

**Unclassified**

**ENV/EPOC/GSP(2010)9/ANN3/FINAL**



Organisation de Coopération et de Développement Économiques  
Organisation for Economic Co-operation and Development

**10-Feb-2011**

**English - Or. English**

**ENVIRONMENT DIRECTORATE  
ENVIRONMENT POLICY COMMITTEE**

**ENV/EPOC/GSP(2010)9/ANN3/FINAL  
Unclassified**

**Working Party on Global and Structural Policies**

**SYNTHESIS REPORT ON NATIONAL POLICIES TO SUPPORT ECO-INNOVATION**

**BACKGROUND REPORT N°3: CASE STUDIES ON SELECTED PUBLIC-PRIVATE  
PARTNERSHIPS**

Contact person: Xavier Leflaive (e-mail: [xavier.leflaive@oecd.org](mailto:xavier.leflaive@oecd.org))

**JT03296274**

Document complet disponible sur OLIS dans son format d'origine  
Complete document available on OLIS in its original format

**English - Or. English**

## TABLE OF CONTENTS

THE CARBON TRUST, UNITED KINGDOM .....	3
Rationale and objectives.....	3
Organisation and governance relations .....	4
Budget and financial arrangements .....	10
Main types of activity.....	11
External co-ordination and coherence.....	23
Main findings and lessons learned .....	25
Appendices.....	30
SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA .....	33
Introduction.....	33
An instrument framed for the specific features of eco-innovation? .....	33
A coherent and articulated investment strategy for eco-innovation.....	37
P-PPs vs. alternative instruments to stimulate and support eco-innovation.....	39
How does SDTC cope with the usual criticisms addressed to P-PPs? .....	40
References.....	41

### Tables

Table 1. Income structure of the Carbon Trust (2008 and 2009) .....	10
Table 2. Classification of Carbon Trust measures .....	17
Table 3. Carbon Trust expenditures by type of activity, 2008 and 2009 .....	18
Table 4. Distribution of SDTC funding by sector .....	36
Table 5. Environmental benefits of the projects funded by SDTC by sector.....	36
Table 6. Relative SDTC funding and GDP by province .....	37
Table 7. Leverage of SDTC funding.....	39

### Boxes

Box 1. Composition of the Carbon Trust Board of Directors .....	6
Box 2. A snapshot of governance arrangements of other UK public-private partnerships in the field.....	9

## THE CARBON TRUST, UNITED KINGDOM

### Rationale and objectives

#### *Rationale and a short history*

The United Kingdom was one of the first countries to announce a climate change programme in late 2000 and to initiate a low-carbon policy. In 2001 it introduced the climate change levy to provide a price signal to encourage non-domestic energy consumers to improve their energy efficiency and thereby reduce their carbon dioxide emissions. The levy was announced in 1999 in order to give business a two-year notice before its implementation. The climate change levy was designed to be “fiscally neutral”.

The idea of the Carbon Trust was suggested by the government’s Advisory Committee on Business and the Environment, which was set up to advise it on business-related environmental issues. The proposed body was to support business in improving energy efficiency by advising on how to use existing technologies and by supporting development of new low-carbon technologies. The Advisory Committee put forward two options to the government: a company limited by guarantee and a non-departmental public body (NAO, 2007).

Recommendations to ministers by both the leading departmental teams (Department of the Environment, Transport and the Regions – DETR; Department of Trade and Industry – DTI) and the Advisory Committee opted for an “arm’s-length” entity, similar to the Energy Saving Trust, which was already in operation and judged to be effective. Feedback from the business community clearly indicated that it would have greater trust in advice from a private-sector company than from a public-sector organisation. The primary objective of business was to create the right delivery mechanism for the business sector to maximise the effectiveness of initiatives to reduce carbon dioxide emissions (interviews in 2010)

The process of setting up the Carbon Trust was relatively fast. The decision to establish the new organisation was taken at the level of the prime minister’s office with ministers heading DETR and DTI directly involved. A working group was formed of three officials and one seconded staff from KPMG. Its task was to prepare the legal documents necessary to register a new entity in accordance with the United Kingdom’s Companies Act.

The Carbon Trust (CT) was set up by the government in spring 2001 as a not-for-dividend private company limited by guarantee with a remit covering the whole of the United Kingdom. The vision outlined for the Carbon Trust by Prime Minister Tony Blair in 2000 was that it would “take the lead on low-carbon technology and innovation in this country and put Britain in the lead internationally”.

The main rationale behind the Carbon Trust was that businesses and the public sector alike faced the market failure resulting from the lack of market incentives to improve energy-efficiency and develop clean energy technologies. The mission of the Carbon Trust was to help businesses and public organisations to reduce their emissions of carbon dioxide through improved energy efficiency and the development of commercial low-carbon technology. The need to do so received further support from the finding of the former Energy Efficiency Best Practice programme that about 20% of energy purchased was being wasted.

In 2001, the Carbon Trust issued a first draft strategic framework setting out its plans. It was drawn up after a series of workshops and consultations with individual stakeholders. Over the first three years, the Carbon Trust received GBP 95 million from the climate change levy, plus an annual GBP 17 million inherited from the Energy Efficiency Best Practice Programme.<sup>1</sup> In 2002 the Carbon Trust took over the management of most of the programme from the DETR, the predecessor of the Department for Environment, Food and Rural Affairs (DEFRA). It also manages and promotes the government's enhanced capital allowances (ECAs) scheme and the list of energy-efficiency technologies qualifying for ECAs.

### ***Main objectives and targets***

The mission of the Carbon Trust is “to accelerate the transition to a low carbon economy by helping organisations reduce their carbon emissions and developing commercial low carbon technologies”. A key challenge was to balance support for technologies with great long-term potential in terms of carbon savings with measures, which are, in the short term, more cost-effective.

The Trust initially set itself three key objectives:

- to ensure that UK business and the public sector contribute fully to meeting ongoing targets for greenhouse gas emissions;
- to improve the competitiveness of UK business through resource efficiency;
- to support the development of a UK industry that capitalises on the innovation and commercial value of low-carbon technologies nationally and internationally.

The Carbon Trust's targets were indicated in the context of the overall UK carbon emissions reductions target. The overall goal was to reduce carbon dioxide emissions by 20% until year 2010, that is, from 592 million tCO<sub>2</sub> (tonnes of carbon dioxide) a year in 1990 to 474 million tCO<sub>2</sub> a year in 2010. Business was to account for 27% of the carbon reduction target. The Carbon Trust target was to save 4.4 million tonnes of carbon a year by 2010 (NAO, 2007).

### **Organisation and governance relations**

#### ***Organisational structure***

##### *Legal status*

The Carbon Trust was set up by the government in March 2001 as a not-for-dividend private company limited by guarantee. As such it cannot distribute profits to its members; all profits have to be reinvested in the business. The board members are not held personally accountable for company operations. At the time of designing the Carbon Trust some considered the option to create it as an adjunct to an existing entity, the Energy Saving Trust, but the Advisory Committee on Business and the Environment did not support this option because it did not feel this would give business “sufficient confidence” in the new entity. The private company model was seen as a guarantor of independence; the “arm's-length” status of the new organisation formed the basis of a close relationship with the business community.

---

<sup>1</sup> The Advisory Committee on Business and the Environment argued for a budget of GBP 300 million, that is, 20% of revenues from the climate change levy (Environmental Data Services, 2001).

*Executive bodies*

## The Board of Directors

The Board of Directors is the highest decision-making body of the Carbon Trust. The board is composed of 18 members: three executive directors (employees of the Carbon Trust) and 15 non-executive directors. Five non-executive directors represent government departments (funding central government departments and the devolved administrations). A further ten non-executive directors are independent stakeholders from industry, trade unions and non-governmental organisations that contribute independent expertise and external views. Box 1 lists the Board members.

## The Investment Committee and the Preliminary Investment Committee

The Investment Committee consists of members drawn from the Carbon Trust's Board. The Committee is responsible – subject to the overall direction of the Board – for overseeing all the investment activities of the Carbon Trust. In particular, it decides on investments of less than GBP 1 million and recommends (or not) investments above GBP 1 million to the Board for authorisation. The decision of the Investment Committee is final and bidders cannot appeal it. The Preliminary Investment Committee consists of four senior staff and takes decisions on smaller investments.

*Staff and external consultants*

## Core staff

The core staff of the Carbon Trust consists mainly of former employees of major private players in the field of low-carbon technologies and equity investment. Employee numbers (including executive directors but excluding non-executive directors) increased from 151 at 31 March 2008 to 194 at 31 March 2009. There were also two staff members on secondment from other organisations for a total of 196 staff (Carbon Trust, 2009a). Similarly to private corporate structures, most of the organisation's administrative functions were at first contracted out, together with the management of the accredited energy consultants used to provide energy advice (House of Commons, 2008).

## Consultant accreditation scheme

In 2006, the Carbon Trust launched its own consultant accreditation scheme. Previously, it had used consultants accredited by the Energy Institute to deliver much of the advice and support it provides to organisations. As of 2009, Carbon Trust relies on 480 accredited consultants.

**Box 1. Composition of the Carbon Trust Board of Directors**

**Sir Ian McAllister**, CBE Chairman

**Ian Stephenson**, OBE Deputy Chairman, Chairman of Carbon Trust Enterprises Limited, Director IT, HR and EHS, Johnson Matthey plc

**Tom Delay**, Chief Executive Officer

**Rosemary Boot**, Finance Director

**Michael Rea**, Chief Operating Officer

**Dr. Neil Bentley**, Non-Executive Director, Business Environment CBI

**Sir Richard Brook**, Non-Executive Director, The Leverhulme Trust

**Dr. Colin Church**, Non-Executive Director of Carbon Budgets and National Climate Change Delivery, DECC

**John Edmonds**, Non-Executive Senior Research Fellow at King's College, London University (formerly General Secretary, GMB and President, TUC)

**Olive Hill**, Non-Executive Director of Technology and Process Development, Invest Northern Ireland

**Edward Hyams**, Non-Executive Chairman, Energy Saving Trust

**Colin Imrie**, Non-Executive Deputy Director, Energy Markets, Business, Enterprise and Energy Directorate, Scottish Government

**Dr. Paul Jefferiss**, Non-Executive Group Head, Climate, Carbon and Environment, BP (formerly Head of Environmental Policy, RSPB)

**Hugh McNeal**, Director for Low Carbon Business Opportunities, Department for Business Innovation & Skills

**Chris Mottershead**, Non-Executive Vice-Principal (Research and Innovation), Kings College, London University (formerly Distinguished Advisor, BP)

**Lucy Neville-Rolfe**, CMG Non-Executive Corporate and Legal Affairs Director, Tesco PLC

**Matthew Quinn**, Non-Executive Director, Department for Environment, Sustainability and Housing, Welsh Assembly Government

**Timothy Weller**, Non-Executive Chair of the Carbon Trust Audit Committee, Chief Financial Officer, United Utilities PLC

*Source:* Carbon Trust website, [www.carbontrust.co.uk](http://www.carbontrust.co.uk) (January 2010).

*Corporate structure*

The Carbon Trust has developed into a large corporate-like structure with a number of wholly or partly owned subsidiaries. The organisation has two main commercial arms: Carbon Trust Enterprises Ltd, which develops new businesses, and Carbon Trust Investments, which is the venture capital investment subsidiary of the Carbon Trust.

The subsidiaries of Carbon Trust are all part of the Innovations, Investments and Enterprises activities and were set up from 2003 on the advice of the Carbon Trust's auditors to improve governance and increase the transparency of tax treatment by separating out each part of the business with the potential to make a profit and to allow the subsidiaries to have a visible commercial focus (NAO, 2007).

The Carbon Trust has three principal directly held and wholly owned subsidiary companies: Carbon Trust Enterprises Limited (CTEL), Carbon Trust Investments Limited (CTIL) and Carbon Trust Fund Management Holdings Limited (CTFMHL).

### The Carbon Trust Enterprises Limited (CTEL)

The Carbon Trust Enterprises Limited exists to undertake the Carbon Trust's commercial activities primarily through its joint ventures and subsidiaries. The latter include notably (Carbon Trust, 2009a):

- Joint ventures:
  - Insource Energy Limited (64.2% of the issued share capital): A renewable energy developer of an integrated energy supply and waste management business providing tailored, on-site solutions for food and drink manufacturers in the United Kingdom.
  - Connective Energy Limited (40% of the issued share capital): A renewable energy business looking to develop a UK low-carbon heat supply business.
  - Partnerships for Renewables Limited (51% of the issued share capital): A renewable energy developer working with public-sector bodies to develop, construct and operate on-site renewable energy projects in the United Kingdom.
- Subsidiaries:
  - The Carbon Trust Footprinting Company Limited (100% of the issued share capital) focuses on engaging with businesses seeking to measure, reduce and communicate the carbon impacts of their products and services. It labels products with the carbon footprint embodied in a product in bringing it to the shelf and acknowledges a commitment to reduce that footprint over a specified period. The carbon label was introduced for the first time in the United Kingdom in March 2007.
  - The Low Carbon Culture Company Limited (100% of the issued share capital) provides consultancy services to help companies to achieve cost and carbon savings through active carbon management.
  - The Carbon Trust Standard Company Limited (100% of the issued share capital) focuses on providing organisations with certification of their performance in taking action to reduce their carbon emissions, with the endorsement of the Carbon Trust Standard.

### Carbon Trust Investments Limited (CTIL)

Carbon Trust Investments invests in the United Kingdom's clean energy technology industry. It typically co-invests between GBP 250 000 and GBP 3 million per transaction leveraged with other private sources of funding. As of March 2009, the Carbon Trust held through Carbon Trust Fund Management Holdings Limited (CTFMHL) a 40% interest in CT Investment Partners LLP (CTIP) and through CTIL a 50% interest in the Low Carbon Seed Fund LLP.

The Carbon Trust Investment Partners LLP (CTIP) advises the Carbon Trust on its investment activities and employs the Carbon Trust's investment team. This is to separate investment advice activities from the Trust's provision of grants and other publicly funded support. The CTIP occupies a separate part of the Trust's offices, although senior staff from both sides meet on various committees. The Carbon Trust has recently reorganised the CTIP. The Carbon Trust now holds 40% and the executive partners hold 60% of the CTIP's share capital. In April 2009, the Carbon Trust took over the Low Carbon Seed Fund LLP, enabling both its venture capital and seed capital investment activities to be conducted directly (Carbon Trust, 2009a).

The report of the National Audit Office (2007) highlighted a potential conflict of interest, namely that CT Investment Partners staff could influence publicly funded research and development or incubator support for emerging businesses which they, in time, may back by way of investment and thus may earn carried interest. The Carbon Trust confirmed that it has put “Chinese Walls” (for example, physical separation of offices within the same building) in place between the people making the grants and those making the investment decisions, and that it would put in place further safeguards to address this risk if the investment fund is subsequently launched.

#### Carbon Trust Fund Management Holdings Limited (CTFMHL)

The Carbon Trust Fund Management Holdings Limited is a holding company which owns the Carbon Trust’s economic interest in the CTIP. The CTIP is authorised and regulated by the Financial Services Authority to undertake designated investment business. It is a partnership between the CTFMHL and the investment management team as executive partners. The CTIP provides investment advisory services to CTIL and the company (Carbon Trust, 2009a).

#### *Organisational culture*

The Carbon Trust prides itself on its “business ethos” and on its functioning as a private-sector company. One Carbon Trust director confirmed this with a characteristic statement: “In terms of ethos, we are very much a private sector company, so we do everything in a very businesslike, professional way” (Policy Innovations, 2009). The organisation openly sees itself as a part of the business community and collaborates closely with key players in the low-carbon field (interviews in 2010).

The interviewed stakeholders confirm that the Carbon Trust has developed an organisational culture characterised by a business focus and a “fast pace” of delivery. The Carbon Trust staff mentions an “electric and dynamic atmosphere” that is very different from that of government departments. The difference between the Carbon Trust and a government department is partly a reflection of how the respective entities view and deal with risk and partly the availability of specialist staff from, for example, the clean energy technology community, the private equity funds or the big companies. One respondent pointed out that one of the side effects of being a business-like environment is the relatively high rotation of experts working for the Trust. Nonetheless, this does not put the overall level of expertise within the organisation at risk, as newly hired staff are at least as experienced in the field as their predecessors. One may refer to it as “continuity of expertise”. By contrast, the career rotation of staff in government departments collaborating with the Trust may bring in civil servants with little or no relevant experience in the field.

When asked about how their “low-carbon” mission differentiates them from other players in business they remarked: “When we contact business partners we put business opportunity upfront and the green bit away” (interviews in 2010). The Carbon Trust understands very well that its reputation as a part of the business community is the key to its success. When the Carbon Trust works towards its mission of a shift to a low-carbon economy it does so from perspective of the business sector rather than public sector.

#### ***Governance relations***

##### *Relations with key stakeholders*

##### Relations with government

As a private company, the Carbon Trust is legally independent from the government and enjoys a high degree of autonomy in designing and delivering its operations. The Grant Offer Letter from the Department of Energy and Climate Change (DECC) (previously DEFRA) provides the flexibility the



Carbon Trust needs to do its job. It is more than would typically be given to non-departmental public bodies.

Formally, the Department's influence over the Carbon Trust is restricted to commenting on its annual business plan and raising issues at quarterly board meetings (NAO, 2007). The government's role in the Board meetings was described in interviews as "steering and guiding" to remain in line with current government policy. Government has a very limited influence, however, on the actual choices of technology areas to be targeted or on the specific design of the Carbon Trust's instruments. In addition, the Carbon Trust provides all of its founders with a quarterly report on progress against the objectives set out in its business plan, and meets its founders quarterly to discuss. The Carbon Trust also engages its founders as stakeholders when developing significant new initiatives.

At the end of the day, it is the government that decides the Carbon Trust budget. This can be seen as an ultimate control tool in the hands of funding departments. The fact that the Carbon Trust budget is confirmed on an annual basis and the three-year budget indication does not constitute the government's commitment limits the Carbon Trust's horizon. The Carbon Trust realises that its allocation from government depends on many factors which it cannot control and sums it up as follows: "We don't know the other factors that are governing the decision and we don't know where we sit in the hierarchy of the department policy" (interviews in 2010). However, since the launch of the Carbon Trust in 2001, its budget has increased year on year – a reflection, in part, of the importance the government attaches to tackling climate change and moving the United Kingdom to a low-carbon economy; it is also in part a recognition by the government of the success the Carbon Trust is having achieving its objectives.

The formal system of checks and balances between the government and the Carbon Trust is complemented by frequent informal working contacts between the two organisations. Frequent working meetings and encounters at various events offer innumerable opportunities to find consensus between the two sides as well as to share early signals about possible future developments.

**Box 2. A snapshot of governance arrangements of other UK public-private partnerships in the field**

The National Industrial Symbiosis Programme (NISP) was set up to develop collective solutions in the area of resource efficiency and is funded by the Environment Department (DEFRA) and regional development agencies. Its work programme is agreed with DEFRA, a representative of which also attends board meetings.

The Energy Saving Trust (EST) advises businesses, public-sector bodies and the public on energy efficiency and is funded by government. DEFRA and the Department for Transport are members of the company and have the right to attend board meetings. The EST consults the departments on its work programmes.

The Waste and Resources Action Programme (WRAP) is funded by DEFRA to help reduce waste and boost recycling. The department is represented on its Board and endorses its work programmes.

**Relations with business**

The Carbon Trust prides itself on its independence and its close contacts with business and equity investors. The stakeholders often underline that the Carbon Trust enjoys a high level of trust and has a strong reputation in the eyes of business. The fact that it was established as a private, independent company is often mentioned as a key factor in building that trust.

According to the report of the NAO (2007), the private-sector status of the Carbon Trust has allowed the management team to build close relationships with potential investors, to recruit staff with business

expertise who are experienced in taking business proposals forward, and to respond quickly and flexibly to changes in market conditions.

Furthermore, the Carbon Trust's "arm's-length" relationship with government has enabled it to take the opportunity to explore a range of innovative options for reducing carbon dioxide emissions. Also, the Carbon Trust believes that its customers and private investors were more willing to share information with them as well as to commit their funds when they recognised that the Carbon Trust was independent and as such would not share their confidential business data with government (interviews in 2010; NAO, 2007). Furthermore, the results of Carbon Trust analyses (*e.g.* by the Insights or Innovations team) are regarded as more trustworthy by business than government sources owing to the independent status of the Carbon Trust (interviews in 2010).

#### *Access to information and confidentiality issues*

Although it is publicly funded, as a private company the Carbon Trust is not subject to the Freedom of Information Act on environmental issues. The organisation has, nonetheless, published data and reports on its activities which were judged not to have any commercially sensitive information. The level of access to information on Carbon Trust activities is agreed in partnership with private partners and as such is considered on a project-by-project basis (interviews in 2010).

#### **Budget and financial arrangements**

At the outset, the Carbon Trust was funded mostly from the UK Climate Change Levy, a tax on non-domestic users of electricity, gas and coal. The remainder came from funds voted by the UK Parliament. Over the next two or three years, the funding route was consolidated so that all the Carbon Trust's funding now comes from funds voted by the UK Parliament (interviews in 2010). With the creation of the Department of Energy and Climate Change in October 2008, it became the company's main government funding department.

Government grant funding is approved annually and drawn down monthly in advance. Grant funding from Invest Northern Ireland and the FCO (the Foreign and Commonwealth Office) is received in arrears. The Carbon Trust is notified of its indicative budget for three years for planning purposes, but this information does not constitute an official government financial commitment.

**Table 1. Income structure of the Carbon Trust (2008 and 2009)**

	31 March 2009, GBP thousands	31 March 2008, GBP thousands
<b>Grant income</b>		
DECC	80 325	83 542
Invest Northern Ireland	3 376	2 688
The Scottish Government	5 169	9 570
The Welsh Assembly Government	4 965	4 415
DEFRA	800	–
FCO	120	–
<b>Grant funding provided for interest-free loans</b>		
DECC	12 000	5 474
Invest Northern Ireland	2 000	1 214
<b>Total grant receipts and grant income receivable</b>	<b>108 755</b>	<b>106 903</b>
Movement in deferred income	(18 629)	(13 323)
<b>Total grant income</b>	<b>90 126</b>	<b>93 580</b>
<b>Finance income</b>		
Bank interest	1 407	1 116

Unwinding of discount on interest-free loans	2 425	1 786
Net gain on deemed acquisition and disposals of group undertakings	162	2 777
Dividend income receivable	387	–
<b>Total finance income</b>	<b>4 381</b>	<b>5 679</b>

Source: Carbon Trust (2009a).

Income in 2008/09 was made up of: grant claimed from DECC, DEFRA, FCO and the devolved administrations; separate funding for the interest-free energy efficiency loans scheme in Northern Ireland; and interest income on the Carbon Trust's own funds (Table 1). Other sources included sales in commercial subsidiaries, sales to expert advice customers and investment transaction fees (Carbon Trust, 2009a).

The company has grant funding of GBP 103 million for 2009/10 from DECC, DEFRA, the Department for Transport, the Foreign and Commonwealth Office and the devolved administrations. This funding does not include additional funding announced in the 2009 Budget of up to GBP 83.9 million to expand the company's interest-free energy efficiency loans scheme in England and up to GBP 54.5 million to provide further funding to Salix Finance Limited to administer a new public sector loan scheme in England without a requirement for matching funding. Subject to that change, future activity will largely continue the programmes undertaken in 2008/09, but on an enhanced scale where additional funding has been provided. The retained profit for the period was GBP 1.991 million (2007/08 – GBP 3.368 million).

The Carbon Trust's funding thus comes primarily from the UK government. The organisation is also actively pursuing other funding sources and mechanisms (interviews in 2010; Policy Innovations, 2009). The most obvious sources are private capital leveraged by Carbon Trust operations, notably through the Technology Accelerators (the Offshore Wind Accelerator is the most successful), and profits from the venture capital arm. The Carbon Trust has also started to consider other sources of funding including philanthropic sources and foreign investors.

## **Main types of activity**

### ***Main areas of activity***

The Carbon Trust recognised two strategic needs: to deploy energy-efficiency technology at mass scale to reduce carbon emissions now and to develop new and emerging low-carbon technologies to reduce future carbon emissions. In essence, the organisation exercises two parallel streams of activity divided according to the time horizon of expected carbon savings:

- Carbon Now to cut carbon dioxide emissions now and to benefit from immediate cost savings and increased business efficiency. This is done by providing companies and the public administration with expert advice, finance and accreditation, and by stimulating demand for low-carbon products and services.
- Carbon Future to find ways of cutting carbon emissions in the future and to capture the commercial opportunities and economic benefits of doing so. This is done by supporting early-stage pre-commercial, pre-venture capital (VC) low-carbon technology development through project funding and management, investment and collaboration, and by identifying market barriers and practical ways to overcome them.

Both Carbon Trust representatives and government stakeholders point to the challenging nature of discussions on how to balance the allocation of resources between short-term and longer-term carbon savings.

The Carbon Trust is organised into five business areas: Insights; Solutions; Innovations; Enterprises; Investments. The following sections introduce each of the areas and their main instruments. The final subsection is devoted to the international dimension of the Carbon Trust operations.

### *Insights*

In terms of its policy advice activities, the Carbon Trust informs key decision makers on opportunities and threats relating to climate change mitigation, including explaining market opportunities and developments. This is achieved by delivering new, fact-based analysis for business, investors and policy makers, which helps set out the decisions required and the economic opportunities created.

An example is a report, *Focus for Success – A New Approach to Commercialising Low Carbon Technologies*, which aims to answer a number of key questions concerning technology support in the United Kingdom. First, it considers whether the United Kingdom should lead in commercialising new technologies. Second, it discusses how to make the United Kingdom more attractive for developing and deploying low-carbon technologies. Finally it looks at the scale of investment required and the potential benefit for the United Kingdom (Carbon Trust, 2009a).

### *Solutions*

Carbon Trust provides advisory services to all business and public sector organisations in the United Kingdom, irrespective of size, sector or carbon footprint. Carbon Trust has developed a new carbon-saving advice service (Carbon Survey) for smaller businesses which meets their specific needs and should help them to gain substantial cost savings. The support offered through this improved service focuses on providing smaller organisations with a one-day on-site carbon survey to identify low or no-cost energy efficiency measures quickly. Carbon Trust then delivers a concise report on how to implement these actions and indicated further services that it might be able to offer. In 2008/09 Carbon Trust carried out over 3 000 on-site carbon surveys to give tailored advice to businesses of all sizes (Carbon Trust, 2009a).

The Carbon Trust also runs an interest-free loan scheme for small and medium-sized enterprises for energy-efficient equipment as part of Solutions for Business. It also provides revolving funds and zero interest loans for public-sector organisations through the publicly funded Salix Finance, an arm's-length company of the Carbon Trust. Since the start of the scheme in 2003 Carbon Trust has offered nearly GBP 80 million in interest-free energy efficiency loans to businesses, saved over 500 000 tCO<sub>2</sub>, and approximately GBP 80 million for the enterprises involved.

The company also manages the Energy Technology List (ETL), which specifies enhanced capital allowance (ECA)-qualifying equipment. Over 14 000 products are currently listed on the ETL. In 2009 three new technologies were added to the list: uninterruptible power supplies, close control air conditioning and air-to-water heat pumps (Carbon Trust, 2009a).

The Carbon Trust recently launched the Clean Tech Revolution campaign to raise awareness of opportunities relating to innovation in the low-carbon area. The campaign will actively highlight the economic benefit that the United Kingdom can capture from taking a leading position in commercialising key low-carbon technologies and, through an innovation awards programme, will showcase examples of British low-carbon innovation.

*Innovations*

## Applied research

The Applied Research Open Call is a public competition which has been run three times a year since 2002. It is open to all types of organisations and any technology area that could save carbon in the future. The call is very competitive. Only about 10% of the applications received are offered grant funding and commercialisation support. The funding supports highly innovative applied research and development and commercialisation and provides face-to-face advice on how to exploit the work and develop a successful business proposition. As of 2009, the Carbon Trust had offered a total of over GBP 24 million in funding to 175 innovative projects. This investment has attracted additional commitments of almost GBP 30 million from the private and public sectors (Carbon Trust, 2009a).

## Technology acceleration

The Technology Accelerator is “a portfolio of directed projects set up and wholly or partly funded by the Carbon Trust to support sectors which have significant long-term potential to reduce carbon emissions, but whose potential is constrained by barriers to commercialisation” (Carbon Trust, 2009a). In its review, the NAO (2007) underlined that the accelerators are particularly well designed to fill what could otherwise be a barrier to the development of commercially viable low-carbon technologies. The NAO also noted that the Carbon Trust’s co-ordination of businesses and researchers to collaborate on the accelerator projects appeared to be unique in the UK policy landscape and that the focus on applied research and commercial development rather than on basic research and academic achievement meant it supported a range of projects different from other sources of grants (such as those supported by research councils).

Carbon Trust currently runs eight accelerators focused on a variety of technologies or challenges, including: Advanced Photovoltaic Challenge, Algae Biofuels Challenge, Biomass Heat Accelerator, Buildings Accelerators, Industrial Energy Efficiency Accelerator, Marine Energy Accelerator, Marine Renewables Proving Fund, Micro Combined Heat and Power Accelerator, Offshore Wind Accelerator, Polymer Fuel Cell Challenge, Pyrolysis Challenge.

The biggest accelerator project addresses offshore wind energy. It was set up in collaboration with five European utilities in Norway, Denmark, Germany and the United Kingdom. The aim of the accelerator programme, with an overall budget of GBP 30 million (GBP 10 million from the Carbon Trust), is to scale up generation of electricity from current-generation offshore wind turbines and to reduce costs by at least 10%.

In the Low Carbon Buildings Accelerator, the Carbon Trust has been working closely with a range of major refurbishment projects in order to understand the barriers to achieving a low-carbon building and how to overcome them. It published in 2009 some of the lessons from that work in a guide for clients and project managers.

The Industrial Energy Efficiency Accelerator aims to identify new carbon savings opportunities in complex manufacturing processes and to demonstrate to industry how these can be achieved in practice. In 2009 pilot projects were carried out with three very diverse sectors: asphalt manufacturing, plastic blow-bottle moulding and animal feed manufacturing. Each technology field presented different, industry-specific challenges.

The Carbon Trust launched in October 2009 the Polymer Fuel Cells Challenge, a UK bid for a breakthrough in fuel cell technology, which aims to accelerate the commercialisation of breakthrough UK technology that could achieve mainstream cost-effective (mass) production of cars and buses powered by fuel cells, as well as provide electricity and heat in homes and businesses. The aim is to drive forward the

commercialisation of UK fuel cell expertise, which should play a crucial role in the Clean Tech Revolution both by cutting carbon and creating jobs and economic value (Carbon Trust, 2009b).

#### Incubator scheme

Carbon Trust also supports the development of low-carbon technologies and companies that are further away from commercial readiness. Its business incubator scheme helps companies with promising low-carbon technologies become attractive to investors. As of 2009, the scheme had helped to incubate 82 businesses which had gone on to raise around GBP 84 million in private investment (Carbon Trust, 2009a).

The incubator activity is a publicly funded activity and is not part of the investment portfolio *per se*. It is part of the continuum of innovation support that the Carbon Trust provides, from R&D through applied research and directed research (House of Commons, 2008).

#### *Enterprises*

The Carbon Trust creates and develops low-carbon enterprises in markets which have the potential to deliver significant carbon reductions and financial returns for the United Kingdom but in which barriers to rapid deployment exist. It aims to prove their commercial viability and provide co-investment and strategic opportunities to partners who can bring the skills and capital investment to complement those of the Carbon Trust. For example, the Carbon Trust is working with HSBC to build the Partnerships for Renewables (PfR) joint venture, which aims to deliver 500 megawatts (MW) of onshore wind power on public land over the next five to eight years. The Carbon Trust also created two 100% owned companies, the Carbon Trust Footprinting Company and the Carbon Trust Standard Company, to commercialise its carbon reduction label and its standard to verify an organisation's good carbon reduction performance.

The Carbon Trust designed the Carbon Reduction Label to help companies communicate the impact of their carbon footprinting work to consumers. Companies that display the Carbon Trust's Carbon Reduction Label (on pack, online or elsewhere) are making a commitment to reduce the carbon footprint of their product or service. In June 2008 the Carbon Trust introduced the Carbon Trust Standard to address a problem of business "green washing". The carbon standard is only awarded to companies and organisations that measure and reduce their carbon emissions annually. The standard has been deemed by the UK government evidence of early action in respect of the introduction of the government's Carbon Reduction Commitment (CRC). Achievement of the standard will help companies demonstrate robust early action in the scheme. To qualify, organisations must show an absolute cut in emissions for one to three years, depending on their size. They must commit to achieving further year-on-year cuts. The standard is one of only two early action metrics recognised under the CRC, a market-based emissions reduction scheme for large energy users, including retailers, local authorities and engineering and manufacturing firms (Environmental Data Services, 2009a, p. 8).

Published in October 2008 by the British Standards Institution (BSI), co-sponsored by the Carbon Trust and DEFRA, the PAS 2050 is the first international standard for companies to measure the carbon footprint of their products and services. The Carbon Trust is now working with the World Resources Institute and ISO to support the global harmonisation of product carbon footprinting standards. Alongside PAS 2050, the Carbon Trust also published the Code of Good Practice for communication and reduction associated with product carbon footprinting, and "Product Carbon Footprinting: the New Business Opportunity", for organisations considering carbon footprinting activities.

*Investments*

The Carbon Trust acts as a minority co-investor on commercial terms in the early-stage low-carbon technology sector by seeking to leverage funds from the private sector into new companies. The organisation invests between GBP 250 000 and GBP 3 million in clean energy companies, from the seed stage through to growth capital. As of 2009, the Trust had invested in 12 businesses, together with additional investments made through the Low Carbon Seed Fund LLP. The organisation has committed GBP 25 million to venture capital activity and has invested GBP 12.2 million, leveraging total private funding of GBP 108 million (Carbon Trust, 2009a).

As of October 2009, the Carbon Trust was to inject up to GBP 18 million in additional funding over the next 12-18 months into the UK clean energy sector to help plug the financing gap faced by early-stage UK clean energy businesses. The purpose of the fund is to make direct equity or equity-related investments in UK early-stage, low-carbon technology companies that demonstrate commercial potential. Against a backdrop of declining investment in the sector it represented more than a quarter of the United Kingdom's entire venture-capital clean energy investment in 2008, which stood at GBP 66.5 million, its lowest in over five years.

The function of the investment management team is to make investments using their funding in an area in which there is an acknowledged market failure at the very small, early-stage end of the technology company market (House of Commons, 2008). The Carbon Trust Investments team is in a completely separate part of the organisation. The employees of Carbon Trust Investments are not party to any of the funding decisions that are made in terms of R&D grant funding to low-carbon technology businesses generally, in order to ensure a clear separation between the R&D funding and investments as venture capital.

*International dimension*

The Carbon Trust's international activity aims to maximise its impact in terms of its mission by:

- increasing the potential for carbon savings, recognising the scale of global carbon emissions relative to the United Kingdom;
- leveraging the experience gained in the United Kingdom to achieve emission reductions more quickly than would otherwise be the case;
- sharing the fixed costs for developing and maintaining Carbon Trust know-how and systems.

The Carbon Trust's goal over the next few years is to achieve a step-change impact on carbon savings, now and in the future, and to attract the private-sector investment required to accelerate the move to a low-carbon economy. The budget for its international activities comes from the Carbon Trust's allocation from the Department of Energy and Climate Change. The department has agreed with the Carbon Trust that the international dimension is a legitimate element of its work.

The Carbon Trust has been active in developing a strategic international presence to look for business partners as well as for additional sources of revenue. In June 2009, the Carbon Trust Board approved the establishment of Carbon Trust International Ltd, a wholly owned subsidiary of the Carbon Trust to further its international objectives. The Carbon Trust works in the following countries:

- Qatar: In November 2008, the Carbon Trust signed a Memorandum of Understanding with the Qatar Investment Authority to explore opportunities for low-carbon collaboration and to create a clean tech fund designed to invest primarily in UK companies.
- China: The Carbon Trust has signed a framework agreement with the China Energy Conservation Investment Corporation (CECIC) to create a GBP 10 million joint venture to accelerate the development and deployment of low-carbon technologies. The aim is to open new Chinese markets for innovative UK low-carbon technologies and businesses as well as to support China's efforts to move to a low-carbon economy while opening up new commercial opportunities for low-carbon businesses in the United Kingdom. During 2008/09 the Carbon Trust opened a representative office in China and commenced expert advice activities funded by the Foreign and Commonwealth Office (Carbon Trust, 2009a).
- Florida, United States: In July 2008, the Carbon Trust agreed to work with the governor of Florida on innovation in low-carbon technology and ways to help reduce emissions in the near term; in 2010, the Carbon Trust appointed a head of operations in the United States to be better able to respond to increasing US interest in the Carbon Trust model.
- Australia: The Carbon Trust has a contract with the Australian government to help set up the Australian Carbon Trust announced by the Australian Prime Minister, Kevin Rudd on 4 May 2009.
- Global dimension: Working with the UK Department for International Development, the Carbon Trust supports the concept of climate innovation centres to be located in developing countries which aim at accelerating the deployment of new technologies through research, product development, adaptation, testing and demonstration. This proposal has been introduced in the UNFCCC climate negotiations by the Indian government and has received the support of the United Kingdom and other governments. The centres could be funded by public-private partnerships (P-PPs) between the international community, host governments and the private sector and would focus on technologies that meet the specific needs of developing countries. While further research is needed, the paper's authors suggest that an initial investment of USD 2.5 billion over five years could fund five regional centres and leverage up to USD 25 billion in private-sector assets. The concept of "transferring" low-carbon technologies from rich countries to developing nations, which has been the standard approach in climate discussions, has not proven productive. Climate innovation centres are expected to be more successful in leveraging technologies and overcoming barriers.

### ***Classifying Carbon Trust measures***

The measures implemented by the Carbon Trust can be structured according to a typology of supply-side and demand-side measures.

Supply-side measures include: equity/debt support; research and development; demonstration and commercialisation; education and training; networks and partnerships; information services; provision of infrastructure.

Demand-side measures cover notably: regulations and standards; public procurement and demand support; technology transfer.

The Carbon Trust's activities cover to some degree almost the full scope of the proposed typology. This wide coverage allows the Trust to take a systemic approach and to plan their interventions in different



parts of the value chain. Table 2 presents the instruments classified according to their supply or demand focus.

**Table 2. Classification of Carbon Trust measures**

	Type of measure	Carbon Trust activity
Supply-side measures	Equity/debt support	"Solutions" <ul style="list-style-type: none"> <li>• Interest-free loan for small and medium-sized enterprises and for public sector organisations</li> </ul> "Investments" <ul style="list-style-type: none"> <li>• Low Carbon Seed Fund LLP</li> </ul>
	Research and development	"Innovations" <ul style="list-style-type: none"> <li>• Applied research call</li> <li>• Research accelerators</li> </ul>
	Demonstration and commercialisation	"Innovations" <ul style="list-style-type: none"> <li>• Technology accelerators</li> </ul>
	Education and training	"Solutions" <ul style="list-style-type: none"> <li>• Training through the work of accredited consultants</li> <li>• Clean Tech Revolution campaign</li> </ul> "Innovations" <ul style="list-style-type: none"> <li>• Business incubators (advisory services)</li> </ul>
	Networks and partnerships	"Innovations" <ul style="list-style-type: none"> <li>• Public-private partnerships built for individual technology accelerators</li> </ul>
	Information services	"Solutions" <ul style="list-style-type: none"> <li>• Advisory services</li> <li>• The Energy Technology List (ETL)</li> </ul> "Insights" <ul style="list-style-type: none"> <li>• "Technology accelerators"</li> <li>• Published reports and studies</li> </ul>
	<i>Provision of infrastructure</i>	-
Demand-side measures	Regulations and standards	"Enterprises" <ul style="list-style-type: none"> <li>• Carbon Trust Standard</li> <li>• PAS 2050</li> </ul> "Insights" ( <i>indirectly</i> ) <ul style="list-style-type: none"> <li>• Studies on potential impacts of regulations</li> </ul>
	Public procurement and demand support	"Enterprises" <ul style="list-style-type: none"> <li>• Carbon Reduction Label</li> </ul>
	<i>Technology transfer</i>	- Climate innovation centres (CICs)

### ***Expenditure per area of activity***

The Carbon Trust invested nearly 72% of its total annual expenditure in 2008/09 in its "Carbon Now" line of activity, which consumes by far the biggest part of the budget. Total expenditure for "Carbon Future" activities amounted to GBP 18.8 million compared to about GBP 66 million for "Carbon Now". The single most expensive item in the budget is expert advice (GBP 35 million).

That said, probably the most relevant trend in Carbon Trust expenditures in recent years has been the significant reduction in funding allocated to "Carbon Now" and the increased budget for "Carbon Future" activities. As Table 3 illustrates, expenditure for "Carbon Future" grew by nearly GBP 4 million whereas that for "Carbon Now" dropped by GBP 7.8 million between 2008 and 2009. Another related trend was the increase in spending on accreditation services: the Carbon Trust Footprinting Company Limited and the Carbon Trust Standard Company Limited cost GBP 5.6 million compared to GBP 2.0 million in 2007/08. These changes were in line with the Carbon Trust's strategy as well as the recommendations of external reviews. In the longer term, the Carbon Trust is planning to maintain the level of the "Carbon Now" expert

advice activity while using less of its government grant funding, since larger customers have begun to co-fund expert advice services. The degree of intervention using “Carbon Now” instruments will be reconsidered in light of the carbon reduction commitment energy efficiency scheme (CRC) as it becomes established.

**Table 3. Carbon Trust expenditures by type of activity, 2008 and 2009**

	2009, GBP thousands	2008, GBP thousands
<b>Carbon Now</b>		
Expert advice	35 055	39 533
Finance	10 181	14 367
Accreditation	5 595	1 977
Opening markets now	15 232	17 958
Total carbon now	66 063	73 835
<b>Carbon Future</b>		
Opening future markets	7 487	5 119
Technology commercialisation	9 403	7 799
Investment	1 871	1 971
Total carbon future	18 761	14 889
<b>Total programme expenditure</b>	<b>84 824</b>	<b>88 724</b>
Other management and administration expenditure	3 439	3 296
Change in fair value of investment portfolio	1 518	3 702
Discount on interest-free loans	2 396	2 438
<b>Total expenditure for the financial year</b>	<b>92 177</b>	<b>98 160</b>
<b>Activity not included in expenditure</b>		
Net effect of investment made less fair value fluctuations	3 203	(1 533)
Remaining effect of interest-free loans	17 939	18 094
<b>Total activity for the financial year</b>	<b>113 319</b>	<b>114 721</b>

Source: Carbon Trust (2009a).

Over the next five years, the Carbon Trust has planned a shift in the balance of its activities, away from providing publicly funded support to large businesses and towards innovation, new low-carbon technologies and new business models and ways of doing business. It is estimated that the work already undertaken to support emerging technologies would reduce carbon dioxide emissions by between 13.7 million and 20.7 million tonnes by 2050 (House of Commons, 2008).

### ***Internal co-ordination and coherence***

The Carbon Trust is characterised by close collaboration between different teams working in various areas of activity. Its flat organisational model and physical proximity allow for better co-ordination than in many government departments which often implement similar instruments using separate programmes funded from different budgetary lines (interviews in 2010). The links between different teams are further strengthened by internal mobility. For example, the former director of the incubation programme moved to the venture capital arm. Another factor helping internal collaboration is the organisation’s relatively small size, at least compared to any UK government department.

There is an historical link between the Innovations and Insights team which work in close proximity. In fact, many areas addressed in the “Innovations” area started in the “Insights” team (interviews in 2010).

The latter does the initial stakeholder analysis (including consultations), gap analysis (determining the occurrence of market failure and intervention rationale) as well as the assessment of the potential for risk reduction (as an effect of introducing the planned intervention, *i.e.* the value added of the intervention). This analytical approach can lead to identifying possible interventions to reduce the identified market failures and gaps in public intervention.

There is also a very close “symbiotic” link between the incubation arm (“Innovations”) and the early-stage venture capital activity (“Investments”). The latter supports companies with sufficient commercial maturity. Companies with growth potential, but premature for early-stage investment, are offered the opportunity to be referred to the incubator service teams that can advise them on the next steps in their development.

Activities which address adjacent phases in the technology development process tend to have closer links than those dealing with less proximate phases. The links tend to be very close across the “Carbon Future” line of activity. On the other hand, the Innovations team’s relations with the Solutions team are less close, as the former addresses technologies in stages that are too early to be considered for instruments implemented in Solutions areas (*e.g.* inclusion on the Energy Technology List).

### ***Impact assessment***

#### *Approach to internal impact assessment*

Internal impact assessment is performed by the dedicated Impact Assessment Team. The team is part of the corporate structure of the organisation and as such is separate from the business divisions that deliver carbon savings. The Carbon Trust has significantly developed its own methodology for measuring the impact of its operations. Work on improving the assessment is continuous.

The methodologies used to measure the impact of the “Carbon Now” and “Carbon Future” activities are different. The measurement for “Carbon Now” activities (notably “Solutions”) is believed to be relatively straightforward (interviews in 2010).

The expert advice and finance activities are focused on shorter-term CO<sub>2</sub> emission reductions. The Carbon Trust reports on implementation of CO<sub>2</sub> and energy-saving measures made by their customers during the year. The expected effects of all of the “Carbon Now” activities implemented by the Carbon Trust via its subsidiaries and accredited consultants are first established for a representative sample of customers and then projected onto the entire customer base. The reported impacts of the Carbon Trust were challenged by the external evaluation of the organisation which argued that the actual savings were significantly lower; the attribution of effects was also questioned.

In contrast, “Carbon Future” activities focus primarily on catalysing market development to accelerate the deployment of new and emerging low-carbon technologies which are to deliver longer-term CO<sub>2</sub> emission reductions. The Carbon Trust’s assessment is based on a model of potential future impact. The impact assessment of the “Investment” and “Innovations” areas is considered as most challenging owing to uncertainty of prospective carbon saving. The analysis focuses on the assessment of the likelihood and the time it will take the assessed emerging technology to reach the market, the projected level of market penetration and the effectiveness in term of carbon savings (interviews in 2010).

The Low Carbon Technology Assessment (LCTA), first published in 2003 and revised in 2007, provides a way of ranking the technical potential for future carbon dioxide savings of a wide range of low-carbon technologies in relation to the Carbon Trust’s intervention (NAO, 2007). Drawing on the LCTA, the Carbon Trust has designed a future impact estimation tool to estimate carbon savings going forward. Its aim is to inform decisions on projects initiated in-house, such as the Accelerators, in order to identify

technologies in which the United Kingdom has a competitive advantage. In such assessments, the carbon metrics are combined with the projected commercial returns.

In general, for both its expert advice and finance activities, the Carbon Trust monitors and reports: an estimate of its overall impact in terms of implemented CO<sub>2</sub> emission reductions on an annual basis; its programme cost-effectiveness on an annual and lifetime basis; and the lifetime cost-benefit of its activities, taking into account programme costs and an estimate of the costs and benefits to customers.

The Carbon Trust calculates its cost effectiveness in delivering CO<sub>2</sub> emission reductions over two time periods: annualised cost effectiveness (programme costs divided by annualised CO<sub>2</sub> emission reductions of all implemented recommendations) and lifetime cost effectiveness (programme costs divided by lifetime CO<sub>2</sub> emission reductions of all implemented recommendations).

To capture the fact that CO<sub>2</sub> emission reductions are most beneficially achieved when the cost to business is less than the financial savings that result from reduced energy use, the Carbon Trust also calculates the cost and benefit of its activities, taking into account the financial costs and benefits to its customers in addition to the costs it incurs:

- Cost benefit = net present value of Carbon Trust programme costs, customers' implementation costs and customers' energy cost savings divided by lifetime CO<sub>2</sub> emission reductions of all implemented recommendations.

#### *Annual and quarterly assessments and reports*

The Carbon Trust undertakes an annual assessment of its impact at the end of the financial year. This assessment reports: *i)* the total CO<sub>2</sub> saved as a result of the actions customers of the Carbon Trust have taken; *ii)* the potential CO<sub>2</sub> savings from its investments and funding for developing low-carbon technologies; and *iii)* the level of efficiency with which these have been achieved. The results of the impact assessment are presented in the performance assessment section of the Annual Report. In addition, the Trust provides reports against the performance metrics set out in its business plans for each financial quarter. The results help shape the business planning decisions taken throughout the year.

The Board is responsible for reviewing the effectiveness of the Carbon Trust's system of internal control. An Audit Committee is responsible for monitoring the group's financial reporting and its audit process and for reviewing the system of internal control (including financial, operational compliance and risk management) and making recommendations to the Board as appropriate. Two of the members of the Audit Committee are representatives of government departments. The remaining two members are independent. The chairman of the committee is a chartered accountant. The committee meets four times a year. The meetings are also attended by the company's external auditors (Carbon Trust, 2009a).

The Carbon Trust seeks independent assurance on its impact assessment reporting processes under the International Standard on Assurance Engagements (ISAE) 3000. In 2008-09 the company mandated KPMG to review the application of its impact assessment methodology. This comprised a review of the methodology, including verification of baseline assumptions and their limitations. The review has assured that the estimated savings were reasonable. The traditional financial audit of the use of public money is undertaken by Ernst & Young. Both KPMG and Ernst & Young were selected to perform their roles through a competitive tendering procedure.

*One-off external assessments and evaluations*

The 2007 report of the National Audit Office (NAO) was the first substantive external review of the Carbon Trust's performance. It focused on the cost-effectiveness of the advice offered to businesses and the public sector and its programme to encourage the development of low-carbon technologies.

The NAO has statutory audit access rights to conduct value-for-money examinations of the Carbon Trust itself but not of its subsidiaries. Private-sector auditors normally undertake the financial audit of the Carbon Trust's accounts. Nevertheless, the Carbon Trust's management team provided the NAO with full audit access to any papers or individuals within the subsidiary companies in order to undertake the examination.

The NAO commissioned a private consultancy, Morgan Harris Burrows (MHB), to review the initiatives developed by the Carbon Trust to determine whether it was effective in supporting the development of emerging low-carbon technologies, and whether the interventions were sufficiently co-ordinated with other public-sector sources of funding. The review highlighted in particular that the Carbon Trust had put in place strict due diligence procedures and suitable arrangements for ongoing monitoring. Should any of the organisations funded by the Carbon Trust run into difficulties, the extent of any potential loss is limited to the amount invested (NAO, 2007). The MHB report stated "A number of those interviewed have suggested that the Carbon Trust is unique in the world and as such is a model that other countries may emulate. The Carbon Trust 'Brand' and capability has gained a high reputation in both industry and academia; the value of this needs to be protected and enhanced." (MHB, 2007) Another external review was undertaken under the auspices of the House of Commons (2008).

***Reported results and impacts****Key results and impacts*

According to Carbon Trust's assessments, the organisation's activities have contributed to saving over 23 MtCO<sub>2</sub> as of 2009, delivering costs savings of around GBP 1.4 billion (Carbon Trust, 2009a). It has helped to drive around GBP 1 billion of additional investment into the development and deployment of low-carbon technologies, markets, products and services. The organisation supported the development of over 250 new low-carbon technology projects and companies in the United Kingdom. The Carbon Trust Footprinting Company has certified the carbon footprints of over 2,500 products and awarded the Carbon Reduction Label to more than 2,000.

Over the financial year 2008/09, the Carbon Trust supported 30,000 customers, saving companies up to GBP 227 million in direct costs and cutting up to 2 million tonnes of carbon dioxide from their annual emissions. The Trust leveraged in the region of GBP 300 million of private investment into carbon reduction and low-carbon technology projects and delivered carbon savings cost effectively at GBP 4-6 per tonne of carbon saved. The organisation has offered GBP 22.3 million of interest-free energy efficiency loans to businesses and the Carbon Trust Standard Company has certified 71 companies to the Carbon Trust Standard.

The Carbon Trust also launched three major projects to accelerate the deployment of low-carbon energy technologies, including a GBP 30 million flagship project with the offshore wind industry (Technology Accelerator) aimed at cutting the cost of offshore wind energy by 10%. It has signed a contract with the China Energy Conservation Investment Corporation to set up a joint venture company to help businesses that have decided to establish a presence in Chinese low-carbon technology markets.

In 2007 the NAO praised the Trust for its success in leveraging private funding. For every pound the Carbon Trust had invested in its low-carbon technology innovation programme, the private sector had

invested two. Its venture capital arm has been even more successful, attracting GBP 10 of private funding for every GBP 1 invested. The ratios for innovation activities have improved since and now are about GBP 7 for GBP 1. The average financial leverage for all operations is seven to one (interviews in 2010).

Out of all Carbon Trust customers who received specific guidance or advice between April 2005 and March 2006 80% were satisfied with the service received (NAO, 2007). Over three-quarters of respondents considered that they had received sufficient advice to reduce their carbon dioxide emissions, and 76% said that they would not have achieved the same level of energy or carbon savings without the intervention of the Carbon Trust, compared to 20% who said they would have made the same changes anyway.

### *Barriers to achieving carbon savings*

NAO (2007) noted that less than 40% of the potential carbon savings identified by the Trust between 2003 and 2006 were actually achieved. Its survey of Carbon Trust clients found that 60% of organisations had implemented no more than five out of average of 11 recommendations. The Carbon Trust's own research corroborates the NAO's findings. For most businesses, energy costs represent less than 1% of costs and the regulatory pressure to take action is weak. It is not surprising, therefore, that it is hard to secure the necessary management attention; competing priorities for investment, tight payback criteria, perceived risk, lack of funds and the lack of support from senior management were mentioned as the main reasons for not implementing recommendations (interviews in 2010). For the vast majority of businesses, investing in energy-efficiency measures was cost-effective, but 65% still believed that the cost of mitigating climate change was too high. Energy-efficiency measures were crowded out of the management agenda by investment opportunities perceived as more interesting or offering better returns. Businesses often lacked data on energy usage and so found it difficult to monitor their energy consumption accurately. They relied instead on estimated figures from suppliers, which did not show them how energy had been used within the business, and, therefore, how savings could be made. The assessment notes, however, that the Carbon Trust deliberately includes some demanding measures in its advice to encourage companies to be ambitious in their energy-saving plans (House of Commons, 2008).

The assessment of the effectiveness of the Carbon Trust advice's indicated some deficiencies. According to the House of Commons (2008), encouraging greater take-up of recommendations depends in part upon supporting energy consultants to work more effectively with businesses. The Carbon Trust had developed a consultant accreditation scheme to standardise and raise the quality of advice offered. However, the chargeable rates of GBP 435 for a standard site survey and up to GBP 700 a day for more specialist advice restricted the time that could be spent with businesses owing to the limits on public funding and the restrictions on the level of financial support to individual company to meet European Union requirements for state aid. Any step-change in take-up without a corresponding increase in government funding would thus be likely to depend on franchising specified services for accredited third parties to market competitively.

The NAO concluded that in spite of its efforts to focus its work on the largest emitters, the Trust has worked with only 12% of companies with energy bills greater than GBP 50 000 a year, 30% of local authorities, 40% of universities and 12% of hospital trusts. The NAO recommended the Trust expand its energy-efficiency accreditation scheme to allow companies to verify their emissions reduction claims, and build stronger links with overseas organisations to monitor best practice. The energy-efficiency accreditation scheme has formed the basis for the Carbon Trust Standard.

Referring to Carbon Trust performance, Tom Delay (CEO of the Carbon Trust) said the organisation was successfully targeting the biggest emitters, but "it could not force companies to take up its offers". He added that the Trust had worked with around a third of firms with energy bills greater than GBP 500 000 a year (responsible for around half of UK businesses' emissions) including 52 out of the 100 FTSE 100.

External assessments as well as the interviews conducted for this study also brought to the fore the question of attribution of the reported Carbon Trust results. The issue was raised whether and to what extent it can be established that reductions in carbon dioxide emissions were directly achieved as a result of the Carbon Trust's intervention or were due to wider fiscal and customer pressures on organisations. The issue was recognised by both the Carbon Trust and the government. The Carbon Trust has been working to develop a methodology to avoid inappropriate attributions and potential double counting of savings reported by different organisations and government programmes. The methodology is under development (interviews in 2010).

### ***Exit strategy***

“This is very much an organisation set up to deal with a market failure. When the market is no longer failing, when the pension funds and the private sector energy efficiency advisory market is fully functioning, the Carbon Trust will not be needed.” (Helen Ghosh, DEFRA, 2007)

The report of the House of Commons (2008) emphasised that the need for public funding of advice on energy efficiency should decrease as public awareness of climate change and energy prices increase. According to interviews, the “Carbon Now” activity of the Carbon Trust should not be required in a “reasonably short term” as the market starts to offer solutions currently provided by the Carbon Trust (interviews in 2010). In this area of activity there are no technological barriers characterised by high uncertainty. Existing barriers are related to the regulatory framework, cost and absorption capacity of business. Therefore, the Carbon Trust should develop an exit plan to scale back its advice work over the next five to ten years.

The Carbon Trust's policy analysis and commentary on the government's climate change programme in 2006 identified the opportunity to drive energy efficiency investment by regulation rather than by continuing public subsidy. The government's decision to strengthen the regulatory landscape for energy efficiency means that the Carbon Trust can now review its energy-efficiency services and develop its exit strategy as appropriate. The exit strategy in “Carbon Future”, where technological uncertainty is high, is less evident, although the same reasoning applies: when market failure is removed the rationale for the Carbon Trust is removed as well.

At the end of the day, Carbon Trust representatives believe that the future operations of the Trust will depend to a large extent on the strategic political choices of the UK government (interviews in 2010). Should the regulatory framework become more stringent, introducing fines for non-compliance with energy-efficiency legislation, Carbon Trust activities currently implemented under “Carbon Now” might be less needed, as companies would be forced to implement changes to avoid penalties. In a less regulated environment (based on voluntary commitments), however, other incentives (*e.g.* interest-free loans) and support measures (*e.g.* advisory services) may continue to be needed. However, companies may still need a source of trusted advisory services.

## **External co-ordination and coherence**

### ***Co-ordination and coherence with other government programmes***

#### *The Carbon Trust in the UK policy landscape*

The literature review and the interviews tend to confirm that Carbon Trust activities, notably those implemented under “Carbon Future”, are different from, but complementary to, other UK instruments (see in particular the review in BERR-DEFRA-DIUS, 2008).

### *Co-ordination of public policy measures*

#### Government-initiated approaches

The UK government has taken a number of initiatives to co-ordinate its programmes and implementing bodies, including various formal and informal (“behind-the-scenes”) co-ordination arrangements. In 2008, three of the main independent, publicly funded bodies – the Technology Strategy Board (TSB), the Energy Technologies Institute (ETI) and the Carbon Trust – created the Low Carbon Innovation Group (LCIG), a strategic collaboration with a shared vision to deliver the United Kingdom’s low-carbon innovation goals. The Low Carbon Innovation Group meets regularly to review the strategic direction and content of their respective low-carbon technology programmes and initiatives. The group is to be expanded to include representation from the research councils, the Environmental Transformation Fund and, when relevant, regional development agencies and devolved administrations.

The government admits that the low-carbon policy landscape may not be easy for users to understand. To solve this problem it funded a Knowledge Transfer Network (KTN) on Energy Generation and Supply which is supposed to act as “one-stop shop” for various low carbon initiatives.

#### Direct co-ordination and collaboration between different initiatives

The existing implementing bodies collaborate with each other directly. The Carbon Trust engages in direct discussions with other initiatives without necessarily talking to the government first, whenever it feels there is a risk of overlap of activities. As necessary, the Trust talks with the government about “missed opportunities” to establish effective collaboration (interviews in 2010).

So far as helping to save energy and reduce carbon emissions is concerned, the Carbon Trust, the Energy Saving Trust (EST) and the energy utilities are the principal delivery organisations. The EST and the utilities focus on energy efficiency in the domestic sector; the Carbon Trust focuses on business and the public sector. The Carbon Trust and the EST work to manage and thereby avoid the potential for overlap. They are represented on each other’s Boards and they co-operate on specific projects, for example:

- The development of engagement strategies for small businesses, and the micro-combined heat and power (CHP) field trials led and funded by the Carbon Trust. EST was represented on the Advisory Committee for the Carbon Trust study on micro-CHP (interviews in 2010.).
- The Community Energy programme run by the EST and for which the Carbon Trust provided strategic and ongoing advice.
- The EST, as a contractor to the government’s low-carbon buildings programme, sub-contracted the energy efficiency element to the Carbon Trust because of the strong expertise developed within its Technology Accelerator team.

Examples of other direct collaborations between different initiatives include joint calls for proposals published by the Carbon Trust and the TSB.

#### *Co-ordination with the private sector*

The Carbon Trust’s commercial activities have been perceived by some businesses as potential competition. Some of the organisations interviewed as part of NAO’s 2007 review of the Carbon Trust’s Innovations, Enterprises and Investment activities expressed concern about the potential for conflict between the Carbon Trust’s intelligence gathering and commercial work.



The Energy Services and Technology Association (ESTA) stated that companies set up by the Carbon Trust (Connective Energy and Insource Energy) compete in the private sector instead of providing a service, such as developing and sharing knowledge of new technologies. According to the Carbon Trust, it seeks to identify opportunities to earn a carbon and commercial return where service provision is non-existent (interviews in 2010). Thus, Connective Energy and Insource Energy work to “create markets that are not yet fully formed” and do not compete with other companies (Environmental Data Services, 2009b, pp. 6-8).

ESTA noted also that some of their members were unwilling to share commercial information with the Carbon Trust as they viewed elements of the Carbon Trust as potential competitors. The association voiced their concern that the Carbon Trust competes with private consultants delivering similar services such as energy audits (Environmental Data Services, 2009b). The Carbon Trust believes that by providing funding towards the cost of energy audits, it accelerates the delivery of energy-efficiency improvements in a market which has been slow to gain momentum. Through the demanding accreditation requirements for its consultants, it is also raising the standard of service delivery. As the new carbon reduction commitment energy efficiency scheme (CRC) becomes fully established and drives market action through regulatory pressure, the Carbon Trust will review its energy audit services.

Research by the Carbon Trust estimated that the energy advice market is growing at a rate of 20% a year, but that there have been few new market entrants. Some of this growth is likely partly to reflect the Carbon Trust’s own market position and increased workload. The 2007 NAO review found that energy consultancies with fewer than five employees claimed that the Carbon Trust accounted for around half of their work, consultancies with between 10 and 49 employees said it accounted for 33%, and those with more than 50 employees said 19%.

Both the ESTA and the Energy Institute believed that the Carbon Trust had not engaged adequately with them to maximise the potential growth of the market and reported some frustration among their member consultants about the potential for future fee-earning work (NAO, 2007). Among the consultants who replied to the NAO survey, 39% expressed dissatisfaction with the Carbon Trust’s willingness to listen to their ideas. The ESTA also reported concern among its members about the standardisation of reports, which in their view limits their usefulness.

The Carbon Trust is aware of this criticism but believes that it consults widely with its stakeholders and takes their views into account when planning future work. The organisation has been through a process of re-accrediting its consultants since 2006. This has involved “tightening up” consultant accreditation requirements, and this may have led to a degree of dissatisfaction among some of its consultants (interviews in 2010).

### **Main findings and lessons learned**

This section synthesises the main findings and lessons learned about the mode of operation and the value added by the Carbon Trust model. It discusses both perceived advantages and potential disadvantages (or trade-offs) linked to the model. It makes reference to the framework introduced in earlier OECD work on public-private partnerships, which focuses on issues such as risk-sharing and trust as well as value for money and reducing operational and transaction costs (OECD, 2008).

#### ***The mode of operation***

##### *High level of autonomy*

As a private company, the Carbon Trust is legally independent from the government and enjoys a high degree of autonomy for designing and delivering its operations. Formally, the government’s influence over

the Carbon Trust is restricted to commenting on its annual business plan and raising issues at quarterly Board meetings. The government has very limited influence on the choices of technology areas to be targeted or on the specific design of the Carbon Trust's instruments. At the end of the day, however, it is the government that decides on the Carbon Trust budget. This can be seen as an ultimate control tool in the hands of funding departments.

#### *Risk sharing between government and private sector*

A well-designed risk sharing mechanism is considered a key feature of a successful P-PP (OECD, 2008). In the Carbon Trust model, important investment decisions are taken by the Investment Committee (or, for large investments, by the Board) which comprises representatives of both the government and the private sector. The public sector does not interfere in the internal risk assessment processes and methodologies developed by the Carbon Trust. This demonstrates the government's trust in the organisation's technological and commercial expertise.

Through its Innovations and Investments work, the Carbon Trust aims at identifying the risks that inhibit the private sector from moving towards a low-carbon economy. First, it explores why the market is not providing goods and services on "a willing buyer, willing seller basis". Second, it designs interventions to overcome market failure. It works to characterise the risks and barriers and build "stepping stones" whereby business, investors and other partners can share the risks. Risk is reduced by forming partnerships and by applying impact assessment methodologies that allow for analysing expected carbon savings and commercial returns (interviews in 2010). Bringing various parties together is seen as an essential step in understanding the nature of the relevant risks and developing an appropriate response.

Specific risk-sharing arrangements for projects involving many stakeholders are negotiated with all concerned parties on a project-by-project basis. The Trust has developed a capacity to act as a "market catalyst" for initiatives that require risk to be shared by many companies, often including large private corporations (e.g. Off-Shore Wind Accelerator). In case of applied research projects, the Trust shares costs and help to reduce associated risks by providing high-quality technical and professional expertise.

#### *Building trust and engaging business*

Owing to its independent status and close engagement with business, the Carbon Trust enjoys a high level of trust in the private sector. The organisation has been successful in establishing itself as a strong brand in the eyes of investors. This good reputation is partly a consequence of its early entry and "pioneer" status in the low-carbon field and partly because of its independently verified positive impact on carbon savings.

The business sector regards the Carbon Trust's arm's-length relationship with the government as evidence of its independence. Therefore, the Trust's advice and reports are seen as more objective than if they had come from a government or other public sector organisation. For example, the Carbon Trust's micro-combined heating and power field trials and subsequent analysis reduced uncertainty among businesses and investors about the potential of the CHP technology application in the United Kingdom.

The Confederation of British Industry (CBI) welcomed the fact that the Carbon Trust did not have to pursue a specific political agenda. A quarter of the customers in the NAO's census of the Carbon Trust's customers, who rated the Carbon Trust as providing better energy advice than others, explained that this was because "they were independent and did not have to promote particular services" (NAO, 2007).

*Consolidating expertise and co-producing policy*

The interviews refer to the significant influence of the Carbon Trust's analytical work on the policy-making process. By virtue of its reputation the Carbon Trust attracts professionals with substantial experience in the field of environmental technologies and low-carbon investment. External stakeholders point to the high quality of the technological and investment expertise developed by the Carbon Trust and its unique view across the innovation chain. This knowledge base is a clear operational advantage when compared to an ordinary government department, which is typically characterised by a high level of staff rotation and very limited technological expertise.

The government uses the Trust's studies and projections developed through Insights in its own policy programming and regulatory work. The Trust aims at clarifying complex issues and helping stakeholders understand better what the issues and options are to accelerate the move to a low-carbon economy. Examples include, notably, the studies on offshore wind energy or the potential for the use of micro-CHP (used in planning of the UK feed-in tariffs scheme). Also, the CRC scheme, which is about to be implemented in the United Kingdom, has been a response to the Carbon Trust's work; the Trust's study presented to the government in 2006 proposed a way to address the gap in energy-efficiency policies so they address mid-sized organisations and businesses.

***The value added of the model****Value for money and efficiency gains*

The Carbon Trust is seen as one of the best programmes in the low-carbon UK policy landscape. The organisation has delivered support for improving the energy efficiency of businesses more efficiently than the former government-run programme. The Carbon Trust is seen as "single organisation with a single purpose" which makes it a very focused delivery body. The company-like organisational structure of the Carbon Trust makes it operate faster than a government department. The private sector model allows the organisation to adapt very flexibly to changing tasks and budgets (NAO, 2007; interviews in 2010).

Furthermore, delivering multiple interventions through one organisation that integrates a number of functions under one roof reduces operational costs as compared to many separate bodies. Among the examples presented in this case study is the close collaboration between investment and incubator teams, both of which benefit from expertise typically developed in the private sector.

*Leveraging private capital into a low-carbon economy*

Close contacts with business and the strong knowledge base of the Carbon Trust underpin its ability to design and implement market interventions which attract significant portions of private capital. The Carbon Trust investments leverage relatively high amounts of private funds, and the average financial leverage for all operations is seven to one (interviews in 2010). The investment decisions of the Carbon Trust lend credibility to the selected technology developers or start-ups and increases chances to attract further private investment (Kern, 2008; interviews in 2010).

*Reduced transaction costs*

A well functioning P-PP can reduce the transaction costs of the stakeholders involved. The Carbon Trust activities reduce different types of transaction costs for business with a view to removing barriers to a low-carbon economy. By providing and animating the space in which public and private stakeholders, including research organisations, can meet, the Carbon Trust contributes to reducing transaction costs otherwise carried by individual stakeholders.

In concrete terms, by undertaking analytical work on specific technologies (*e.g.* micro-CHP), managing the Environmental Technologies List (ETL) as well as by its labelling activities (via the Carbon Trust Footprinting Company Limited), the Trust reduces uncertainty and the cost of information search. Furthermore, it optimises bargaining costs in the sense that it is more effective than a government department in reaching multiparty agreements with business stakeholders. The examples of such contracts include the agreements concluded for the Technology Accelerators, notably that of offshore wind energy.

### ***Potential risks to be considered***

While reflecting on the potential risks related to the Carbon Trust P-PP model, it should be kept in mind that different stakeholders will take different views. For example, the independent status of the Carbon Trust is a clear advantage from the point of view of the business community and the ability to be creative and responsive to the needs of the market, whereas it may appear a challenge and potential risk to public-sector representatives and NGOs that are sensitive to the issue of access to information. Therefore, it is necessary to think about the potential pros and cons of particular P-PP models in terms of trade-offs.

### ***Question of control and “public ethos”***

The choice of implementing policies through the Carbon Trust places strategic control and day-to-day management of public funds in the hands of a private body. Government stakeholders did not consider this a problem, but rather a logical consequence of the decision to choose a particular P-PP model. The government, as founder of the Carbon Trust, retains ultimate control over the organisation as it can terminate its budget. However, the issue of control was considered important by many external stakeholders, notably NGOs (NAO, 2007; House of Commons, 2008).

One interview raised a concern about whether and to what extent the Carbon Trust is a part of the public sector. As it is outside the public sector, the organisation develops its own “culture” which can put it in “a different place [from] where the central government may be” (interviews in 2010). On the other hand, the “culture” the Carbon Trust has developed has enabled it to become a highly effective delivery body focused on one of the government’s primary policy objectives.

### ***Issue of transparency in the eyes of the wider public***

Another trade-off related to its operational model is that the Carbon Trust does not have to share all information with the general public. An interviewee referred to the Carbon Trust’s practice of diversifying and extending its organisation to the point where it loses transparency for its founders and other stakeholders (interviews in 2010). From the point of view of the Trust, its policy on information disclosure is as open as possible having regard to the confidentiality and sensitivity of the material divulged to it in confidence by business partners.

### ***Interaction with businesses providing similar services***

Stakeholders raised concerns about whether some of the Carbon Trust’s activities (*e.g.* energy audits delivered by the Carbon Trust) might lead to “crowding out” of services otherwise available on the market. The Carbon Trust’s goal has been to improve the quality of energy-efficiency advisory services as well as to enhance their accessibility. The stakeholders did not feel, however, that they were sufficiently involved in the planning of the Trust’s activity.

The lesson learned is that, already in the planning process, the P-PP should actively engage other private actors operating in their field. It should also continuously monitor the market situation (*i.e.* presence of market failure) and analyse the wider impacts of its activities.

***Transferability of the model***

In general, the potential transferability of the Carbon Trust's P-PP model to other countries depends on:

- the readiness and the capacity of government to delegate direct control over policy delivery to an external non-public body (interviews in 2010);
- having an appropriate legal framework involving good governance, public accountability and reporting issues for the PPP (OECD, 2008; interviews in 2010);
- the presence of suitable business partners potentially interested in the public-private arrangement (interviews in 2010).

These requirements limit the transferability of the model to the governance cultures with the experience or the political will to introduce solutions typical of the new public management. Furthermore, Kern (2009) argues that prior to considering applying the model, the political goals for a low-carbon economy and the capability for innovation in the energy sector need to be taken into account.

This study did not consider the transferability of the Carbon Trust model in depth. The interviews as well as recent successful developments in international applications of the model allow for drawing some tentative conclusions. The most "natural" environments for the model are "Anglo-Saxon cultures" (notably the United States, Australia and Canada). The model also attracted attention from non-democratic regimes with market economies (such as "oil economies") as well as fast-growing emerging countries (*e.g.* China). On the other hand, reservations were expressed about transferability to "Nordic" or "continental cultures" such as France or Germany (interviews in 2010).

## Appendices

### *Interviews*

All interviews took place in January 2010. The interviews with the Carbon Trust were conducted at the Carbon Trust premises in London on 20 January 2010. The remaining interviews, apart from interviews with Mr. Arnold Black and Mr. Jonathan Essex, were conducted by telephone.

#### *The Carbon Trust*

David Vincent, **Director, Projects** (co-founder of the Carbon Trust)

Kofu Atuah, **Technology Acceleration Manager**, in charge of Micro-CHP Accelerator

Michael Coffey, **Aquastrat LTD, contractor to the Carbon Trust**, in charge of Off-Shore Wind Accelerator

#### *UK government*

Tim Lord, **The Department of Energy and Climate Change (DECC)**

Hugh McNeal, Director for Low Carbon Business Opportunities, **The Department for Business, Innovation and Skills** (currently appointed to sit on the CT Board)

Jeanie Cruickshank, Director of Energy and Innovation, **Department for Business, Innovation and Skills** (formerly on the CT Board)

#### *Investors*

Alex Hook, **NESTA**

#### *NGOs and think tanks*

Karen Lawrence, Policy Officer, **Local Government Information Unit (LGIU)**

Arnold Black, Deputy Director, **KTN Environmental Sustainability**

Jonathan Essex, **Bioregional**

#### *Researchers and analysts*

Florian Kern, Research Fellow, **SPRU, Sussex University**

Joe Ravetz, Co-Director, CURE, **SED, University of Manchester**

Matt Prescott, **independent expert**, formerly director of Carbon Limited at Royal Society for the R  
Encouragement of Arts, Manufactures and Commerce

**References**

BERR, DEFRA, DIUS (2008) UK Environmental Transformation Plan, 2008

Carbon Trust (2009), Annual report 2008/09

Carbon Trust (2009), Delay T., Carbon Trust Chief Executive, 'UK clean tech sector a hotbed of innovation, GBP 18m Investment Boost For UK Clean Tech Sector', press release, 19 October 2009

\*\*Daily Hansard - Written Answers (2009), 13 July 2009: Column 33W, Carbon Trust: Energy Saving Trust, <http://www.parliament.the-stationery-office.co.uk>

\*\*Daily Hansard - Written Answers (2009), 30 March 2009: Column 922W, <http://www.parliament.the-stationery-office.co.uk>

Environmental Data Services (2001), 'The Carbon Trust: picking winners in the climate change game', ENDS Report 322, November 2001, pp 23-26

\*\*Environmental Data Services (2007), 'Carbon Trust on track to help organisations meet CO2 reduction target', ENDS Report 395, December 2007, pp 12-12

\*\*Environmental Data Services (2008), 'UK launches world's first footprinting standard', ENDS Report 406, November 2008, pp 26-28

\*\*Environmental Data Services (2008), Carbon Trust's progress is 'pretty small beer', ENDS Report 401, June 2008, p 59

Environmental Data Services (2009a), 'Carbon Trust emissions standard slow to take off', ENDS Report 415, August 2009, p 8

\*\*Environmental Data Services (2009), 'Carbon Trust side-steps freedom of information', ENDS Report 408, January 2009, pp 8-9

Environmental Data Services (2009b), 'Carbon Trust under fire from energy consultants', ENDS Report 410, March 2009, pp 6-8

\*\*Environmental Data Services (2009), 'Green business: the UK's struggling giant', ENDS Report 411, April 2009, pp 32-35

\*\*Environmental Data Services (2009), 'Green commission faults UK low-carbon strategy' ENDS Report 413, June 2009, pp 9-10

\*\*Environmental Data Services (2009), 'Low-carbon industrial strategy revealed', ENDS Report 414, July 2009, pp 43-44

House of Commons (2008), Committee of Public Accounts, 'The Carbon Trust: Accelerating the move to a low carbon economy', Twenty-first report of session 2007-2008, HC157, May 2008

Kern F. (2008) Fostering innovation for sustainable energy systems: Lessons from the Carbon Trust in the UK, Paper to be presented at the DIME International Conference "Innovation, sustainability and policy", GREThA, University Montesquieu Bordeaux IV, France, 11-13 September 2008

Kern F. (2009) The Carbon Trust: A model for fostering low carbon innovation in the transition countries?, *Economic and Environmental Studies*, Vol. 7, No. 1, 34-47, October 2009

MHB - Morgan Harris Burrows (2007), The Carbon Trust Innovation and investment, A report to the National Audit Office

National Audit Office (2007), 'The Carbon Trust, Accelerating the move to a low carbon economy', Report by the Comptroller and the Auditor General, HC 7 Session 2007-2008, 22 November 2007

OECD (2008) Public-Private Partnerships, In Pursuit of Risk Sharing and Value for Money, Paris

Policy Innovations (2009) O'Neil E., Interview of Michael Rea and Scott Kaufman, 'Green Business Boom for Carbon Trust, TRANSCRIPT', Carbon Trust, April 8, 2009, [http://www.policyinnovations.org/innovators/people/data/evan\\_oneil](http://www.policyinnovations.org/innovators/people/data/evan_oneil)

\*\*Tax Payers Alliance, 'British Environmental Group Expands into America at Taxpayers Expense', <http://www.taxpayersalliance.com/bettergovernment/2009/08/british-environmental-group-expands-into-america-at-taxpayers-expense.html>, 2009

\*\*UK Trade & Investment (2009), UK Low carbon international marketing strategy, Case study: Carbon Trust



## SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA

### Introduction

This case study examines the potential role of public-private partnerships (P-PPs) in promoting eco-innovation on the basis of Sustainable Development Technology Canada (SDTC). Created by the Government of Canada in 2001, this foundation manages two investment funds with a total of over CAD 1 billion, one for sustainable development technologies and the other dedicated to biofuels. The case study considers the relevance and efficiency of this dedicated instrument for supporting eco-innovation. SDTC has been evaluated several times; the most recent report was published in 2009 and reviewed its investment strategy and the efficiency of its internal operations.

This is not a traditional *ex post* evaluation report. It considers the main economic and working assumptions of SDTC as a public policy instrument as they relate to the specific features of eco-innovation in order to discuss their potential relevance and efficiency. The analysis is based on four key questions, which are discussed in the following sections of the report:

- Why a specific fund for eco-innovation, with public investment?
- Is the scope of eco-innovation homogenous enough for a coherent investment strategy?
- How does a P-PP compare with alternative instruments to support innovation?
- How does a public instrument dedicated to eco-innovation such as SDTC stand up to the criticisms regularly addressed to P-PPs?

### **An instrument framed for the specific features of eco-innovation?**

Following 16 tenders since 2002, SDTC has received 1 760 applications involving more than 5 000 participants. In December 2009, 183 projects had been selected for a total public investment amounting to CAD 464 million.

Eco-innovation exhibits a number of distinctive economic features. Fieldwork research and academic literature have identified the following key elements:

- Contrary to innovative products based on the creation of a new utility or quality improvement, there is no clear, undisputed, instantly valued and widely shared evaluation of superior utility for green products or services. Most have higher prices but do not offer superior performance, quality improvement or satisfaction of a previously unmet need. They usually offer an alternative to existing solutions with improved environmental impact at a higher price.
- The economic evaluation of eco-innovative products requires a life-cycle analysis to take into account savings over a long period of time. Even direct customer benefits such as energy saving must be aggregated on a life-cycle basis to compensate for the purchase price premium. External effects such as pollution or climate change are even more difficult to value on an individual consumer basis.

- Some green technologies involve network externalities (knowledge spillovers or facilitating infrastructure networks).
- Eco-innovation combines traditional product innovation valid in a specific market or sector with horizontal enabling innovation, potentially valid for any sector.
- Very often, eco-innovation involves several independent technological trajectories (*i.e.* limited demand substitution or R&D economies of scope) and thus raises irreversibility issues for public support or firms' R&D effort.

These features call for specific public instruments to stimulate and support innovation. The question is then: how does a public-private partnership, and in particular public venture capital such as SDTC in Canada, meet the specific needs of eco-innovation? In practical terms, three issues should be examined: Does this instrument facilitate a better and comprehensive evaluation of the utility an eco-innovation offers the customer? Does it consider product as well as horizontal (cross-sector) innovations? Does it encourage the parallel development and exploration of alternative technical trajectories for a given eco-objective?

The key role of combining public funding with private investment was underlined in Europe by a Green Paper on P-PPs published by the European Commission in 2004. Building on a series of domestic initiatives, it seeks to encourage P-PPs as a way of raising investment through administrative and financial incentives. The core idea is that the private sector will play an increasingly important role in financing infrastructure and modernising public services. The rationale is that governments, constrained by their growing public deficits, debt and EU fiscal rules, cannot alone make the necessary investment in public services and guarantee their affordability and the best possible quality in the future. P-PPs are proposed as an efficient and innovative enabling instrument to complement government efforts with private funding. Like Europe, Canada and the United States have promoted the idea of P-PPs and encouraged their development.

While P-PPs can be implemented for a wide variety of services, the focus of this case study is innovation, new technologies and the associated R&D investment. Economic theory has long established the legitimacy of public intervention in this area to cope with market failures associated with the high level of uncertainty, the presence of positive externalities, and the long-term horizon of profitable returns. However, in most cases, the resulting policy mainly focuses on the early stages of technology development, with instruments such as R&D grants and the provision of public research facilities (laboratories, testing platforms, patent office). The idea is that, once the fundamental, applied research and prototype stages have been successfully overcome, the investment in product design, demonstration and commercialisation should be borne by private companies, which will benefit from the associated economic profits. While this assumption is indisputably true in many cases (cars, consumer goods, services), the specific features of eco-innovation raise additional challenges in later stages of the technology life cycle.

Before moving to market commercialisation, it is essential to prove the effective customer value of the eco-innovation in full-scale, real-world test situations. Given the lower cost of existing non-green substitutes, many eco-innovations would otherwise face levels of uncertainty and risk that could compromise their successful commercialisation. The demonstration stage is vital, not only to prove the technical validity of the technology in the field, but also to demonstrate the economic utility to the consumer and to stimulate early demand. Another element should also be considered from a public welfare perspective: for a given environmental benefit and generic utility, several technological alternative trajectories often are in competition, with limited or no economies of scope in R&D between them. There is the example of renewable power, with wind, solar, biomass, hydro and geothermal as alternative and independent solutions; even within the solar field, there is competition between solar tower, polycrystalline modules and thin films. In such a technological environment, it may be important from a public interest

perspective to encourage the parallel development of several trajectories, in order to avoid future lock-in or dependency on foreign innovations. This implies a larger and more costly development effort than concentrating all resources on a single trajectory, with an unavoidable level of duplication and inefficiency.

This explains why, at the firm and country level, the demonstration and development stage between research and commercialisation for an eco-innovation involves higher than usual uncertainty and larger investment intensity. There are technological, financial and market risks which no normal investors (private companies, business angels, venture capital, private equity, banks) will undertake alone. Even if venture capital investment in “clean tech” has grown rapidly since 2005 (to CAD 5.4 billion in 2009 according to the Cleantech Group) and now leads investment in biotechnology and software, this is not yet sufficient to cover the financing gap for demonstration and development in the eco-innovation chain. This gap has two negative consequences in terms of welfare: *i*) barriers to market entry are too great for potentially viable entrepreneurs and innovators; and *ii*) it lowers the return on investment in fundamental and applied upstream research, as no revenue will be derived from the commercialisation of successfully developed products or processes.

This market failure makes the case for a dedicated public instrument. SDTC’s project is in line with this objective.

To close this gap, a SD Tech Fund was established by SDTC in 2001. It aims at supporting the late-stage development and pre-commercial demonstration of clean technology solutions. CAD 350 million were initially allocated to support climate change and clean air projects. An additional CAD 200 million were provided in 2005 for clean water and clean soil projects. The fund does not act like a traditional source of venture capital (VC), as it does not take an equity stake in the companies or ask for repayment of any kind for the financial contribution it provides. It does not claim ownership of the intellectual property. The rationale is that the fund works as a catalyst for a project with a grant that helps overcome the financial barrier in the demonstration and development stage and encourages private investment to leverage this public funding. Risk reduction therefore appears to be the main objective of this instrument. The target of public support is also limited to a given project or innovation, not a company as a whole as in the case of equity investors. Finally, most projects involve a consortium of several firms and/or academic institutions. This instrument can be justified from a welfare perspective by the economic spillovers from the successful commercialisation of eco-innovations. The 2010 corporate plan describes this public objective in the following terms: “to increase each project’s chances of successfully getting to market and to help Canadian entrepreneurs carry out their innovation efforts within Canada. [...] To improve the productivity and the global competitiveness of the Canadian industry.” (SDTC, 2010)

Beyond the specificity of this funding mechanism, a public instrument such as SDTC also differs from private capital on several key points:

- it can accept longer time horizons, beyond the average 5-7 years of VC investment in a company;
- factors other than financial profitability can be considered in the investment decision, such as job creation, environmental benefit or local economic development;
- information, knowledge and results can be shared in a targeted community.

The second of these defines an important specificity of SDTC as a public instrument. The SD Tech Fund evaluation of applications (statements of interest) explicitly refers to the notion of “sustainability”, which is not a financial criterion, but a mix of environmental, economic and social considerations. The issue of knowledge sharing and spillovers is discussed below.

Once the economic rationale of the instrument is defined (financing a gap in the innovation chain for technology demonstration and development) and justified, one must then consider how an organisation like SDTC deals with the horizontal nature of some eco-innovations and with cases of proliferating technological environments. The general investment criteria in SDTC's selection process do not rule out horizontal innovation or the financing of two or several alternative competing technologies for the same utility. But only a study of the 183 selected projects (as of December 2009) can show if this occurs in practice. The diversity of the sample can be judged along three dimensions: sector, technology and geography. Even if energy (production and utilisation) clearly appears as a priority, Table 4 shows that quite a wide range of sectors benefit from SDTC funding.

**Table 4. Distribution of SDTC funding by sector**

Sector	Number of projects	SDTC funding (CAD millions)	SDTC funding breakdown
Energy exploration and production	29	109	23%
Power generation	28	84	18%
Energy utilisation	52	98	21%
Transport	27	80	17%
Agriculture	12	36	8%
Forestry, wood and pulp & paper products	10	16	3%
Waste management	26	45	10%

Source: SDTC, December 2009 data.

Moreover, Table 5 shows the potential horizontal nature of the associated eco-innovations by listing for each sector the type of environmental benefits achieved by the selected projects.

**Table 5. Environmental benefits of the projects funded by SDTC by sector**

Sector	Number of projects	Environmental benefits			
		Climate change	Clean air	Clean soil	Clean water
Energy exploration and production	29	26	27	6	6
Power generation	28	26	27	2	2
Energy utilisation	52	45	46	12	20
Transport	27	25	18	2	4
Agriculture	12	10	11	11	10
Forestry, wood, pulp &, paper products	10	9	9	5	1
Waste management	26	18	19	18	22

Source: SDTC, December 2009 data.

In terms of technological coverage, the 183 funded projects cover a total of 106 technology areas. This indicates significant diversity but also leaves room for parallel exploration of competing alternative trajectories.

Finally, it is worth considering the geographical dimension to test for potential bias. Table 6 therefore compares the share of SDTC funding by province with the relative weight of the region's GDP in the Canadian economy. It indicates quite a fair geographical distribution of project funding (extreme values of the ratio between a province's GDP and SDTC funding correspond to small figures). When looking at the details of selected projects, it is clear that in the four main provinces in terms of SDTC funding (88% of the total), all seven sectors are covered with the sole exception of transport in Alberta.

**Table 6. Relative SDTC funding and GDP by province**

Province	GDP 2008 (CAD millions)	Share of 2008 GDP	SDTC funding	Share of SDTC funding	Ratio
Ontario	532 209	40.3%	182	38.7%	1.0
Quebec	269 665	20.4%	67	14.3%	0.7
Alberta	185 780	14.1%	53	11.3%	0.8
British Columbia	164 520	12.5%	111	23.6%	1.9
Manitoba	42 407	3.2%	11	2.3%	0.7
Saskatchewan	41 583	3.2%	26	5.5%	1.7
Nova Scotia	29 215	2.2%	8	1.7%	0.8
New Brunswick	23 351	1.8%	2	0.4%	0.2
Newfoundland and Labrador	19 953	1.5%	0.7	0.1%	0.1
Prince Edward Island	4 148	0.3%	9	1.9%	6.4

Source: SDTC, December 2009 data.

All these elements lead to the conclusion that SDTC is a policy instrument that properly takes into account in its economic model and its practical implementation the specific features of eco-innovation.

### **A coherent and articulated investment strategy for eco-innovation**

The second issue to consider is whether and how a public institution such as SDTC should structure a coherent and articulated investment strategy for eco-innovation. Given the huge variety of technical projects and the on-going "greening" affecting every economic activity, there is a clear risk of dilution and dissipation of the necessarily limited financial resources available. This raises two distinct questions: Where should the boundaries be drawn? Do the many eco-innovation projects generate positive externalities that could be valued and capitalised by the funding institution?

To implement an efficient and generic selection process, SDTC has been mandated to allocate funds to four types of environmental benefits: climate change, air, water and soil. Every statement of interest for a technical project is rated along these four dimensions and the sustainability criteria defined above. This analytical framework is used to test the eligibility of a given project, without pre-defining a set of targeted sectors or technologies. Owing to the nature of eco-innovation, proposals can come from any sector of the economy and a diversity of technological backgrounds.

This allows the fund to monitor the balance of funding over time according to its initial political objectives. Of the SD Tech Fund's total endowment of CAD 550 million, CAD 350 million were earmarked for projects with an environmental benefit related primarily to climate change (80%) and clean

air (20%). This initial orientation was implemented in practice in the fund's operations. In December 2008, 92% to 95% of the designated funds had been allocated to projects in these areas. Additional priorities for clean water and soil (introduced with a complementary CAD 200 million from the federal budget in 2004) have also been clearly taken into account in project selection. Of the total portfolio of 154 SDTC projects in December 2008, 91% have climate change benefits, 84% have clean air benefits and 38% have soil or water benefits.

As detailed above, the rating of the four environmental benefits does not preclude a significant diversity of sectors, technologies and products/services, and 88% of SDTC projects have more than one environmental benefit. Moreover, 11 of the 123 currently active projects financed in December 2008 by the SD Tech Fund combine the four environmental advantages, thereby demonstrating the clear horizontal character of the eco-innovation involved. Three projects cover only one of the four environmental dimensions considered. Among the 24 completed projects, three cover the four categories and four cover only one.

While cleaner air, soil and water are clear and restricted goals of technological eco-innovation projects, climate change has a much larger and more diverse objective. The different available solutions for climate change mitigation are reviewed in *Energy Technology Perspectives* (IEA, 2008) according to their potential contribution to the necessary reduction of greenhouse gas emissions between 2010 and 2050. Energy (fuel and electricity) efficiency (36% of the global reduction effort), renewables (21%), and carbon capture and storage (CCS, 19%) are the leading technological fields in terms of the potential volume of carbon abatement. However, CCS demonstration projects require levels of capital investment and support funding well beyond the financial capacity of the SD Tech Fund (the same is true for nuclear power generation). Nonetheless, some associated technologies or equipment development for CCS systems have been selected for the fund's portfolio. Most of the projects deal with efficiency of power generation, renewable power and to some extent end-use efficiency.

In summary, the "climate change" target and the selection criteria work as an effective framework for structuring a coherent and articulated investment strategy for the fund, while authorising a wide variety of technologies and applications.

The objective of the SD Tech Fund is not limited solely to the funding of demonstration and development technological projects. As a public instrument, it also aims at generating larger collective benefits for the Canadian economy, as detailed in the SDTC corporate plan. Its purpose 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 among diverse persons in the private sector and in academic and not-for-profit organisations 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;
- ensure timely diffusion by funded recipients of new sustainable development technologies in relevant market sectors throughout Canada.

The second element clearly refers to the economic notion of "national system of innovation", here in the environmental field, and the emphasis is on the collective dimension and multiple interactions in the innovation process. The review of selected projects illustrates this concern as the consortia combine large corporations, start-ups, universities, laboratories and a few NGOs. SDTC also stresses that the timely

relevance and market prospects of the proposed technical projects are to be explicitly assessed in the due diligence carried out by the fund's team (based on the model of venture capital firms).

Finally, a last issue should be considered. Beyond technical projects, SDTC also targets the community of Canada's clean-technology entrepreneurs. To do so, the SD Tech Fund needs to accumulate expertise in the financing, management and eco-technical evaluation of eco-innovation in order to train firms' managers and improve their skills and capacities. However, the organisation and practical implementation of the corresponding knowledge transfer and experience sharing is not clearly detailed. With nearly 200 projects supported, SDTC will certainly gain vast experience in the development and diffusion of eco-innovation. In particular, it should be able to identify common bottlenecks or skills requirements with a view to further dedicated action. Still, there is currently little information on the method and instruments SDTC intends to use to carry out this collective task (apart from individual support of managers in selected projects) and make the most of the positive externalities.

The SD Tech Fund portfolio does not at present include projects in services, such as generic services for supporting and facilitating eco-innovation in the firms and regulatory issues, scaling-up and industrialisation, human resources. This is a complementary dimension of public intervention in favour of eco-innovation which could be addressed. In particular, the dissemination of SDTC results and the exploitation of the knowledge it has gained regarding eco-innovation could help define and shape a more relevant and efficient range of supporting services. The resulting competitiveness of business services would in turn strengthen the local technological and business network and improve the attractiveness of the country for eco-operations.

#### **P-PPs vs. alternative instruments to stimulate and support eco-innovation**

Even if the kind of operations carried out by SDTC cannot be strictly assimilated to a P-PP mechanism, the relevance of a public grant for technology demonstration and development must be compared to alternative available forms of public intervention. This suggests considering the economic efficiency of the instrument. The central argument in the SDTC scheme is that a public grant will help overcome the very high barriers to effective demonstration of the technology's potential, but will also trigger large additional private investments, given the reduced level of uncertainty. To try to evaluate the extent of the financial leverage allowed by public funding, Table 7 summarises the main features of the leveraging by private companies of SDTC funding: minimum value, maximum, average, mean and standard deviation, based on the sample of 147 projects run by SDTC at the end of 2008.

**Table 7. Leverage of SDTC funding**

CAD millions

	SDTC funding	Leveraged funding	Ratio
Minimum	0.15	0.18	0.51
Maximum	13.90	36.39	5.96
Average	2.53	5.10	1.92
Mean	2.00	3.55	1.88
Standard deviation	2.14	5.62	0.83

Source: SDTC, 2008

These data show the ability of the public funding of the selected projects by SDTC to stimulate a real financial commitment from private firms. Only 14 projects (9.5% of the total) have a leverage ratio lower than one; and 57 (39%) have a leverage ratio higher than 2. The small value of the standard deviation means that 68% of the selected projects have a leverage ratio between 1.1 and 2.7.

This result offers a new perspective on the traditional assessment of P-PPs as a policy instrument. It should first be recalled that the term still lacks an internationally agreed definition. It is used in practice to cover a wide variety of institutional arrangements between public authorities and the business world in some fields of public interests. It covers for practical purposes two distinct cases: first, financing a public-sector capital investment project with a private company or a consortium of private firms; and second, contracting for delivering services, usually operating the capital assets financed through the first scheme. This raises two central but rather different issues for public authorities: Is a P-PP a better way of financing the necessary capital investment than existing alternatives? Is a P-PP a better way of operating the service than alternatives? In the case of eco-innovation support, only the first issue has to be considered: the efficiency of public funding for technology demonstration and development of an eco-innovation.

The usual argument claims that the government can borrow money on international financial markets more cheaply than any private company (for a mix of reasons involving economic size, capacity to raise taxes if necessary, legitimate sovereignty). In this context, a P-PP is at a disadvantage for financing capital expenditure compared with finance raised by government borrowing. There must therefore be significant efficiency gains from involving the private sector in order to offset the additional borrowing costs. This argument has however to be revisited in the light of the current worldwide economic and budgetary crisis and the specific features of eco-innovation. Public stimulus to sustain economic growth has raised the total public debt in many countries to levels that push interest rates sometimes above those faced by large private corporations. In addition, the high level of risk and uncertainty associated with most eco-innovations is not compatible with the usual market mechanisms. There is thus room for mutually profitable co-operation between the public and private sectors to amplify entrepreneurial initiatives and facilitate scientific breakthroughs in commercially viable environmental applications for the market.

### **How does SDTC cope with the usual criticisms addressed to P-PPs?**

Finally, one has to consider the usual criticisms of P-PPs. A range of concerns have emerged about the use of P-PPs based on considerations of the public interest: *i)* long-term liabilities and a concern that the P-PP may transfer investment costs from present to future generations; *ii)* dangers of fragmenting and worsening working conditions for employees in public services; *iii)* transparency of the process of allocating funding for projects and potential risks of corruption; *iv)* potential future lock-in; and *v)* unbalanced negotiating positions owing to information asymmetries with private partners. SDTC, as a public mechanism which funds technological demonstration and development projects, is only affected by the first and the third arguments.

As far as long-term liabilities for future generations are concerned, the limited level of public assets allocated to the SD Tech Fund (CAD 550 million) clearly restricts the corresponding risk. This sum is divided among a great number of projects, for an average support amounting to CAD 2.5 million, which means that even with a high rate of failure, the final public cost is capped. Regarding transparency and corruption concerns, two safeguards should be underlined. First, an independent selection committee (with a minority representation from the federal government) has been established by SDTC and a clear framework based on due diligence procedures implemented for evaluating statements of interest by companies or consortia. Second, SDTC co-operates with companies through non-repayable grants and does not take any equity stake or intellectual property ownership of the demonstrated innovation. While this might be considered as too weak a signal in terms of financial commitment to the success of the project



compared to venture capitalist operations, such an approach clearly forecloses any risk or temptation of corruption based on future financial benefits.

The review of the four fundamental questions raised by a public fund for eco-innovation demonstrates that SDTC plays a very positive role in enhancing Canada's competitive position in the environmental field. Though the services side is still not considered and the dissemination of accumulated experience is not formally organised, this original public instrument successfully passes the different tests examined here. Whether such an instrument will be made durable with sufficient public financing over time to effectively reach its objectives, and ultimately improve Canada's position in the world competition on environmental innovation, is still however an open question.

## References

International Energy Agency (2008), *Energy Technology Perspectives*, Paris, France

SDTC (2008), Supplement to the 2008 Annual Report

SDTC (2010), *SDTC Corporate Plan - Executive summary*  
([http://www.sdtc.ca/uploads/documents/en/Executive\\_Summary-2010.pdf](http://www.sdtc.ca/uploads/documents/en/Executive_Summary-2010.pdf) )

\*\*UNEP & New Energy Finance (2008) *Public Venture Capital Study*, SEF Alliance, Basel.