Evaluation of Sustainable Development Technology Canada

Interim Evaluation Report - Final

June 27, 2006
RR

Presented to • Présenté à
Sustainable Development
Technology Canada

Robinson Research, in association with
TNS Canadian Facts

TABLE OF CONTENTS

Chapter **Page**

I INTRODUCTION 1
- A. SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA 1
- B. THIS REPORT 3
- C. HIGHLIGHTS 4

II METHODS 9
- A. EVALUATION PLAN 9
- B. INFORMATION SOURCES FOR THE INTERIM EVALUATION 9

III THE NEED FOR SDTC (RATIONALE) 13
- A. OVERVIEW OF THE RATIONALE 13
- B. THE FUNDING GAP 13
- C. SUSTAINABLE DEVELOPMENT INFRASTRUCTURE IN CANADA 17
- D. CONCLUSIONS AND RECOMMENDATIONS ON THE SDTC RATIONALE 20

IV SDTC OPERATIONS 23
- A. EXTERNAL REVIEWS AND AUDITS 23
- B. PROGRAM DELIVERY 25
- C. CONCLUSIONS AND RECOMMENDATIONS 30

V SHORT TERM RESULTS 33
- A. LEVERAGE OF SDTC FUNDS 33
- B. PROJECT IMPACT AND MARKET IMPACT AS OF DECEMBER 2005 33
- C. PREPARATION FOR MEASUREMENT OF LONGER TERM OBJECTIVES 33
- D. RISK OF PREMATURE EVALUATION 35
- E. CONCLUSIONS ON SHORT TERM RESULTS 35

APPENDIX A: SDTC RATIONALE FROM THE PERSPECTIVE OF THE ECONOMICS LITERATURE 37

I INTRODUCTION

A. SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA

The Government of Canada created and financed a foundation, Sustainable Development Technology Canada (SDTC) to "act as the primary catalyst in building a sustainable development technology infrastructure in Canada." The Act establishing the foundation came into force on 22 March, 2002.[1]

The first funding agreement, which was signed on 26 March 2001, provided a grant of $100 million that was to be invested over five years. The agreement specified that funds should be available for new projects until at least 31 December 2005, should be disbursed by December 2008 and over the life of the agreement, 80% of the funds should support projects that address climate change issues and 20% should primarily support clean air projects.[2] The agreement specified the purpose of the fund as follows:

(a) fund the development and demonstration of new Sustainable Development technologies related to climate change and clean air, in order to make progress towards Sustainable Development;

(b) 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 and clean air; and

(c) encourage rapid diffusion of the new Sustainable Development technologies in all sectors throughout Canada.[3]

On March 31, 2004 an amendment to the funding agreement granted an additional $250 million. This agreement directed that the new funds should be available for projects up to at least 31 December, 2007 and that the funds should be totally disbursed by December 2009. The amendment maintained the focus of the new funding at 80% for climate change and 20% for clean air projects. In addition, it specified that over the life of the agreement, SDTC should make available at least $50 million for

[1] *Canada Foundation for Sustainable Development Technology Act*, S.C. 2001, c. 23.
[2] *Funding Agreement Toward the Sustainable Development Technology Fund,* 26 March 2001, Section 4.01.
[3] This statement of the purpose of the fund appears in Section 2.01 of each funding agreement.

projects directed to the hydrogen economy and another $50 million for projects related to clean fossil fuels.[4]

One year later on March 31, 2005, a third funding agreement came into effect. This agreement provided an additional $200 million, extended the period for funding new projects to December, 2010 and required that all project funds are to be disbursed by December 2012. The funds provided under this agreement are to be directed to projects that are primarily focused on clean water or clean soil.[5]

The funding agreements set out in detail the procedures, criteria, contracting conditions and the like that SDTC must follow. Briefly, at least once per year[6] SDTC must conduct calls for Statements of Interest (SOI) from proponents who propose to develop qualifying new technologies. An assessment of the SOIs identifies promising projects and the proponents of those projects are invited to submit full proposals which must meet a number of conditions, for example describing the work to be done, the involvement of a consortium which includes an end user of the technology and projecting eventual market performance and environmental impacts. A technical and business review and due diligence procedure identifies successful proposals. Approved projects must enter into contracts that meet a number of conditions including specifying eligible costs, project milestones and the involvement of the consortium. Upon completion of the project, proponents must submit a final report that specifies the project results and updates the market and environmental projections for the technology. It is important to note that each successive funding agreement has added new requirements that have significantly increased the burden on project proponents and on SDTC.

When it was established as a foundation at arm's length from government, SDTC had no close precedents to follow in terms of its organization, operating procedures or relations with government. In less than four years SDTC has established a functioning organization that now employs 24 people, initiated 8 funding rounds, reviewed over 1000 statements of interest and approved 79 proposals for the development and demonstration of new technologies. As of December 2005, seven projects were complete.

[4] *Amended and Restated Funding Agreement Pertaining to the Sustainable Development Technology Fund*, 31 March 2004, Section 9.01 to 9.04.
[5] *Funding Agreement Three Pertaining to the Sustainable Development Technology Fund*, 31 March, 2005, Sections 4.02, 9.01, 9.04.
[6] SDTC has chosen to conduct two funding rounds per year.

B. THIS REPORT

The funding agreements require that SDTC develop an evaluation framework and complete an independent interim evaluation by June 30 2006. The interim evaluation should "assess whether the Fund is meeting its purposes and objectives and, to the extent possible, whether adjustments to the program can and should be made." It should "focus on the administration of the Fund and provide commentary on the overall operation of the Foundation in meeting the purposes of the Fund as outlined in Section 2.01, including an evaluation, in aggregate, of the Project Impact and Market Impact, of Funded Projects by Market Sector as estimated as of the date of the evaluation."[7]

This report responds to the requirement for an interim evaluation for operations up to 31 December, 2005. It addresses a number of questions that stem from the requirement for this interim evaluation (above) or from the evaluation plan:

< **Rationale.** Is the rationale for SDTC still valid?

- Is there a continuing need for SDTC, in terms of the purposes of the fund: the need for funding to support the development and demonstration phase; support for collaboration to strengthen the capacity to development and demonstrate sustainable development technologies; and rapid diffusion of new clean technologies?
- Is there duplication or complementarity with related government funding programs?
- Is the volume of SOIs and proposals sufficient to support the rate of investment required by the funding agreements?

< **SDTC Operations.** Are SDTC services delivered appropriately?

- Does SDTC comply with the requirements of the funding agreements?
- How do project proponents react to the selection, contracting and project management procedures and to the related interactions with SDTC? Do they think SDTC strikes an appropriate balance between rigour and speed, is the response burden on proponents at an appropriate level?
- Are projects whose proposals were accepted making reasonable progress toward completion of the SDTC funded activities?

[7] *Funding Agreement Three Pertaining to the Sustainable Development Technology Fund*, 31 March, 2005, Article 10.10.

< **Short Term Results.** Do the results to date indicate that SDTC is making progress toward achieving its objectives?

- Do forecast environmental impacts indicate that SDTC investments appear to return social benefits that exceed their costs?

C. HIGHLIGHTS

1. Methods

The interim evaluation conducted qualitative interviews in 2004 – 05 with 40 key informants drawn from three settings, venture capital specialists, representatives of stakeholder organizations and government officials. From the first five funding rounds, we interviewed 40 project proponents of funded projects and 19 whose SOI was not successful. In early 2006 a survey completed 29 interviews with proponents of recently funded projects and 27 proponents whose proposals were not successful. Overall, we completed interviews with over 90% of candidate respondents from each group, except proponents of unsuccessful SOIs (interviews were completed with about half of those sampled for whom contact information was still valid) and government officials (interviews with about two-thirds of candidates).

The evaluation team has reviewed extensive documentation on other investigations, two external (non-financial) audits and various internally-funded reviews. We accessed administrative data on venture capital activity in Canada. Throughout the project, SDTC staff provided information, feedback and commentary and have been very supportive of our work while respecting the independence of the evaluation.

2. Rationale for SDTC

The principal rationale for SDTC focuses on the need to fund environmental technologies that are ready to move from bench scale to commercial product. In the process, SDTC support helps to build an infrastructure for the development of sustainable development technologies. The rationale assumes that promising Canadian sustainable development technologies face extreme difficulty arranging funding for the 'technology development and demonstration' phase of their development and therefore are at risk of not reaching the market. SDTC addresses this funding gap for qualifying technologies.

a) The Funding Gap

Is there a continuing need to address the funding gap? The research shows that almost universally, key informants and project proponents acknowledge the funding gap. Data on venture capital activity, the most likely non-governmental source of funds for emerging technologies, confirms the existence of the gap. The evaluation found scant evidence of venture capital investments of the sort that are the focus of SDTC support. Clearly, SDTC is not displacing or crowding out private funding and key informants have difficulty visualizing the possibility that the level of venture capital investment would increase substantially in the foreseeable future.

b) Sustainable Development Infrastructure

Is there a continuing need to strengthen Canada's capacity to develop and demonstrate clean technologies? The presence of the funding gap indicates that the infrastructure requires continuing support but the findings from the evaluation suggest that it is gaining strength.

While SDTC is a relatively new organization, it appears that its active outreach program has created reasonable levels of awareness in Canada's sustainable development community.

A key concern for the SDTC design and rationale is whether the volume of SOIs and proposals will be sufficient to justify the level of funding required by the funding agreements. To date the evidence is positive. The level of SOIs seems to be holding steady about 100 per funding round and SDTC has approved 10 to 15 proposals from each round and the annual commitment of funds to approved projects is consistent with the rate of expenditure anticipated by the funding agreements.

SDTC is required by its funding agreements to invest in projects made up of a consortium, a strategy the economic literature suggests will improve the probability and/or magnitude of success. While some have reservations, the consortia requirement finds support among project proponents. Proponents of a majority of funded projects would have involved the members of their consortium regardless of the SDTC requirement and many see the involvement of the consortium as benefiting their project.

The evaluation found general agreement that SDTC occupies 'a clearly defined niche' among government funding programs. Any overlap with other programs is minimal and well-managed with hand-offs or referrals in both directions.

Coordination with other funding agencies presents a challenge because when SDTC was launched, there were no directly relevant precedents for the relations of an arm's length private sector oriented funding agency such as SDTC and established government departments. We found two distinct points of view: SDTC should be more

involved with other departments and programs; and the arms length relationship is an essential characteristic of SDTC that would be jeopardized if it were to act more like a conventional government program. While this situation initially led to tension between SDTC and some departments, the situation appears to be improving. A number of respondents noted SDTC's initiative to host regular exchanges with departmental counterparts and they applauded its technical contribution and its forward looking assessment of the evolving need for funding support.

c) Conclusions and Recommendations on the SDTC Rationale

The evaluation found strong evidence of a continuing need for SDTC's funding support. The funding gap remains a major barrier to emerging technologies. While SDTC's initiatives may be strengthening the Canadian infrastructure for new technologies, without SDTC, the existing infrastructure is unlikely to access the financial resources required to bring these technologies through the development and demonstration phase.

We recommend that SDTC should continue to pay close attention to relationships with government programs and departments. The evaluation notes progress in this area. However it will require continuing attention from SDTC and its government counterparts to maintain an appropriate balance between the independence that is the hallmark of an arm's length organization and the cooperation and collaboration needed to achieve maximum impact from all of government's initiatives in this area.

3. SDTC Operations

a) External Reviews and Audits

In addition to the normal routine of financial audits and annual reports, in its short history SDTC has been the subject of two major external reviews. In 2005, Natural Resources Canada commissioned an audit of SDTC's compliance with the first two funding agreements. As well, the Commissioner of the Environment and Sustainable Development (CESD) from the Office of the Auditor General launched a performance audit in mid-2005. The compliance audit reviewed SDTC's conformance with the requirements set out in 98 clauses of the funding agreements and "found no evidence that SDTC did not comply with the terms and conditions of the agreement" except with respect to reporting executive salaries, which are now included in annual reports. The report of the CESD audit will not be available in time to be reflected in this evaluation.

b) Program Delivery

While key informants from all groups praised the high quality of SDTC's operations and the strength of the peer review and selection process, they expressed concern about the slow pace of the funding process and the level of detail required for the SOI and proposal. They were complimentary about the support and guidance offered by SDTC staff during the SOI and proposal process but were less positive about the process to negotiate the contract once the proposal was approved.

The data on project progress show increasing time lags from project approval to a signed contract. The time required doubled from the first funding to the fourth funding round, 6 months to about 1 year on average to sign a contract. Over half of all approved projects have not yet signed a contract. In good part, this trend reflects the more stringent requirements of successive funding agreements, SDTC's tighter contracting procedures, and the time proponents need to complete the requirements. In a few cases, external factors such as changes at the corporate level or external events such as BSE (Bovine Spongiform Encephalopathy) may influence the ability of proponents to proceed with a project. After signing, projects show some slippage against milestone targets, which is typical of demonstration projects, but most appear to be making reasonable progress toward completing their SDTC-supported work. A benchmarking exercise indicates that SDTC projects progress at a rate that is comparable with that of projects supported by other foundations and other public research funding programs.

c) Conclusions and Recommendations on SDTC Operations

Based on currently available audit reports and our knowledge of SDTC's procedures and operational data, we conclude that SDTC complies with its funding agreements and follows appropriate procedures for project selection and management. Given the very detailed nature of the funding agreement requirements, it is remarkable that in its short history SDTC developed and implemented procedures that achieved what is essentially a clean report from a comprehensive compliance audit.

We recommend that SDTC continue its examination of the contracting process, identifying changes in procedures, forms and communications with project proponents. This examination should seek to minimize the time lags in the contracting process that are attributable to SDTC, improve the rate at which contracts are completed, if possible, reduce the time and resources required for applicants to respond to STDC's requirements and improve proponents' views of the contracting process. In this examination, SDTC should review the merit of the procedures required by the funding agreement and by related government expectations, to ensure that only necessary project controls are provided. If any procedures or controls are identified that could be relaxed or made less burdensome to proponents without degrading SDTC's project

management or protection of public funds, those should be highlighted and re-negotiated with government.

We recommend that SDTC continue to monitor delays that can be attributed to SDTC and to proponents. This approach may highlight aspects of the procedures that could be improved and thereby reduce delays. We recommend that SDTC communicate the information on delays and expected turnaround times to individual proponents so that proponents gain a better understanding of the SDTC process and of their performance relative to the expectations of the SDTC process.

We recommend that SDTC continue its examination of the process to debrief proponents of unsuccessful SOIs and proposals. While this procedure has been the subject of much attention and review, the feedback from proponents indicates a need for further improvement.

4. Short Term Results

The rate of project approvals and the proportion of SDTC funding are consistent with the funding agreements. The funded work on seven of 79 projects was complete as of December 2005. One project was not able to overcome the technological challenges and upon agreement by all parties, was terminated. Four projects were unable to satisfy the requirements to sign a contract and were cancelled. At the time of this report, some non-contracted projects were experiencing significant difficulty in completing their remaining financing and consortium arrangements. At this early stage, there were few project or market impacts to report.

The evaluation design uses a cost-benefit framework to measure project impact. This approach allows the evaluation to assess whether the benefits to Canadians are sufficient to justify the SDTC investments. Based on the results from the demonstrations completed by the first seven projects, the environmental audits of those results and proponents' market projections, the projected benefits are substantial relative to the SDTC contributions. While the projects must survive significant market and business risks before the projected impacts can be achieved, based on the results to date, SDTC investments are on track to return positive benefits for Canadians.

5. Conclusions on Short Term Results

We conclude that the SDTC results indicate that SDTC is meeting the purposes of the fund. While only seven projects are completed, the current projections of potential market impact indicate a strong potential for the SDTC investments in those projects to return positive benefits to Canadians.

II METHODS

A. EVALUATION PLAN

SDTC launched the evaluation in 2003, retaining TNS Canadian Facts, Social and Policy Research to develop an evaluation plan.[8] SDTC's *Corporate Plan: April 2003* summarized the resulting evaluation framework and the logic model was again featured in the *Corporate Plan April 2004*.

B. INFORMATION SOURCES FOR THE INTERIM EVALUATION

1. Qualitative Interviews

In 2004-05, we conducted a series of qualitative interviews, exploratory discussions that provided a broad initial understanding of the respondents' views. The key informants drawn from a number of settings:

- **Venture capital**, respondents who participate in venture capital financing, six identified by SDTC and six from our contacts.
- **Stakeholders** representing organizations with an interest related to SDTC's mandate. SDTC identified 16 interview candidates and we completed interviews with 15 or their designates.
- **Government officials**, many of whom held senior positions. SDTC identified 19 candidates for interview and we completed 15 interviews, 14 with officials suggested by SDTC and one with an official who was identified during those interviews.
- **Project proponents**
  - **Successful Proposals.** We completed interviews with 40 project proponents from the 48 projects approved from the first five funding rounds.
  - **Unsuccessful Statements of Interest.** SDTC provided contact information for a sample of 37 proponents from the first six funding rounds whose SOIs were not successful. The contact

[8] *Evaluation Plan for Canadian Foundation for Sustainable Development Technology*, TNS Canadian Facts, Social and Policy Research, August 15, 2005.

information was valid for 26 of them and we completed interviews with 19 of these proponents.

2. Quantitative Interviews

Early in 2006 we drew upon the qualitative research to develop a questionnaire that we used in surveys of two groups of project proponents:

- **Successful proposals** approved subsequent to funding round six. From the 30 eligible project proponents, we completed 29 telephone interviews.
- **Unsuccessful proposals** from all funding rounds. SDTC provided contact information for proponents whose proposal had been rejected. After removing duplicates and proponents who were continuing development of their proposal, we completed interviews with 27 of 55 eligible respondents.

3. Review of Documents and SDTC's Current Developments

We reviewed numerous documents supplied by SDTC. They describe a compliance audit undertaken on behalf of Natural Resources Canada and a performance audit carried out by the Commissioner for the Environment and Sustainable Development of the Office of the Auditor General. We reviewed reports of the SDTC-initiated environmental reviews of completed projects, and documentation on the work performed to date to enhance SDTC's internal control and project management frameworks as well as various internal project reviews. The report of the CESD performance audit will not be released in time for its findings to be incorporated in this report.

We have maintained regular contact with SDTC staff and have obtained clarification and substantiation of recent developments with respect to the topics addressed in this report.

4. Case Studies

We have completed case studies for seven projects that have completed the work funded by SDTC.

5. Review of Administrative Data on Venture Capital Activity in Canada

Thomson Macdonald maintains an extensive database on Canadian venture capital and private equity (VC) transactions called VCReporter.[9] We used this resource to analyse Canadian venture capital activity.

[9] For more information, see http://www.canadavc.com/

this page intentionally left blank

III THE NEED FOR SDTC (RATIONALE)

A. OVERVIEW OF THE RATIONALE

The stated purposes of the funds granted to SDTC indicate that Canada requires assistance to stimulate the development and demonstration of new sustainable development technologies related to climate change and clean air (the focus was broadened by the third funding agreement to include clean soil and clean water). Funded projects should support collaborations that will strengthen the Canadian capacity to develop and demonstrate these technologies. The projects should be designed to encourage diffusion of the demonstrated technologies. The rationale is strongly supported in the economics literature. Appendix A to this report offers a brief explanation of the economic rationale and its implications for this evaluation.

B. THE FUNDING GAP

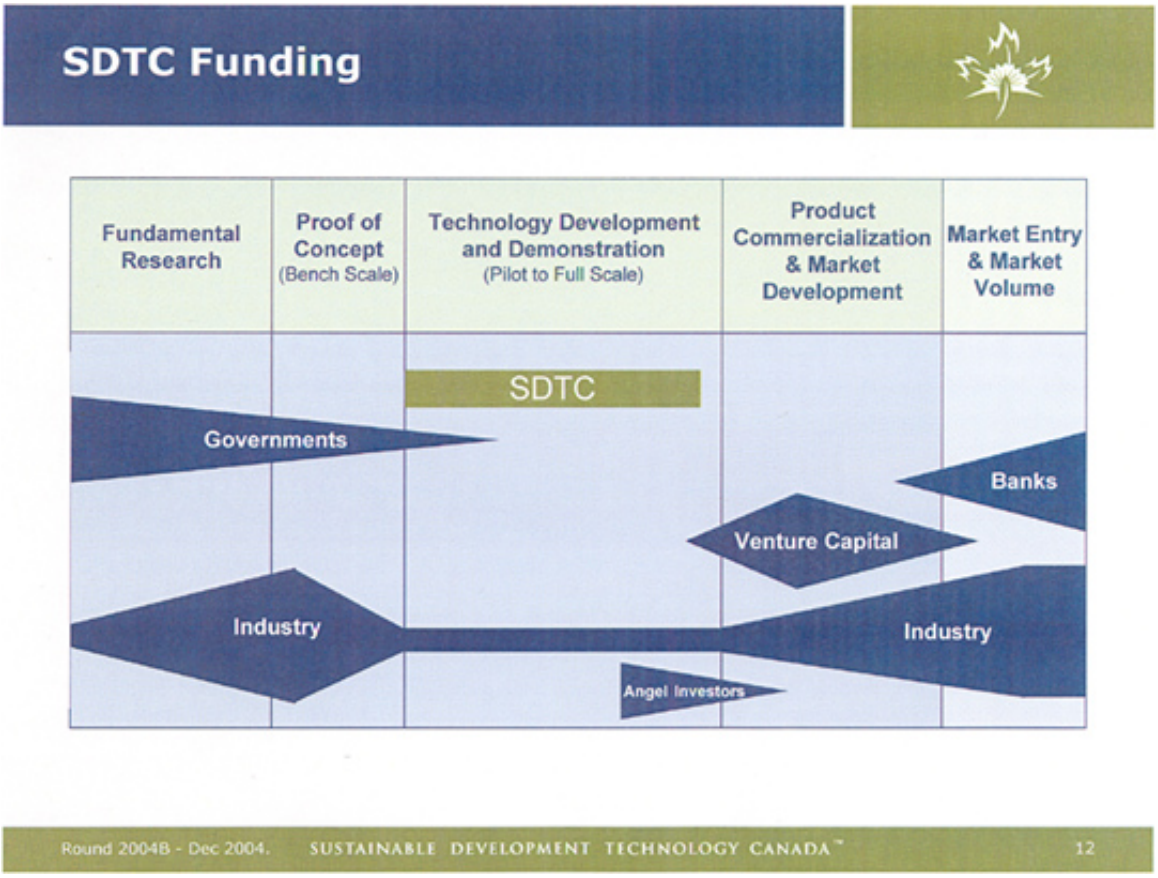
1. Description of the Funding Gap

The development of a new technology passes through a number of stages from fundamental research to market entry.[10] Although this is an iterative process, for simplicity SDTC identifies five stages of development. Governments, industry, angel and venture capital investors, and banks all play a role financing the development of new technologies. SDTC has developed Exhibit III-1 to summarize its view of the stages and the sources of funding.

The SDTC analysis describes a 'funding gap' in the technology development and demonstration phase. When technologies move from the prototype stage to full demonstration, most are spun out from academic institutions to private research laboratories, individual entrepreneurs and small or medium sized enterprises. The exhibit reflects the view that most funding sources in the private sector are unwilling to accept the high risks associated with the development and demonstration phase. Further, SDTC asserts that the situation is more severe for sustainable development technologies, which tend to be relatively capital intensive and require longer development cycles.

[10] The SDTC web site offers a more detailed description of its analysis of the development process and associated risks and sources of funding support.

Exhibit III-1 SDTC Funding



The SDTC analysis concludes that promising Canadian sustainable development technologies face extreme difficulty in reaching the market. As a result, it is necessary to provide a substantial funding commitment to this sector to develop sufficient critical mass of sustainable development technology developers, manufacturers and suppliers and to build awareness in the financial community. SDTC aims to bridge the gap in the Innovation Chain by funding promising companies and institutions that join together to provide solutions for climate change and clean air problems.

2. Does the evaluation substantiate the funding gap?

a) Views of People who are Knowledgeable about Funding Research and Development

i) Project Applicants

Successful applicants commented on the dearth of funding prior to the creation of SDTC. They described Canadian venture capitalists as not interested in assuming the technological and market risk associated with pre-commercial ventures. Successful applicants projected what would have happened had SDTC not supported their proposals, indicating that less than one project in ten would have gone ahead as planned and about half would not have gone ahead at all. The remainder proceeded with changes, typically scaling down the project, while recognizing that these changes have reduced the probability that their technology will eventually achieve commercial success.

ii) Stakeholders and Government Officials

A majority of key informants who represent stakeholder organizations agreed that the funding gap exists. In their view, the market does not provide sufficient funds to bridge gaps in the innovation chain. They identified a shortage of funding in particular for pre-commercialized sustainable development technologies. The minority who suggested that the market could provide adequate funds acknowledged that SDTC likely speeds up the innovation process for some projects.

Most government officials agreed that a funding program like SDTC is necessary, noting that that few programs specifically target either climate change or the stage in the innovation process between research and commercialization. About half of the officials interviewed felt that with SDTC in place, adequate funding sources exist for climate change initiatives but some note that the recent extension of SDTC's mandate to address technologies for clean water and clean soil is unique. Some respondents noted that government funding in other countries can support a higher proportion of project costs.

iii) Venture Capital

While venture capital investments are by their nature risky, the risks increase for the earlier stages in the development process. The earliest stage at which venture capital may become involved, start-up or seed funding, corresponds to the Technology Development and Demonstration phase shown in Exhibit III-1. Projects in this phase are the focus of SDTC's funding activities.

Seed funding is a relatively long-term investment. The product or technology is not yet ready to enter the market and it may take up to 10 years before the venture capital investor can exit the project and realize a return on the investment. The risk arises from this long involvement and the uncertainties involved in each of the multiple steps required to bring a product to market. Of course seed funding should have the highest potential rewards if projects succeed.

The interviews with representatives of the venture capital sector clearly indicate that projects at the development and demonstration stage will have difficulty finding a source of funding other than SDTC. Some venture capital funds may have been invested in a few projects at this stage. However, a number of our respondents commented that only the most sophisticated investors can adequately assess the risks at the seed funding stage. The key informants we interviewed consistently reported that insufficient funds were available to support emerging technologies at the development and demonstration stage of the innovation process. They saw no indication that SDTC might be crowding out private investment and little prospect that this situation would arise in the foreseeable future.

b) Data on Venture Capital Activity in Canada

Thomson Macdonald maintains an extensive database on Canadian venture capital and private equity (VC) transactions called VCReporter.[11] VCReporter structures capital markets into sectors and stages of development. The Energy and Environment Technology sector and the earliest stage, "Seed Funding" together define VC projects that are a reasonable match to the projects of interest to SDTC. On this basis, VCReporter quantifies the venture capital activities of Canadian capital markets that in the SDTC rationale correspond to the funding gap. It should be noted that these data focus solely on venture capital activity and do not capture development and demonstration activities that may be supported by angel investors, by industry, or by SDTC.

Exhibit III-2 shows that Energy and Environmental Technologies sector represents a small fraction of VC activity in Canada and within that sector, seed funding accounts for a small fraction (about 2%) of venture capital activity. Both proportions have remained steady over the last 10 years. SDTC funding is large relative to venture capital activity in SDTC's target area. During 2005 SDTC committed $86 million compared to venture capital commitments of $1.8 million to deals at the seed stage within the Energy and Environmental Technologies sector.

[11] For more information, see http://www.canadavc.com/

Exhibit III-2 Venture Capital and SDTC Funding (Committed Funds)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Venture Capital Investments ($million)										
All sectors, all stages	$1,033	$1,631	$1,558	$2,650	$5,778	$3,715	$2,529	$1,612	$1,763	$1,829
Energy and Environmental Technologies, all stages	$42	$42	$41	$69	$83	$115	$82	$48	$63	$65
Energy and Environmental Technologies, Seed Funding			$2.1	$2.7	$1.4	$1.1	$1.6	$0.4	$0.4	$1.8
SDTC Funding ($million)										
Equivalent to Energy and Environmental Technologies, Seed Funding							$6	$28	$54	$86
SDTC Funding as % of Energy and Environment VC Seed Funding							396%	8056%	12764%	4845%

C. SUSTAINABLE DEVELOPMENT INFRASTRUCTURE IN CANADA

The SDTC mandate looks beyond financial support to other aspects of the infrastructure to support new sustainable development technologies. This section examines some aspects of that infrastructure.

1. Awareness and Use of SDTC

Most key informants report that SDTC and its granting program, while relatively new, are well known among those who might consider applying for a grant. Some noted that the level of awareness continues to increase, an expected result given SDTC's relatively short history and its level of outreach activity. Some stakeholders report that their organizations have educated their members about the funding available through SDTC. Others note that in the small Canadian sustainable development community, news about a funding program such as SDTC travels quickly.

2. Complementary programs

Most successful applicants observed no overlap between SDTC and other funding programs. Many commented that SDTC was truly addressing a gap in available funding for projects such as theirs. In general, they recognize that other programs fund earlier stages of development or different technologies than those that receive SDTC support.

Most government officials agreed that little overlap exists and a small amount of overlap is necessary. Most departmental programs support earlier stages in the innovation chain and none share SDTC's focus on building the Canadian capacity to develop new technologies. Officials generally agreed that SDTC occupies a "clearly defined niche." Project proponents and government officials described instances of SDTC referring proponents to other funding sources and officials indicate they have referred to SDTC project proponents who appeared to match its project profile.

3. Coordination with Other Canadian Funding Agencies

We asked government officials about the coordination of SDTC activities with other funding organizations. A number of the senior officials we interviewed noted that SDTC represents a new model for public funding. When established, it was something of an experiment. They commented that SDTC's initial years of operation appear to have validated the model. However because there were no directly relevant precedents for SDTC, in particular for its relations with government, we found some differences of opinion about how closely involved SDTC should be with departments and other programs. These commentators split between two points of view:

- SDTC can be a very positive influence and should be more involved with other departments and programs.
- An essential characteristic of the SDTC model is its arms length relationship with government. That would be jeopardized if SDTC were to act more like a conventional government program.

These differing views about SDTC and its relations with government were reflected in other interviews. About half believed that SDTC has good working relationships with other federal bodies. Others did not believe that SDTC and other funding organizations were coordinating their activities sufficiently. These respondents felt that SDTC would benefit from developing more positive, participatory relationships with other funding organizations. Some commented on tension between SDTC and some federal bodies. They tended to trace this to a perception that SDTC has both portrayed itself and behaved as an independent body, rather than as part of a larger technology development team. Among those who expressed reservations about working relations, a number of respondents observed that relationships have improved. They and others appreciate SDTC's initiative to hold monthly meetings with

departmental counterparts, its contributions to technical committees and its contribution to a national strategy for sustainable development, as evidenced by the "Renewable Electricity Generation SD Business Case".[12]

4. Volume of Statements of Interest and Proposals

The evaluation plan identifies the volume and quality of Statements of Interest (SOIs) and proposals as key indicators of the continued need for SDTC support. Exhibit III-3 summarizes the results for seven funding rounds.

Exhibit III-3 Summary of SOI, Proposals and Acceptances by Funding Round

Round #	1	2	3	4	5	6	7	8	9
Round	2002A	2002B	2003A	2003B	2004A	2004B	2005A	2005B	2006A
Statements of Interest (SOI)	353	148	117	116	72	92	85	101	86
New Invites	33	21	26	33	24	28	30	31	29
Re-Submit Invites	0	6	3	3	10	14	10	24	25
Declined to Submit or Withdrew	6	4	3	9	14	16	21	28	*
Submitted Detailed Proposals (DP)	27	24	27	30	24	27	22	32	*
Submitted to Investment Committee (IC)	27	23	26	27	20	26	19	27	*
Approved for Funding	7	9	9	10	10	15	15	*	*
Funded Projects as % of SOI	2.0%	6.1%	7.7%	8.6%	13.9%	16.3%	17.6%	*	*
Funded Projects as % of Proposal Received	25.9%	39.1%	34.6%	37.0%	50.0%	57.7%	78.9%	*	*

Source: SDTC Administrative Data from TNS File and Proposal Summaries by Funding Round.
* Proposals under review as of December 31, 2005.

The exhibit shows that the flood of SOIs submitted to the initial funding round has decreased, but the volume remains high relative to the number of projects funded. Project proponents submitted in the order of 100 SOIs in response to each of the recent funding rounds. In summary, it appears that the volume of SOIs has maintained a level

[12] The business case is available on the SDTC web site.

that should allow SDTC to select the most promising proposals from an array of viable candidates. The exhibit also shows a steady rise in the probability that a proposal will be funded, from about 25% in the first funding round to over 75% for 2005A. This suggests that SDTC's input and advice to proponents has resulted in stronger proposals that are more likely to be accepted by SDTC's Investment Committee.

5. Consortia

The funding agreements require that every project sponsored by a private sector organization must involve other organizations and/or individuals in a consortium. Typically, a consortium involves members drawn from other stages in the supply chain such as researchers, product developers, manufacturers, distributors, retailers, end customers and investors. The requirement for consortia responds to the second goal of the fund, to foster and encourage collaboration and partnering to build the capacity to develop and demonstrate clean technologies. Consortia also contribute to the third goal which is concerned with prompt diffusion of technologies by involving an external group including end users during the development and demonstration phase.

While some project proponents voiced some frustration with the complexity of assembling and working with a consortium in the development of their technology, it appears the consortia are important to project success. The survey results show that a majority of funded projects would have involved the members of their consortium regardless of the SDTC requirement. Of the remainder, about half said the consortium had a positive effect on the potential success of their projects and the others judged the effect to be neutral.

D. CONCLUSIONS AND RECOMMENDATIONS ON THE SDTC RATIONALE

The evaluation found strong evidence of a continuing need for SDTC's funding support. The funding gap remains a major barrier to emerging technologies. While SDTC's initiatives may be strengthening the Canadian infrastructure for new technologies, without SDTC, the existing infrastructure is unlikely to access the financial resources required to bring these technologies through the development and demonstration phase.

We recommend that SDTC should continue to pay close attention to relationships with government programs and departments. The evaluation notes progress in this area. However it will require continuing attention from SDTC and its government counterparts to maintain an appropriate balance between the independence that is the hallmark of an arm's length organization and the cooperation and

collaboration needed to achieve maximum impact from all of government's initiatives in this area.

this page intentionally left blank

IV SDTC OPERATIONS

A. EXTERNAL REVIEWS AND AUDITS

1. Compliance Audit of Project Solicitation, Selection and Funding Processes and Reporting and Publication Procedures

The three funding agreements specify an extensive array of requirements and procedures for SDTC. In March 2005, Deloitte and Touche LLP reported to Natural Resources Canada the results of an audit of SDTC's compliance with 98 clauses from the first two funding agreements. The audit reviewed documents, interviewed SDTC staff and reviewed the files for 18 approved projects and five unsuccessful proposals. Based upon those sources, the audit examined compliance with:

- 2 clauses of the agreement related to the purpose of the fund dealing with complementarity and the responsibility of the foundation;
- 7 clauses re investment and management of the fund that set out the procedure for review of project proposals, the composition of the Project Review Committee, the mandate of the Project Review Committee, and the requirement for recommendations to the board and project approval by the board;
- 7 clauses re eligible recipients that define eligible recipients, foreign entities, excluded recipients and state an exception to excluded recipients;
- 36 clauses dealing with eligible projects and eligible project costs that specify the characteristics of eligible projects, and procedures for calls for statements of interest, define eligible project costs, non-eligible project costs, non-eligible projects, foundation exercise of discretion, stacking of assistance, non-repayability and recovery;
- 15 clauses regarding selection criteria that specify selection criteria, sources of funding and contents and assessment of applications;
- 3 clauses re commitments and disbursements that specify limitations, technology funding and balance and multi-year funding;
- 28 clauses dealing with covenants of the foundation including corporate plan, annual report, supplement to the annual report, evaluation framework, project reporting, intellectual property, availability of material (relevant to the application process) and transparency.

The audit found "no evidence that would indicate that SDTC did not comply with the selected terms and conditions noted above from the two Funding Agreements for the period from March 26, 2001 to January 31, 2005, with the exception of the partial compliance with Article 10.19".[13] The noted exception, a differing interpretation on the disclosure of remuneration of senior officers, has been addressed in the 2004 and subsequent Annual Reports. Given the very detailed nature of the funding agreement requirements, it is remarkable that in its short history SDTC developed and implemented procedures that achieved what is essentially a clean report from this compliance audit.

2. Audit by the Commissioner of the Environment and Sustainable Development (CESD) of the Office of the Auditor General of Canada (OAG)

Clause 10.14 of the third funding agreement specifies that a value-for-money (performance) audit will be carried out at least once every five years. The first such audit was launched in 2005. The audit objectives primarily focused on SDTC assess how well SDTC is fulfilling its mandate to support and finance the development and demonstration of clean technologies to address the issues related to climate change and to act as a primary catalyst in building sustainable development technology infrastructure in Canada. Specifically, the audit will assess the extent to which:

- SDTC's strategic decisions adhere to its object and purposes (mandate) as set out in the Canada Foundation for Sustainable Development Technology Act and its applicable Funding Agreements with respect to its climate change activities.
- SDTC's project selection and management procedures for its climate change projects are adequate given the context in which it operates and are conducted in an independent and objective manner.
- SDTC has established satisfactory procedures to measure and report on the effectiveness of its climate change activities.

The public release of the findings from this audit is not scheduled until September 2006, too late to be incorporated in the report of this interim evaluation. However since the CESD audit efforts were extensive, this evaluation has not probed further in the areas identified for audit.

3. Other Reviews and Development Activities Undertaken by SDTC

SDTC has undertaken a variety of internal initiatives to examine and refine its procedures and controls. Development of an audit process framework, based on seven

[13] Letter from Deloitte & Touche LLP to Natural Resources Canada, March 8, 2005, p. 20.

audits of completed projects, is nearing completion. Another project to review SDTC's internal control framework was initiated but to avoid possible duplication of effort, was put on hold when the CESD audit was launched,

B. PROGRAM DELIVERY

1. Statement of Interest, Proposal and Contracting Processes

a) Views of Stakeholders and Government Officials

The initial reaction of stakeholders focused on the high quality of SDTC's operations, the calibre of the due diligence exercised by SDTC, the quality of projects selected for funding, the appropriateness of the stage of development being funded and the value of the consortium requirement. A number of government officials praised the strength of the expert review and selection process.

We heard comments from a number of stakeholders about the slow pace of SDTC's funding process and government officials commented that the length of time between the SOI and funding approval was too long. SDTC was aware of this concern and undertook a benchmarking exercise to compare SDTC performance to that of other research funding programs or agencies. The results showed that SDTC takes about the same time from receiving applications to final approval (six to seven months) but it may take longer from approval to contract signing (10 months). This difference reflects in part, SDTC's requirement for a consortium, which is not required by the other funders.

b) Level of Detail and Response Burden

Most successful applicants from the early funding rounds supported the proposal process, describing it as careful, reasonable, very fair, rigorous and detailed. While a few proponents wanted to give more detail in order that reviewers would fully understand their projects, the initial exploratory interviews also identified some concerns that the SOI and proposal required too much detail.[14] The interviews conducted in 2006 explored this issue in greater detail and revealed that about one-quarter of the successful proponents and almost half of the unsuccessful felt the proposal required too much detail and the SOI involved too much time and effort.[15]

[14] In some aspects, SDTC's flexibility is constrained because the funding agreement requires some of the detail. It should also be noted that securing funding in the order of $1 million requires substantial time and effort, whatever the source.

[15] As noted above, the proportion of proposals that are funded has increased, reflecting in part the improvement in proposals in later funding rounds.

c) Support and Guidance Provided by SDTC Staff

When asked their opinions on service delivery, successful applicants from the first funding rounds overwhelmingly responded that SDTC services were delivered in an appropriate manner. They described SDTC staff as extraordinary and praised them as helpful, technically competent and easy to work with. The 2006 interviews asked proponents of recently approved projects a series of more specific questions. We found reasonable levels of satisfaction with the support and guidance provided by SDTC staff when preparing their most recent SOI. While proponents of funded projects were more positive than those whose proposals were rejected, the latter were still moderately satisfied.

Applicants from all rounds raised concerns about timeliness. One respondent summarized the views of many in his comment that SDTC has "sacrificed speed for the sake of quality." The issue of timeliness arose in discussions of each stage of the project. Proponents expressed concerns about the application and approval taking too long, leading to significant lags between their first application and the receipt of first funds. The benchmarking exercise tends to support this comment. When projects submit progress reports, proponents comment that it may take SDTC two to three months to complete the review of the report[16] and then issue a cheque.

Debriefing proponents whose proposals were rejected can have a number of positive benefits. It contributes to the transparency of the selection process and to SDTC's objective of building capacity. It can help to re-direct proponents to other funders or to approaches that would improve the proposal and increase its probability of success in SDTC's later funding rounds. The interviews with proponents whose proposals were not accepted included respondents from all funding rounds. About two-thirds of those interviewed recalled an explanation of the decision not to fund their proposal[17] and two-thirds of those said the information provided helped them to understand the reason for the decision. About half of those who recalled an explanation indicated they received advice about how the project might proceed including advice on how to improve the proposal and about other possible sources of funds.

The survey addressed the process to negotiate the contract once the proposal was approved. The responses were markedly less positive than the reactions to the SOI or proposal stages. Only about half of those proponents whose projects were approved by SDTC indicated that SDTC's requirements for the contracting process were clear and half said they were reasonable. Those who responded negatively to these questions described a lack of staff responsiveness, disruptions in the contracting process as a

[16] Some reports are incomplete or require explanation. Such issues must be resolved before SDTC can authorize payment of funds.

[17] A review of the last two funding rounds shows that debriefing sessions were set up with proponents of all unsuccessful proposals.

result of staff changes and lack of clarity about SDTC's requirements.[18] While most of the requirements are specified by the funding agreements and some may appear unreasonable to proponents, it remains SDTC's role to clearly specify the requirements and ideally, to help proponents understand the underlying rationale.[19]

2. Project Management: Status of Project Progress

SDTC's third goal is to "*ensure timely diffusion by funded recipients of new Sustainable Development Technologies in relevant Market Sectors throughout Canada.*" This requires that projects proceed promptly from approval and contracting to completion. Therefore SDTC must monitor projects and should they encounter delays, do whatever it can to help applicants through the process. The benchmarking exercise conducted by SDTC shows that to date the progress of SDTC projects is in line with that of other foundations and other research funding programs. Nevertheless to support this goal, SDTC should ensure that its procedures impose minimal delays on projects, consistent with the requirements of the funding agreements and good project management.

Each contribution agreement includes a plan for the project with specified milestones that must be accomplished. Upon signing of the agreement, SDTC makes an initial payment to the project and subsequent payments upon achieving the specified milestones. At each milestone, the project submits a report that SDTC reviews and, often after discussion and the completion of requested changes, SDTC accepts the report and processes the milestone payment.

Exhibit IV-1 reveals that the average time to sign a contract has lengthened for each succeeding funding round. Note that while over two years have elapsed since board approvals for funding round 2003B, two of nine projects approved in that round had not signed a contract as of December 2005. In total, fewer than half of all projects approved by the board (32 of 76 approved projects) had signed contracts. In good part, this trend reflects the more stringent requirements of successive funding agreements, SDTC's tighter contracting procedures, and the time proponents need to complete the requirements. In a few cases, external factors such as changes at the corporate level or major events such as BSE may influence the ability of proponents to proceed.

[18] Some of these reactions may arise from SDTC's practice of applying new conditions imposed by a recent funding agreement on projects that were approved before that funding agreement was signed.
[19] After each funding round, SDTC reviews its forms and procedures for each stage, SOI, proposals and contracting, to identify areas for improvement.

Exhibit IV-1 Project Progress vs. Schedule

Funding Round		Active Projects: Contracting: Elapsed Time since Board Approval: Contract not Signed	Active Projects: Contracting: Elapsed Time since Board Approval: Contract Signed	Active Projects: Contracting: Elapsed Time since Board Approval: All Projects	Active Projects: Milestone Payments: Slippage: Milestone Planned Payment Date vs. Actual Payment Date: Initial Payment	Milestone 1	Milestone 2	Milestone 3	Milestone 4	Final Payment	Stalled or Terminated Projects (not included in Active Projects)
2002A	Weeks Delay		23	23	2	36	41	34	13	16	
	# of Projects		7	7	7	7	6	5	2	4	2
2002B	Weeks Delay		26	26	9	19	40	30	7	32	
	# of Projects		9	9	7	8	8	4	1	5	1
2003A	Weeks Delay	116	32	51	10	32	27	24	-6	14	
	# of Projects	2	7	9	5	7	5	4	1	4	1
2003B	Weeks Delay	84	56	70	4	17	9	-6			
	# of Projects	5	5	10	3	4	2	1			1
2004A	Weeks Delay	64	43	56	2	7	3				
	# of Projects	6	4	10	3	2	1				
2004B	Weeks Delay	27		27							
	# of Projects	15		15							
2005A	Weeks Delay	12		12							
	# of Projects	15		15							
Overall	Avg. Delay	38	34	36	6	25	33	27	7	22	
	# of Projects	43	32	75	25	28	22	14	4	13	5

Source: SDTC Project Milestone Status
Note: Some projects did not have an initial payment because they were cost-reimbursable, so the number of projects at milestone 1 exceeds the number that received initial payment.

A briefing to the SDTC Board described the primary causes for contracting delays in terms of: the time required for proponents to complete financing from other sources; the time required to finalize arrangements with consortium partners; and proponent capacity and capability to develop work plans and negotiation of specific clauses in contribution agreements. In response to the situation, SDTC began development of a procedure to monitor the turnaround time with respect to routine transactions of project management and to apportion any delays to SDTC or to the proponent.

The SDTC monitoring procedure has tracked all active projects and assigned a number of explanations for delays. In the contracting phase, about two-thirds of all projects experienced delays resulting from 'consortia members not confirmed' and/or 'financing issues', which are largely out of SDTC's control. These issues appear to dominate the attention of proponents and most turn to the work plan and contracting only after funding and the consortium are resolved. The explanation 'Work plan and budget not sufficient' is the dominant reason for delay for about one-quarter of all projects and it also applies to some of the projects that dealt with consortium or financing issues. In the early funding rounds, liability and intellectual property issues arose fairly frequently. After SDTC took steps to clarify its requirements, we see that these explanations appeared less frequently in later rounds.

The slippage against milestones appears relatively stable over the funding rounds, although many projects were still in the early stages of their schedule. A benchmarking exercise indicates that SDTC projects progress at a rate that is comparable with that of projects supported by other foundations and other public research funding programs. In terms of processing payments, the monitoring procedure calculated the delay from the due date of disbursements (which was assumed to be 45 days after receipt of a milestone report). The average delay was 37 days. Some of this delay can be attributed to the time required for proponents to respond to questions or provide additional information[20] and some to the time SDTC takes to review documents.

The interviews with project proponents in the final stages of completing their contract with SDTC tend to echo the concerns expressed with the contracting phase. Proponents of completed projects perceive excessive delays and lack of clarity about requirements. While few projects have approached this phase of the work, the comments of these early completers may indicate an emerging area of concern.

Exhibit IV-1 illustrates another aspect of project progress. The risks inherent in development and demonstration work suggest that some projects will fail or perhaps

[20] Project reports may not be approved for a variety of reasons, for example, the report does not contain required information, it reflects changes of scope that have not been communicated to SDTC or the report may not show accomplishment of the goal specified for the milestone.

just stall, showing no progress toward completion. We have labelled such projects "Stalled or Terminated Projects" and in Exhibit IV-1, segregated them from active projects. SDTC identified one project where the technology did not meet expectations and four projects that were cancelled prior to contracting. For purposes of the evaluation, such projects should be segregated and their progress tracked independently.

C. CONCLUSIONS AND RECOMMENDATIONS

1. Internal Procedures

Based on the currently available audit reports and our knowledge of SDTC's procedures and operational data, we conclude that SDTC complies with the requirements of its funding agreements and follows appropriate procedures for project selection and management. Given the very detailed nature of the funding agreement requirements, it is remarkable that in its short history SDTC developed and implemented procedures that achieved what is essentially a clean report from a comprehensive compliance audit.

2. Program Delivery

Since SDTC has recently increased its complement of staff and assigned additional people to project management, it is not surprising that project proponents describe changes in the staff assigned to their project. However the comments about responsiveness and lack of clarity of requirements call for careful attention. We recommend that SDTC build on its examination of the contracting process to identify changes in procedures, forms and communications with project proponents. This examination should seek to minimize the time lags in the contracting process that are attributable to SDTC, to improve the rate at which contracts are completed and if possible, to reduce the time and resources required for project proponents to respond to SDTC's requirements. In this examination, SDTC should review the merit of the procedures required by the funding agreement and by related government expectations, to ensure that only necessary project controls are provided. If any procedures or controls are identified that could be relaxed or made less burdensome to proponents without degrading SDTC's project management or protection of public funds, those should be highlighted and re-negotiated with government.

We recommend that SDTC continue to monitor delays that can be attributed to SDTC. This approach may highlight aspects of the procedures that could be improved and thereby reduce delays. We recommend that SDTC communicate the information on delays to individual proponents so that proponents gain a better understanding of the SDTC process and of their performance relative to the expectations of that process.

We recommend that SDTC continue its examination of the process to debrief proponents of unsuccessful SOIs and proposals. While this procedure has been the subject of much attention and review, the feedback from proponents indicates a need for further improvement.

this page intentionally left blank

V SHORT TERM RESULTS

A. LEVERAGE OF SDTC FUNDS

The annual report and its supplement report the direct funding of projects and the leverage of SDTC contributions. These reports show that SDTC has met the requirement set out in the funding agreement of contributing an average of 33% of eligible costs for the portfolio of SDTC-supported projects.

B. PROJECT IMPACT AND MARKET IMPACT AS OF DECEMBER 2005

Seven projects have completed their SDTC-funded development and demonstration phase and in December 2005, two projects were already active in their markets. However as of the reporting date for this interim evaluation, no projects were due to submit reports of their market activities to SDTC and overall, market penetration had just begun.

C. PREPARATION FOR MEASUREMENT OF LONGER TERM OBJECTIVES

1. Method

SDTC supports the development and demonstration of clean technologies which have the potential to deliver economic, environmental and health benefits to Canadians. The evaluation must measure the project impact and market impact of these technologies. The evaluation design indicates that the benefits (value to society) and costs of these initiatives should be measured in the following categories:

- Net technology revenues.
- GHG emission reductions.
- Ancillary air benefits.
- Water quality improvements.
- Soil improvements.

The design uses the analytical framework of cost-benefit analysis to assess the impacts of investments to promote sustainable development. This framework provides a clear comparison of what the investments achieve relative to their cost and provides important information for decision makers.

The initial step in the cost-benefit assessment of sustainable development technologies initiative is to document how these technologies will affect society. The final project reports provide estimates of environmental impact and market penetration. Environmental reviews of completed projects examine these estimates and adjust them as necessary. The objective of the impact analysis is to determine what the environmental and related experience of society would be with the SDTC program and in the absence of the program. The evaluation uses the estimates based on the case study interviews to estimate the incremental impact of SDTC funding on the market outcomes for the technology. The difference between experience with the initiative and without it is the program impact, or in the terms of the funding agreements the Project Impact and Market Impact.

Comparisons of costs and benefits must take into account timing differences. We use an interest rate, called the social discount rate, to adjust benefits and costs that accrue in future time periods to allow a proper comparison with values in the present. Discounting is tied to the issue of the appropriate time horizon for a cost-benefit assessment. If a new technology initiative is introduced how long is it likely to generate continuing benefits? In principle, the time period over which benefits should last is an empirical question and there is no generally accepted time period for measuring impacts. This evaluation uses a 30 year time horizon for the flow of benefits and costs.

While the cost-benefit framework should consider all benefits from projects, the focus of this interim evaluation has been on GHG emission reductions and reductions of Criteria Air Contaminants (CAC). This assumes that technologies that sustain themselves in the marketplace will at least break even in terms of private financial costs and returns. We note that the benefits associated with reductions in GHG emissions account for most of the likely benefits of the projects that were complete as of December 2005. For subsequent projects, a variety of other sustainable development benefits, including water quality and soil conservation should be estimated. All of the estimates that we reviewed for this evaluation are based on data found in proponents' final reports and the environmental reviews authorized by SDTC.

2. Preliminary Findings

The data that we reviewed for seven completed projects focus only on the projected reductions attributable to SDTC in GHG and CAC emissions, relative to the scenario of no investment by SDTC. Our assessment is that these environmental benefits appear substantial relative to the SDTC contributions that are involved. However we note that these estimates are based on projections made as the technologies

are just entering their markets. The technologies must survive various market and business risks before these projections can be realized.

D. RISK OF PREMATURE EVALUATION

We note that the funding agreement 3 allows about 4 years between approval of the last projects and the scheduled delivery of the final evaluation. For example, the first projects from the early funding rounds are now nearing completion, some four years after they were approved. This timing may expose SDTC to the risk of premature evaluation. In other words, the agreement may not allow sufficient time for the later projects to enter their markets, demonstrate commercial viability and achieve sufficient sales to indicate the extent of their anticipated social benefits. Therefore the final evaluation may under-estimate the social benefits accruing as a result of the SDTC investments. The extent of this risk should become clearer as SDTC accumulates experience with the time taken for projects to enter the marketplace and achieve commercial success.

E. CONCLUSIONS ON SHORT TERM RESULTS

We conclude that the SDTC results to December 2005 indicate that SDTC is meeting the purposes of the fund. While only seven projects are completed, the current projections of potential market impact indicate a strong potential for the SDTC investments in those projects to return positive benefits to Canadians.

this page intentionally left blank

APPENDIX A: SDTC RATIONALE FROM THE PERSPECTIVE OF THE ECONOMICS LITERATURE

Government's expectations of SDTC include the funding of projects that develop and demonstrate new Sustainable Development Technologies related to climate change and clean air, water and soil, in order to make progress towards sustainable development. In our assessment of the rationale for these SDTC activities, we have reviewed the related economics literature. This literature makes it clear that SDTC investments in sustainable development technology can make potentially important contributions to the Canadian economy and Canadian society. These contributions have their basis in the standard economic framework for analyzing public support for research and development, which focuses on factors that lead to market failure.

In a wide variety of circumstances, private markets promote economic efficiency without government involvement. We observe government intervention and participation in some markets and not others primarily because of perceived market failures. In the economic policy literature, there are a number of reasons why markets may "fail" (fail to lead to the best result). Briefly, the market allocates resources to research and development that are best from the market's point of view. However, market failure means that this market-determined level of resources is not optimal from society's point of view. Economists describe the reasons for this market failure in terms of spillovers (the public good element of R&D) that prevent investors in new technologies from reaping all of the associated rewards. Those who fund research must pay all the costs of their research and development but other investors (the free riders) may appropriate the R&D results at no cost to them. This argument is strengthened by the issue of incomplete information, and barriers to adoption of new technologies. Through SDTC, government intervention seeks to correct these perceived problems of market allocation for technologies related to sustainable development.

This approach to rationale indicates that in the case of new technology in the energy-environment area, the rationale for public support of specific technologies is stronger than in other areas because of the large potential social benefits they can produce. Economists have identified two inter-related reasons for this:

- **Free rider effect.** The economics literature shows clearly that environmental quality is an important determinant of the well-being of Canadians. However, the free rider effect means that where such social benefits exist, markets tend to under-invest in research and development related to these technologies and fail to produce the level of investment that is optimal from society's point of view. This free rider effect will be offset by the marketplace success achieved by SDTC supported technologies.

- **Negative environmental externality.** Private investors make production and investment decisions based on the costs that they incur. Yet we know that pollution-related impacts on the environment may have severe negative impacts (social costs) on society. Therefore, technologies that improve environmental quality are particularly attractive for public support in that they are likely to have relatively large social benefits from reducing environmental damage costs. That is, SDTC acts to offset the negative environmental externality that makes social costs of producing output higher than the private cost incurred by producers.

Governments seek to design institutions that can move the market most effectively toward the social optimum. In the area of technology policy, the evaluation literature suggests that those government institutions that work within a market context, funding groups of firms or consortia and having market-oriented elements are most likely to make the largest positive contributions. The structure and focus of SDTC embodies this strategy.