000	\$1,300,000
Round 29 - 2016A	Purlucid Treatment Solutions Inc.	Alberta	\$16,539,314	\$3,225,000
Round 3 - 2003A	Quantiam Technologies	Alberta	\$9,844,819	\$1,450,000
Round 27 - 2015A	Quantiam Technologies	Alberta	\$16,230,148	\$4,250,000
Round 24 - 2013B	Questor Technology Inc.	Alberta	\$5,576,703	\$1,977,878
Round 21 - 2012A	R.I.I. North America Inc.	Alberta	\$24,854,873	\$6,453,754
Round 2 - 2002B	Radiant Technologies Inc.	Alberta	\$1,811,912	\$840,000
Round 3 - 2003A	Saskatchewan Power Corp.	Saskatchewan	\$11,149,608	\$2,414,610
Round 15 - 2009A	SBI BioEnergy Inc.	Alberta	\$11,668,063	\$2,175,495
Round 27 - 2015A	Smart Pipe Company Canada Inc.	Alberta	\$7,162,756	\$2,363,709
Round 14 - 2008B	Soane Energy (Canada) Inc.	Alberta	\$1,894,540	\$537,471
Round 14 - 2008B	Statoil Hydro Canada Ltd.	Alberta	\$46,651,875	\$6,000,000
Round 1 - 2002A	Suncor Energy	Alberta	\$3,555,669	\$889,132
Round 29 - 2016A	Swirltex	Alberta	\$1,194,831	\$397,500
Round 4 - 2003B	Synodon Inc.	Alberta	\$4,572,871	\$1,056,790
Round 14 - 2008B	Titanium Corp. Inc.	Alberta	\$21,642,789	\$6,292,635
Round 12 - 2007B	Western Hydrogen Ltd.	Alberta	\$12,357,745	\$4,162,653
Round 21 - 2012A	Western Hydrogen Ltd.	Alberta	\$1,978,551	\$676,816
Round 4 - 2003B	Whitefox Technologies Canada Ltd.	Alberta	\$6,983,099	\$2,608,545
TOTAL			\$915,690,253	\$177,816,162



SECTION 7: SD Tech Fund – Classification of Projects by Region

British Columbia



Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 10 - 2006B	Advanced Lithium Power Inc.	British Columbia	\$5,534,876	\$1,400,000
Round 29 - 2016A	AFCC Automotive Fuel Cell Cooperation Corp.	British Columbia	\$88,370,069	\$10,000,000
Round 13 - 2008A	Alterna Energy Inc.	British Columbia	\$1,290,256	\$564,443
Round 6 - 2004B	Angstrom Power Inc.	British Columbia	\$1,263,271	\$169,752
Round 15 - 2009A	Automotive Fuel Cell Cooperation	British Columbia	\$51,760,258	\$11,506,305
Round 28 - 2015B	Axine Water	British Columbia	\$4,998,093	\$2,000,000
Round 15 - 2009A	Ballard Power Systems	British Columbia	\$32,452,471	\$6,905,887
Round 17 - 2010A	Ballard Power Systems	British Columbia	\$20,994,157	\$7,061,620
Round 29 - 2016A	Canfor Pulp Ltd.	British Columbia	\$39,216,511	\$13,050,000
Round 1 - 2002A	Carmanah Technologies Inc.	British Columbia	\$2,035,062	\$466,167
Round 6 - 2004B	Clean Current Power Systems Inc.	British Columbia	\$4,795,500	\$1,582,000
Round 18 - 2010B	Cooledge Lighting	British Columbia	\$12,998,540	\$4,469,000
Round 17 - 2010A	Corvus Energy Ltd.	British Columbia	\$1,765,052	\$582,467
Round 28 - 2015B	DarkVision	British Columbia	\$9,250,764	\$3,000,000
Round 21 - 2012A	Diacarbon Energy	British Columbia	\$10,905,476	\$2,100,000
Round 13 - 2008A	dPoint Technologies Inc.	British Columbia	\$3,508,695	\$1,378,254
Round 7 - 2005A	EcoSmart Foundation Inc.	British Columbia	\$3,072,015	\$1,499,143
Round 16 - 2009B	Etalim Inc.	British Columbia	\$8,823,899	\$2,936,530
Round 15 - 2009A	Exro Technologies Inc.	British Columbia	\$4,001,042	\$881,235
Round 11 - 2007A	Fuseforward International Inc.	British Columbia	\$1,523,921	\$400,000
Round 13 - 2008A	General Fusion Inc.	British Columbia	\$58,137,591	\$13,897,455
Round 27 - 2015A	General Fusion Inc.	British Columbia	\$38,971,362	\$12,748,560
Round 15 - 2009A	HTEC Hydrogen Technology & Energy Corp.	British Columbia	\$1,148,162	\$348,162
Round 2 - 2002B	IBC Technologies Inc.	British Columbia	\$602,108	\$168,785
Round 28 - 2015B	Illusense	British Columbia	\$4,809,936	\$1,600,000
Round 16 - 2009B	Inventys Thermal Technologies Inc.	British Columbia	\$3,914,947	\$1,598,001
Round 23 - 2013A	Inventys Thermal Technologies Inc.	British Columbia	\$14,540,247	\$3,100,000
Round 4 - 2003B	Lignol Innovations Ltd.	British Columbia	\$20,325,922	\$6,240,816
Round 14 - 2008B	Lignol Innovations Ltd.	British Columbia	\$18,637,607	\$6,370,076
Round 27 - 2015A	Loop Energy Inc.	British Columbia	\$23,164,070	\$7,500,000
Round 5 - 2004A	M.A. Turbo/Engine Ltd.	British Columbia	\$332,604	\$152,844
Round 10 - 2006B	Middle Bay Sustainable Aquaculture Institute	British Columbia	\$11,230,327	\$3,591,444
Round 20 - 2011B	Minesense Technologies Ltd.	British Columbia	\$14,370,427	\$4,435,794
Round 11 - 2007A	MSR Innovations Inc.	British Columbia	\$1,473,397	\$680,839
Round 18 - 2010B	'Namgis First Nation	British Columbia	\$16,005,099	\$5,650,000
Round 27 - 2015A	Nano One Materials Corp.	British Columbia	\$5,976,932	\$2,081,297
Round 7 - 2005A	Nexterra Energy Corp.	British Columbia	\$3,513,692	\$1,159,518
Round 13 - 2008A	Nexterra Systems Corp.	British Columbia	\$20,263,664	\$5,518,777
Round 8 - 2005B	Nutriloc Ingredients Corp.	British Columbia	\$2,404,493	\$847,319



SECTION 7: SD Tech Fund – Classification of Projects by Region

British Columbia *(continued)*

Round	Lead Organization	Province	Total Eligible Costs	SDTC Announced Funding
Round 21 - 2012A	NuWave Research Inc.	British Columbia	\$8,629,130	\$3,430,000
Round 10 - 2006B	NxtGen Emission Controls Inc.	British Columbia	\$9,343,727	\$2,265,194
Round 4 - 2003B	NxtPhase T&D Corp.	British Columbia	\$3,614,695	\$887,598
Round 8 - 2005B	Ostara Nutrient Recovery Technologies Inc.	British Columbia	\$1,777,628	\$375,760
Round 3 - 2003A	Paradigm Environmental Technologies Inc.	British Columbia	\$1,208,804	\$250,000
Round 18 - 2010B	PAVAC Industries Inc.	British Columbia	\$10,526,620	\$3,549,865
Round 7 - 2005A	PDT	British Columbia	\$3,489,382	\$1,191,107
Round 3 - 2003A	Plug Power Canada Inc.	British Columbia	\$9,026,000	\$2,000,000
Round 8 - 2005B	Power Measurement Ltd.	British Columbia	\$9,104,666	\$2,960,871
Round 20 - 2011B	Power Measurement Ltd.	British Columbia	\$0	\$0
Round 15 - 2009A	Pulse Energy Inc.	British Columbia	\$8,847,082	\$2,556,801
Round 16 - 2009B	Quadrogen Power Systems	British Columbia	\$7,441,221	\$2,910,145
Round 27 - 2015A	Ronin8 Technologies Ltd.	British Columbia	\$1,484,313	\$300,000
Round 17 - 2010A	S2G Biochemicals Inc.	British Columbia	\$7,720,257	\$2,616,952
Round 4 - 2003B	Sacré-Davey Engineering Inc.	British Columbia	\$17,681,710	\$5,727,711
Round 14 - 2008B	Saltworks Technologies Inc.	British Columbia	\$8,064,022	\$2,612,638
Round 23 - 2013A	Saltworks Technologies Inc.	British Columbia	\$7,500,000	\$2,500,000
Round 28 - 2015B	Saltworks Technologies Inc.	British Columbia	\$12,000,000	\$4,000,000
Round 29 - 2016A	Saltworks Technologies Inc.	British Columbia	\$1,500,000	\$500,000
Round 20 - 2011B	semiosBIO Technologies Inc.	British Columbia	\$16,033,807	\$4,980,000
Round 28 - 2015B	Sepro Mineral Systems	British Columbia	\$1,339,088	\$440,000
Round 29 - 2016A	SewerVUE Technology Corp.	British Columbia	\$494,126	\$161,376
Round 18 - 2010B	Shipstone Corp.	British Columbia	\$6,018,042	\$2,813,498
Round 13 - 2008A	Sun Central	British Columbia	\$7,748,443	\$2,345,208
Round 14 - 2008B	SunSelect Produce (Delta) Inc.	British Columbia	\$7,235,926	\$1,672,425
Round 17 - 2010A	SWITCH Materials Inc.	British Columbia	\$8,046,780	\$2,363,621
Round 25 - 2014A	SWITCH Materials Inc.	British Columbia	\$10,313,892	\$2,500,000
Round 27 - 2015A	Syscor Controls & Automation Inc.	British Columbia	\$5,035,294	\$1,793,838
Round 8 - 2005B	Tantalus Systems Corp.	British Columbia	\$10,102,523	\$2,981,310
Round 27 - 2015A	Teck Resources Ltd.	British Columbia	\$8,101,975	\$2,673,652
Round 24 - 2013B	Terramera Inc.	British Columbia	\$5,930,386	\$2,284,581
Round 22 - 2012B	Unit Electrical Engineering Ltd.	British Columbia	\$911,235	\$300,000
Round 6 - 2004B	University of British Columbia	British Columbia	\$7,299,098	\$2,408,702
Round 29 - 2016A	waterStrider Treatment Inc.	British Columbia	\$1,570,000	\$500,000
Round 25 - 2014A	West Fraser Mills Ltd.	British Columbia	\$18,581,707	\$6,100,000
Round 2 - 2002B	West Lorne Bio-Oil Co-Generation LP	British Columbia	\$12,215,947	\$5,000,000
Round 1 - 2002A	Westport Innovations	British Columbia	\$3,115,376	\$1,000,000
Round 17 - 2010A	Westport Innovations	British Columbia	\$11,172,245	\$2,302,834
Round 20 - 2011B	Whale Shark Environmental Technologies Ltd.	British Columbia	\$1,959,589	\$829,266
Round 5 - 2004A	Xantrex Technology Inc.	British Columbia	\$3,677,618	\$1,213,614
Round 23 - 2013A	ZincNyx Energy Solutions	British Columbia	\$9,970,000	\$2,900,000
TOTAL			\$854,214,869	\$239,841,056



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 ten 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 renewable feedstocks.

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: sdtc.ca



SECTION 9: NextGen BioFuels Fund – Portfolio since Inception

The development and scale-up of the next-generation biofuels industry has been slower than expected. In turn, this has affected fund allocations from the Next Generation Biofuels Fund. Depressed prices of crude oil and natural gas, and the exploitation of shale oil reserves in the United States, have adversely influenced the commercial demonstration of biofuel-technology platforms. These market factors have been further exacerbated by challenges associated with technology readiness and the lack of available investment capital.

The Next Generation Biofuels Fund (NGBF) is now closed and is no longer accepting applications. As of March 30, 2017, the Fund is fully disbursed and focused on supporting the construction and start-up phases of already funded projects. The SDTC Board of Directors has approved two projects—namely, the Enerkem Alberta Biofuels project and the AE Côte-Nord RTP™ project—to receive final funding commitments.

Details about the two approved projects are noted below:

Projects

Enerkem Alberta Biofuels Project

Total Project Costs:
\$174,500,000

Approved Final SDTC Contribution:
\$63,600,000

SDTC Contribution To Date:
\$53,200,000

As part of this project, 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 utilizes 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:
\$71,700,000

Approved Final SDTC Contribution:
\$27,000,000

SDTC Contribution To Date:
\$27,000,000

The AE Côte-Nord RTP™ project will employ Ensyn's 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 21M litres of RFO annually.

Partners:

- Ensyn Bioenergy Canada Inc.
- Arbec Forest Products Inc.

To learn more about the NGBG funding process, please visit sdtc.ca