

ACCELERATING GROWTH

FOSTERING ENVIRONMENTAL TECHNOLOGY INNOVATION & COMMERCIALIZATION IN ATLANTIC CANADA

A Report for the Atlantic Environment
Technology Advancement Network (AETAN)

By

ÆGIS Management Consulting Group (2004) Inc.

In association with

Lorne Ferguson Consulting

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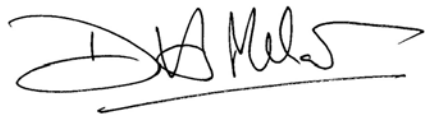
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Finally, special mention should be given to those firms that completed the online survey. We acknowledge that most firms are over-surveyed by a diverse array of government-funded studies. However, without industry input this report would have lacked focus and direction.



David H Millar
President & CEO
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Date: August 25, 2005

DISCLAIMER

The information presented is the research, interpretation and opinions of the consultants (individually and as a team). It does not represent the position of the Atlantic Environment Technology Advancement Network (AETAN), the Atlantic Canada Opportunities Agency (ACOA), Environment Canada, Industry Canada, NRC-IRAP, or the members of the Steering Committee either as individuals or as representatives of their respective departments or agencies.

Whilst every care has been taken to validate, and present in an accurate manner, the research used in compiling this document, readers should confirm this for themselves.

ACRONYMS

ACN	Atlantic Commercialization Network
ACOA	Atlantic Canada Opportunities Agency
AESN	Atlantic Environmental Science Network
AETAN	Atlantic Environmental Technology Advancement Network
AETCP	Atlantic Environmental Technology Commercialization Partnership
AIF	Atlantic Innovation Fund
ATP	Advanced Technology Program
BDC	Business Development Bank of Canada
BDP	Business Development Program (ACOA)
CCHREI	Council for Human Resources in the Environment Industry
CCIE	Cisco Certified Internetworking Expert
CEE	Central and Eastern Europe
CETAC	Canadian Environmental Technology Advancement Centre
CFI	Canadian Foundation for Innovation
CTN	Canadian Technology Network
CIDA	Canadian International Development Agency
CRTI	CBRN Research & Technology Initiative
CSA	Commercialization Specific Assistance
CSI	Commercialization Specific Initiatives
EC	Environment Canada
ET	Environmental Technologies
ETP	Emerging Technologies Program
ETV	Environmental Technology Verification Program
FCM	Federation of Canadian Municipalities
GHG	Greenhouse Gas
IC	Industry Canada
IERD	Industry Energy R&D Program
IRAP	Industrial Research Assistance Program
ITA	Industrial Technology Advisors
NBDAFA	New Brunswick Department of Agriculture, Fisheries & Aquaculture
NRC	National Research Council Canada
NRCan	Natural Resources Canada
NSERC	National Science & Engineering Council of Canada
MIP	Market Incentive Program
MUN	Memorial University of Newfoundland & Labrador
PEMD	Program for Export Market Development
PERD	Panel for Energy Research & Development
REDI	Renewable Energy Deployment Initiative
RETP	Renewable Energy Technologies Program
ROI	Return on Investment

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SBIC	Small Business Investment Companies Program
SBIR	Small Business Innovation Research Scheme
SDTC	Sustainable Development Technology Canada
SME	Small to Medium Sized Enterprise
SR&ED	Scientific Research & Experimental Development Program
STSIB	Industry Canada – Sustainable Technologies and Services Branch
TEAM	Technology Early Action Measures
TPC	Technology Partnerships Canada
TRANSET	Transportation Energy Technologies Program
UNB	University of New Brunswick
UPEI	University of Prince Edward Island
VC	Venture Capital
WPPI	Wind Power Production Incentive

EXECUTIVE SUMMARY

With the international market for environmental technology, goods and services valued at almost \$1 trillion and growth at a rate of 3 percent per year, the global opportunity for Atlantic Canadian small firms in the environment sector is immense. Strategically successful firms will be those that have a distinct competitive advantage or technology, R&D capacity, and the ability to partner with government, research and industry players – regionally, nationally and internationally.

Making the innovation to commercialization process more amenable to smaller companies in Atlantic Canada is vital to the growth of the industry. The sub-sectors, for which Atlantic Canada is recognised as having a high level of skills and expertise, i.e. solid waste, remediation, water/wastewater treatment and consulting, are also areas of intense competition from the U.S., Europe and Asia. Atlantic Canadian SMEs need to increase their capacity to develop new innovative technologies and in doing so also to increase their ability to bring these technologies to the global market.

Structurally, the Atlantic Canadian environmental technologies sector is dominated by small and micro-sized firms with relatively few larger, successful companies. This gap in the “middle ground” of the industry is a major weakness limiting the ability of companies to allocate resources that would enable them to successfully compete internationally and to develop innovative technologies.

Although a huge and growing market, the competitive nature of the global environment sector and the rapid development of technologies to address key environmental problems/opportunities, dictates that a strategy for growth should be based on accelerating the capacity of Atlantic Canadian SMEs to innovate and compete. A strategy of incubation or “normal” growth is insufficient; therefore our theme for this study is “*Accelerating Growth*”.

This study, commissioned by the Atlantic Environmental Technology Advancement Network (AETAN), and commenced in the fall of 2004, sought to address these and other issues arising from the research. The overall purpose of the project is defined in the following sentence –

Identify a model and/or mechanism that would effectively engage and support Atlantic Canadian firms, particularly SMEs, in environmental technology innovation and commercialization.

The approach used during the study included primary (survey, interview and group) and secondary research methodologies; comparative analysis of international models and programs from Canada, the U.S., Ireland, Finland and Israel; and strategic analysis and interpretation of the findings.

The core issues and needs identified through the survey of environmental technology SMEs in Atlantic Canada are summarized in **Table 1** below.

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Table 1: Core Issues and Support Needs of Atlantic Canadian Environmental Technology SMEs (Source: AEGIS Management Consulting Group (2004) Inc.)

ATLANTIC CANADIAN TECHNOLOGY FOCUS	<ol style="list-style-type: none"> 1. Solid waste/waste services 2. Water & wastewater treatment. 3. Remediation. 4. Environmental testing. 5. Renewable energy.
MAJOR BARRIERS & CHALLENGES	<ol style="list-style-type: none"> 1. The regulatory environment at all levels of government. 2. Marketing and sales. 3. Capital Investment. 4. The ability to commercialize. 5. Partnerships.
SUPPORT NEEDED	<ol style="list-style-type: none"> 1. Pre-commercialization funds 2. Financial support for demonstration projects 3. Assistance to access funding. 4. Government to take up role as "first user" 5. R&D support. 6. Partnering. 7. Coordinated access to government programs and services.

From our research the "hot" issues for Atlantic Canadian firms that should be addressed by any model or mechanism are -

1. The **regulatory environment** at all levels of government; and access to government programs and services;
2. **Understanding markets**, competition and marketing requirements;
3. Access to financing and **capital investment** is a barrier to growth of environmental technology SMEs;
4. An industry-driven approach to **commercialization** is required and an approach that is tailored to benefit Atlantic Canada's SMEs; and
5. The need for **focused collaboration** between industry, universities, research organizations, and government on a regional, national and international level.

The report identified that a strategic and focused approach which recognises and builds on the region's unique input advantages was necessary. In support of the model we have proposed a number of strategic and operational recommendations.

The model proposed, which has been given the working title of the **Atlantic Environmental Technology Commercialization Partnership (AETCP)**, is a not-for-profit company, overseen by an *Executive Board* constructed from industry and research/academic fields, and an *Advisory Board* encompassing regional, national and international expertise.

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The mission of AETCP is envisaged as -

To support the creation, and growth, of environmental technology-based SMEs in the four provinces – New Brunswick, Newfoundland & Labrador, Nova Scotia and Prince Edward Island – of Atlantic Canada, and accelerate their development by facilitating focused commercialization and innovation.

The model's scope is defined as -

1. To create a strategic and focused plan for industry development and collaboration;
2. To provide seamless and coordinated access to government programs and services and in doing so to provide leadership and direction in the area of the rationalising and harmonizing environmental regulations and enforcement across all Atlantic Canada's provinces, and access to financing at all stages of the continuum from innovation to commercialization;
3. To accelerate the development of enabling environmental technologies through demonstration projects and the showcasing of best practice;
4. To develop the firms' knowledge, understanding and experience in key markets and to encourage international partnering and collaboration networks; and
5. To accelerate the growth of the environmental technologies sector by creating a collaborative network of government, buyers/customers, suppliers and service providers, and research institutions.

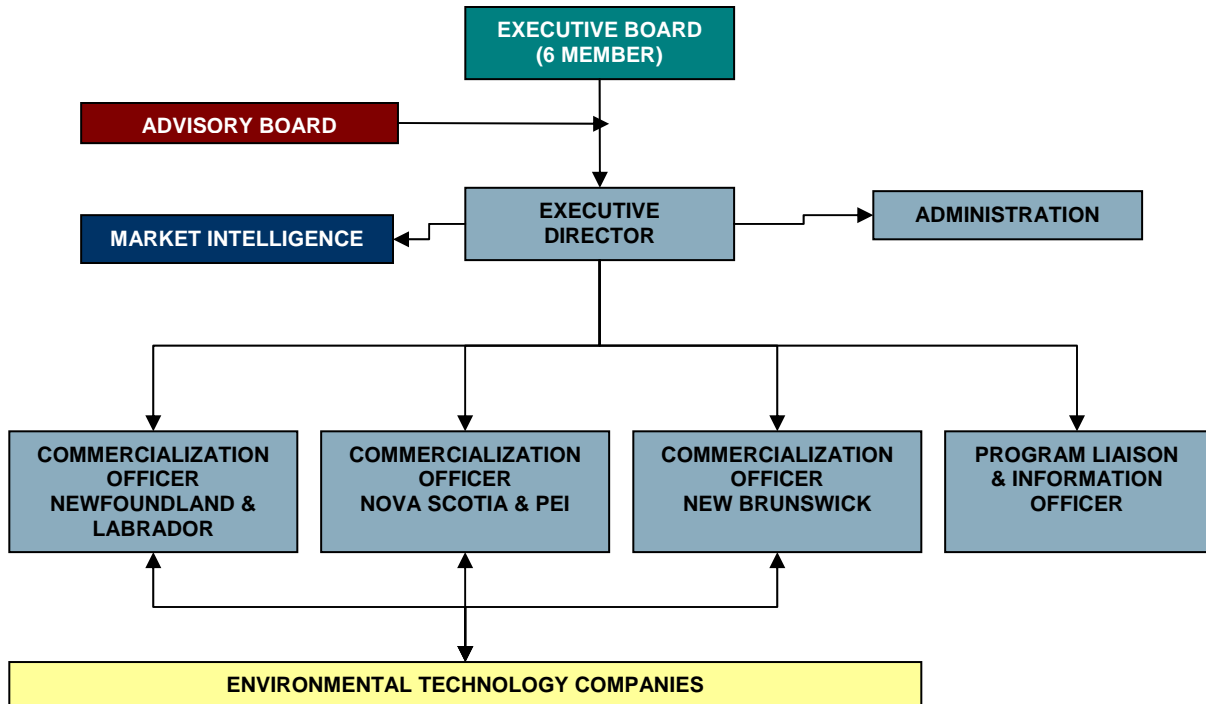
Partnering agreements will be established with existing commercialization agencies to co-locate AETCP's field staff and provide administrative support. AETCP field staff will receive direction from a tightly woven management and support team based in a partner organization.

The organizational structure is illustrated in **Figure 1** below.

AETCP will require development of specific tools, i.e. an *Atlantic Canada Environmental Technology Web-portal*, an *Environmental Technology Roadmap*, a *Business Acceleration Program*, and business diagnostics to achieve its mission.

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Figure 1: Proposed Organizational Chart for AETCP (Source: ÆGIS Management Consulting Group, 2005)



To ensure that innovative Atlantic Canadian SMEs have access to funding at each stage of their development, it is proposed that the organization should have access to financing in the form of an *Atlantic Canada Demonstration and Commercialization Development Program* and an *Atlantic Canada Environmental Technologies Pre-Commercialization Fund*.

As with comparable national and international models, AETCP will require significant government funding during its life-cycle. The budget for the operation of the proposed model is \$770,000 in the first year and \$706,000 in subsequent years. Over a five year minimum commitment period, AETCP will require \$3.594 million (not including the Seed Fund which is suggested at \$3 million). An Implementation Schedule is provided denoting timing, responsibilities and key milestones in our closing section. Our estimate is that AETCP could be launched in Fall 2005 if the foregoing implementation activities are commenced immediately.

AETCP's success will be judged by its success in facilitating, coordinating and supporting the growth of commercially viable, innovative environmental technologies SMEs in Atlantic Canada and in providing economic benefit to the region.

1. OBJECTIVES, METHODOLOGY & APPROACH OF STUDY

ÆGIS Management Consulting Group was engaged by the **Atlantic Environmental Technology Advancement Network (AETAN)**¹ in the fall of 2004 to provide a report on Fostering Environmental Technology Innovation and Commercialization in Atlantic Canadian SMEs. The following pages reflect the research, analysis and interpretation of our findings.

The approach used during the study included primary (survey, interview and group) and secondary research methodologies; comparative analysis of international models and programs from Canada, the U.S., Ireland, Finland and Israel; and strategic analysis and interpretation of the findings.

The overall purpose of the project is defined in the following sentence –

Identify a model and/or mechanism that would effectively engage and support Atlantic Canadian firms, particularly SMEs, in environmental technology innovation and commercialization.

Further details on the approach and methodology are found in **Annex A**.

2. INDUSTRY BACKGROUND

2.1 Global Environment Perspective

Canadian environmental companies face a challenging decade but it is also one of opportunity where the sector's competitive strengths, R&D capacity and ability to partner, allied to a strong relationship with Government will lead to success.

The environment industry is a critical enabling sector for mainstream industry as it moves toward sustainable development practices. Environmental problems and their solutions are increasingly global and their size indicates that they are most likely to have major impacts on the economy.

The opportunities presented by the private and public sectors in their attempts to remedy environmental issues will be with us for many decades. Industry is struggling to become cleaner; agriculture continues to create problems through the overuse of herbicides and fertilizers as well as of water in dry areas; transport presents environmental problems with respect to emissions, excessive use of land for infrastructure and congestion; tourism results in high, seasonal concentrations that

Success factors

- Competitive strength,
- R&D capacity,
- Ability to partner, and
- A strong relationship with government.

¹ AETAN consists of the following federal agencies and departments – Atlantic Canada Opportunities Agency (ACOA), Environment Canada (EC), Industry Canada (IC) and National Research Council Canada (NRC-IRAP). Formed in late 2003, AETAN's aim is the sharing of information on and consideration of ways for the federal government to better support environmental technology innovation in Atlantic Canada.

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put an environmental burden on the few popular vacation locations; and energy consumption is still largely reliant on fossil fuels.

The world market for environmental goods and services is valued at almost \$800 billion and is forecast to increase to almost \$1,000 billion by 2010 representing an annual growth of 3 percent. The environmental industry is therefore comparable in size to the pharmaceutical and aerospace industries.

Developed regions such as Western Europe, Japan and North America account for 85 percent of the world markets but exhibit low growth rates; they are high value but mature and intensely competitive markets. Higher growth rates are forecast for areas such as cleaner technologies and processes, renewable energy, waste management and environmental consulting services.

Environmental markets in developing countries such as Central and Eastern Europe (CEE), South East Asia, China and Latin America will see higher (6-10 percent) rates of growth, particularly in areas such as water and wastewater treatment, waste management, air pollution control and environmental monitoring and instrumentation. Developing countries will also see increasing demand for other environmental goods and services as their economies grow. This will include cleaner technologies, renewable energy, contaminated land remediation and environmental consultancy.

Canada has many successful, internationally recognised environmental manufacturing and service firms, such as Ballard Power Systems, Jacques Whitford, Golder Associates, Les Industries Fournier Inc., SNC-Lavalin, Stantec, the Hatch Group, Trojan Technologies Inc., and Zenon Environmental Inc.

Analysis of global competitiveness points to an opportunity gap in the resources management sector.

Consideration of global industry competitiveness (see **Table 2**) points to an obvious gap with respect to the resources management sub-sectors (water utilities, resources recovery, and environmental energy) where most of the global players from the US, Europe and Japan, have yet to establish dominance. Canadian companies are well placed to take advantage of this gap in supply and have demonstrated advantages such as -

- Leaders in solid waste management;
- Excellence in consulting & engineering services;
- High level of international experience in the analytical services sector;
- Renewable energy experience, e.g. in wind energy projects, which prove Canada is on the cutting edge of technology;
- Canadian research institutions and universities are strong in research and development (R&D); and
- Companies are learning to build partnerships and alliances to accommodate the diverse needs of customers.

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Potential market opportunities for Canadian firms have been identified as²:

- Process and prevention technology;
- Hazardous waste management;
- Remediation and industrial services;
- Analytical services;
- Resources recovery; and
- Environmental energy.

² Decade of Challenge – A Competitiveness Analysis of the Canadian Environmental Industry, 2003, ÆGIS Management Consulting Group, for Industry Canada

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Table 2: Environmental Industry Competitiveness (Source: EBI, AEGIS Management Consulting Group (2004) Inc. Atlantic Canada column derived from current study.)

	US	GERMANY	JAPAN	FR & UK	DEV. NATIONS	CANADA	ATL. CANADA
Equipment							
Water equipment & chemicals	G	G	GE	GE	MP	O	OM
Air pollution control	G	E	E	O	MP	O	OM
Instruments & Information systems	E	G	G	O	P	O	O
Waste management equipment	G	GE	OG	O	OM	O	O
Process & Prevention Technology	P	P	M	P	P	G	O
Services							
Solid waste management	G	OG	OM	EG	MP	GE	GE
Hazardous waste management	G	O	O	OG	P	G	O
Consulting & engineering	GE	OG	M	OG	MP	GE	GE
Remediation/Industrial Services	G	O	M	OM	P	G	GE
Analytical services	G	O	O	O	MP	E	O
Water treatment works	MP	M	MP	GE	MP	OM	GE
Resources							
Water utilities	MP	MP	P	GE	MP	O	OM
Resources recovery	O	OG	O	O	MP	G	G
Environmental energy	OG	OG	OG	OG	P	E	O

(Key: E = Excellent, G = Good, O = OK, M = Mediocre, P = Poor)

Source: Environmental Business International Inc., p5, Environmental Business Journal, Volume XII, No. 9/10. Based on ratings of technology, commercial orientation, management, finance, global presence, government support & labour. Amended by AEGIS Management Consulting Group, March 2003.

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Atlantic Canada is recognised as having excellence in solid waste, remediation, water/wastewater treatment & consulting.

The sub-sectors for which Atlantic Canada is recognised as being good-excellent - solid waste, remediation, water/wastewater treatment, consulting and engineering, are also areas of intense competition from other major regions such as the U.S., France, Germany and U.K. Although Atlantic Canada is considered as being "good-excellent" in solid waste management so also are companies from the U.S., France and the U.K. In the area of water/wastewater Atlantic Canadian companies are considered to be "good-excellent" but again face intense competition from the U.S., Japan and European companies. The remediation sector, however, does indicate opportunity with the main competition coming from the U.S.

Two areas – resources recovery and environmental energy, where Atlantic Canada is either rated good or OK, are sectors where international competition is weakest.

Opportunities for Canadian firms arise from four key influences –

1. Kyoto/Climate Change policies;
2. Government budget directions and funding initiatives;
3. Regulation and enforcement; and
4. Health and the environment issues.

The Decade of Challenge Report³ identified eight environmental industry sub-sectors representing the best opportunities for the Canadian industry in the next decade.

1. Water and wastewater treatment technologies;
2. Engineering and management consulting services (including geomatics);
3. Waste services (including solid waste management, landfill management & technologies, recycling technologies, and resource recovery);
4. Renewable energy (including wind, and solar generation sites and control systems, energy efficiencies and biomass);
5. Analytical goods and service (GHG analysis & emission monitoring, air pollution control);
6. Fuel cell technologies;
7. Remediation; and
8. Natural resource management.

Specific sub-sector opportunities, indicating the Canadian competitive advantage, source of future competition and timescale are presented below (See **Table 3**).

³ Decade of Challenge – A Competitiveness Analysis of the Canadian Environmental Industry, 2003, AEGIS Management Consulting Group, for Industry Canada

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Table 3: Environmental Opportunities for Canadian Companies (Source: AEGIS Management Consulting Group, 2003)

SUB-SECTOR	COMPETITIVE ADVANTAGE	STRONGEST COMPETITION	TIMEFRAME
Water and wastewater treatment technologies	Domestic experience, projects in developing countries, flexibility	France, UK, Spain, Japan	1-3 years
Waste services / solid waste management/ recycling technologies	Domestic experience, good research & development	Germany, France, UK, US	1-3 years
Engineering and management consulting services - real estate assessment, liability & risk assessment, geomatics	Internationally recognised expertise	US, Norway, Netherlands	1-3 years
Analytical goods (instrumentation) and services: GHG analysis & emission monitoring, APC	Leading company located in Canada, excellence in research & development	US, Germany, Switzerland, Japan	3-5 years
Oil & gas environmental technologies; oil spill management; marine pollution technologies	Industry growth and regulatory environment in Canada has provided foundation for development of expertise	US, UK	5 years
Environmental research & development	Centres of Excellence supported by federal and provincial programs	US	3-5 years
Fuel cell technologies	Leading edge research and development and partnership with companies in growth markets	US, Japan	8-10 years
Renewable energy: wind and hydro energy generation sites and control systems	Proven technology; research and development	Denmark, Germany, Spain, Japan	6-10 years
Environmental biotechnologies - contaminated land remediation	Canada's biotechnology focus; federal support; university centres of excellence	US, Germany	8-10 years
Natural resource management	Experience of managing domestic resources; highly developed regulatory environment	Germany, US	6-10 years

3. RESEARCH FINDINGS & INTERPRETATION

In developing our summary of the various research inputs (primary and secondary) we have focused on the primary inputs from our direct consultations and surveys with key stakeholders and the industry in Atlantic Canada. A full listing of reports consulted is provided in the **Bibliography**.

3.1 Literature Review

The main focus of the study is on primary research; however, an overview of literature considered appropriate to the issues raised later by the primary research is provided in **Annex B**.

3.2 Environmental Technology Company Survey

The full survey (with supporting charts) on the responses provided by Atlantic Canadian environmental technology firms is provided in **Annex E**. This section lists the main points from the survey and presents these in tabular format (see **Table 4**).

Table 4: Atlantic Canadian Environmental Technology Company Survey Results (Source: ÆGIS Management Consulting Group (2004) Inc.)

CATEGORY / SUMMARY OF SURVEY RESPONSE
<p>Company Background</p> <p>67 percent of the respondents had been in business more than 5 years with 17 percent being in business for 2 years or less. 50 percent of the respondents had less than 10 employees and 78 percent had 50 or fewer employees.</p> <p>Asked to define their stage of development the majority of firms (56 percent) replied growth and 22 percent considered themselves in a "mature" stage of development. There were no companies in the R&D or developmental stages of growth.</p> <p>In response to the question on whether their firm was generating revenue from their ET innovation and/or commercialization, 47 percent answered negatively with only 33 percent generating income from their ET innovation and commercialization activities.</p>
<p>Technology Focus and Market</p> <p>50 percent of the respondents reported as offering both products and services; 42 percent offered product only and 8 percent offered a service only. (This is not surprising given that the focus of the study is on environmental technologies).</p> <p>The respondents had a broad spread of environmental technology focuses with the main categories (in order) being remediation, environmental testing and renewable energy, waste and wastewater treatment, and waste services (collection, processing and disposal). The "other" category represented 69 percent of responses and again this elicited a wide spread of focus from biological controls, carbon capture and storage, due diligence of real estate through to environmental permitting and audits.</p>

"We have the ideas and can develop the technology. It needs Government to recognize and use these technologies – to jump start them. No one wants to be first."

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CATEGORY / SUMMARY OF SURVEY RESPONSE

The main customer groupings were agri-food, forestry, municipalities, government agencies, hazardous waste contractors and utilities. The “other” category also highlighted universities, real estate owners and the insurance industry as customers.

Key geographic markets were Atlantic Canada (68 percent of responses); US (63 percent); Other Canada (50 percent) and Western Europe (31 percent). Exports to developing countries were minimal.

Innovation and Commercialization Assistance Needed

In answer to “What does your business need to support ET innovation and commercialization?” the biggest response (69 percent) was grants and contributions, followed by access to capital (50 percent) and partners/partnering (44 percent). Other key support was scientific expertise and access to markets (both 31 percent).

A number of useful comments were also made in this category including better cooperation between industry and universities, and the tax system.

Company Research and Development Programs

80 percent of respondents have a R&D program in Atlantic Canada. Of those who did not have an R&D program 33 percent cited the lack of availability of capital for innovation and commercialization development and poor location as their reasons.

73 percent of respondents spend \$250,000 or less on R&D innovation annually (with 53 percent spending less than \$100,000). Only 27 percent spend \$250,000 or higher on R&D innovation per year.

33 percent of companies currently partner with universities (and/or other research institutions) to support ET innovation and commercialization. Dalhousie University, St. Mary’s University, Mount Allison University, University of New Brunswick, CANMET Energy Technology Centre (NRCan), and Nova Scotia Agricultural College were cited as partners.

60 percent of respondents use current government programming; 27 percent do not use any programs. Programs used included NRC-IRAP, Total Innovation Fund (NB), AIF, Genome Canada, NB Innovation Foundation, NBDAFA, CCHREI, ACOA, PEIBDC, PEMD and SR&ED tax credits.

60 percent of respondents are either not sure (40 percent) or do not find (20 percent) government policy supportive of their innovation/commercialization efforts. Comments on this question raised the issue of tax credits as being beneficial if they were targeted properly and if the process was not as “gruelling”. Also it was commented that current government purchasing policies do not provide incentives for local firms.

In response to whether firms considered that Atlantic Canadian universities effectively translated the transition from innovation to commercialization only 7 percent answered positively and 47 percent answered “no”. Several comments are interesting in that one respondent thought that the reward system of universities did not support commercialization. Another suggested that the required technology does not necessarily come from the regional universities.

Challenges and Barriers

The “hot” issues for Atlantic Canadian companies appear to be the regulatory environment, marketing and sales, capital investment, commercialization, and partnering.

In answer to the inquiry about primary challenges and barriers the main responses were –

- The regulatory environment was considered a serious to very serious challenge by 60 percent with 87 percent considering this a moderate to very serious challenge;
- 60 percent considered marketing and sales a serious to very serious challenge and if the “moderate” challenge category is included this rises to 80 percent of respondents;
- Capital investment was cited by 47 percent to be a serious to very serious challenge (this increases to 74 percent if “moderate” is included);

“Government initiatives seem only to handle step one of about ten. More complete initiatives from trade mission to final sale would be much more useful.”

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"As a very young company trying to develop environmental diagnostics we are frustrated by the process of accessing government funding. There seems to be a plethora of agencies that support our types of endeavour but determining which agency is best suited and getting through the application process in a timely fashion has proved challenging."

"Create a climate to support winners and you will have many more!?"

CATEGORY / SUMMARY OF SURVEY RESPONSE

- 40 percent considered the ability to commercialize a serious or very serious challenge (67 percent considered this a moderate to very serious challenge);
- Partnerships were considered a serious to very serious challenge by 40 percent with 67 percent considering this a moderate to very serious challenge;
- The political environment was considered a moderate to very serious challenge by 63 percent of respondents;
- Product development was considered a serious to very serious challenge by 60 percent of respondents and rated very serious by 33 percent of respondents; 60 percent considered technology investment a moderate to very serious challenge; and
- Domestic competition was not considered a serious challenge by 60 percent of respondents; international competition was considered a very serious challenge by 27 percent and a moderate to very serious challenge by 54 percent of respondents;

Other concerns were listed as IP/Patenting, customers, human resources, the tax regime and trade barriers.

Effectiveness of Current Resources

In answer to how effectively named commercialization resources support ET innovation and commercialization:

- 43 percent of respondents cited research organizations as being effective and 79 percent judging them to be moderately effective to effective;
- 59 percent cited IP/Technology transfer organizations to be moderately effective to effective;
- 57 percent cited business incubators as being moderately effective to effective;
- 40 percent cited universities as being ineffective with 50 percent indicating that they were moderately effective;
- 43 percent rated federal departments as being ineffective with only 38 percent rating these as moderately effective;
- Provincial agencies were rated ineffective by 46 percent of respondents; and as moderately effective by 46 percent;
- 53 percent cited venture capital funds as being moderately effective to effective; 65 percent judged financial institutions as being ineffective; 31 percent of respondents considered angel/seed funding as ineffective; and
- 54 percent cited professional management firms as being ineffective.

Clearly the only resource used in the innovation and commercialization of ET that received a positive report was the research organizations; followed by IP/technology transfer and incubators. Universities, federal departments, provincial agencies, financial institutions, angel/seed firms and professional management companies all had a significant level of discontent.

Atlantic Canadian Environmental Company Needs

Respondents identified the following needs, in order of priority, with respect to their innovation and commercialization efforts:

- Pre-commercialization funds are required (94 per cent);
- Financial support for demonstration projects (93 per cent);
- Firms need assistance in accessing funding (87 per cent);
- Government role is as "first user" of new ET (80 per cent);
- R&D support is required by firms developing ETs (80 per cent);
- Partnerships are needed (73 per cent);
- Coordinated access to current government programs and service (67%).
- Access to technological expertise (66 per cent);

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CATEGORY / SUMMARY OF SURVEY RESPONSE

- Business mentoring & business skills development is required (60 per cent);
- International business development assistance is required (60 per cent);
- Incubation facilities are required (57 per cent); and
- Atlantic Canada firms require a dedicated organization focusing on commercializing ETs (53 per cent).

In **Table 5** we have presented a summary of the core issues and needs provided through the survey.

Table 5: Core Issues and Support Needs of Atlantic Canadian Environmental Technology SMEs (Source: AEGIS Management Consulting Group (2004) Inc.)

ATLANTIC CANADIAN TECHNOLOGY FOCUS	<ol style="list-style-type: none"> 1. Solid waste/waste services 2. Water & wastewater treatment. 3. Remediation. 4. Environmental testing. 5. Renewable energy.
MAJOR BARRIERS & CHALLENGES	<ol style="list-style-type: none"> 1. The regulatory environment at all levels of government. 2. Marketing and sales. 3. Capital Investment. 4. The ability to commercialize. 5. Partnerships.
SUPPORT NEEDED	<ol style="list-style-type: none"> 1. Pre-commercialization funds 2. Financial support for demonstration projects 3. Assistance to access funding. 4. Government to take up role as "first user" 5. R&D support. 6. Partnering. 7. Coordinated access to government programs and services.

3.3 Stakeholder Consultation⁴

In the following **Table 6** we have presented the comment and feedback received from key stakeholders in industry, academia, research institutions and federal, provincial and municipal government.

⁴ This includes both direct interviews with key stakeholders and the feedback received during the Industry Forum.

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Table 6: Stakeholder Consultation Comments and Feedback (Source: ÆGIS Management Consulting Group (2004) Inc.)

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Defining the Industry

A clear definition of the environmental technology industry is needed to help focus priorities and resources to support development. The environmental technology sector in Atlantic Canada is characterized by fragmentation, small size, broad definition, very horizontal, lack of actual collaboration although there appears to be a lot of willingness, lack of cluster focus, lack of information sharing about what is on the horizon and where are things going.

“Discovery is serendipitous and not aligned with the needs of the Atlantic Canada economy.”

Stage of Development and Diversity

Atlantic Canada’s environmental technology industry sector is at an early stage of development and is wide ranging, i.e. not focussed. The region does well in the technical (or R&D) side of the commercialization equation but is not accomplished in the “softer” and more market/business-oriented side of the equation.

The sector is nascent even though some firms have been in operation for a number of years. It does not have a lot of critical mass, and there are few successful firms to which one may point. Existing firms are extremely disparate, i.e. not focused in related areas of technology, and tend to be small; many lack the required internal staff and specialized expertise such as marketing and product development needed to be able to partner with post-secondary research institutions. By contrast, the sector has a great deal of potential for future growth and development; and SR&ED uptake per capita is among the best in Canada.

The current industry base includes resource driven sectors, such as offshore oil and gas, forestry, mining and agri-food, as well as energy, health biotechnology, organics. Atlantic Canada’s industry focus has been on a supply driven commodity based economic orientation. This is changing as greater emphasis is placed on value-added processing and technology-based industries. Health issues, air borne carcinogens, asthma, cancer, etc. are all factors that can influence the development of Atlantic Canada’s environmental technology sector. Fish waste is a potential value-added regional asset but plants are widely scattered throughout the region.

There is a lack of receptor companies in Atlantic Canada. This has prompted a push to create “spin offs” which are less stable and require a higher level of support and resources. Spin off companies originating from universities in Atlantic Canada are often headed by a scientist and have a low probability of success. To increase the probability of success there is an urgent need to identify and support “serial entrepreneurs”. To address the lack of receptors the number of incubators should be increased and mentoring provided by seasoned business professionals.

Currently there is a perception of low growth in Atlantic Canada’s environmental technology industry sector as a whole. It was suggested that geographic distance from markets and the lack of business domain expertise at the executive level are competitive disadvantages.

“What is needed is senior level experience and expertise. What we get are new MBAs on short-term contracts who move on as soon as a better career opportunity arises.”

Technology Transfer

A particular strength of Atlantic Canada is its university capacity but the region is not making enough use of it. Research strengths include, e.g. engineering, forestry, business, architecture and advanced materials. However, there are significant barriers to collaboration between universities and industry that include – the traditional view “we do pure research”, intellectual property policies, small firms often lack laboratory technical skills, and universities can partner easier with larger companies who have people with specialist skills.

Universities and researchers need to focus more effectively on technology transfer to firms in Atlantic Canada. There is a high level of funding going into university research but little is coming out of that in the form of technology transfers to Atlantic region companies; academic institutions are perceived as not proactively fostering commercialization. Also, while there is substantial funding available to universities, it is not disciplined in terms of commercialization and this is often reflected in a grant-driven attitude toward research funding rather than a commercialization-driven attitude.

For some researchers, commercialization tends to be viewed as a “hobby” rather than an occupation. Commercialization competes against other academic priorities that consume the

Examples of Canadian universities that have good commercialization track records include the University of Calgary, University of British Columbia and

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available time and attention of researchers, such as teaching, promotion, publishing, seminars and conference travel. Consequently, researchers who are key to commercialization initiatives can often be absent for large blocks of time.

Universities in Atlantic Canada lack senior commercial expertise to act as a liaison between the university-based research environment and what the market wants and needs. They also lack the expertise to be able to determine if research discoveries have commercial applicability. Generally, universities have little or no experience in understanding the market for technology, what it needs and how to get at it.

From a university perspective, programs need to be designed to encourage a culture shift in SMEs. Many SMEs are not sophisticated enough to take advantage of university resources and do not understand how universities function or are structured. For many private sector companies it is a case of partnering to get the funding and once this is achieved then they part company.

The environmental technology area is not a major focus of universities but there are signs of progress, especially within the engineering faculties. Also, an MOU has been established between Nova Scotia Power and Dalhousie University to develop a project on carbon storage and sequestration.

Global Markets – Global Competition

World markets drive environmental technology development and Atlantic Canada's environmental technology companies operate in global markets with global competitors.

A wide range of factors impact on the competitiveness of Atlantic Canada's environmental technology firms including the globalization of issues such as climate change, markets, competition, and acquisitions, which all affect the ability of local firms to do business and compete.

Canada's currency has risen against that of the US, bringing Canadian competitiveness down, and increasing pressure on innovation and productivity improvement. Barriers to entry into the European Union, Asia and other world markets present significant challenges and costs for Atlantic Canadian environmental technology firms.

There are numerous opportunities for the development of environmental technologies in Atlantic Canada. Solutions are available but it is difficult to get customers to buy into them. The potential of wind power is significant but provincial governments need to drive energy policy and encourage a policy which facilitates development and selling power to the grid and ensure that the electrical utilities will cooperate.

There appears to be less resistance in consumer-oriented sectors such as the agri-food industry which is more responsive to the business case and value proposition of environmental technologies. Other opportunities include wastewater management and technology, industrial by-product reuse, and environmental management, e.g., air quality.

International environmental regulations frequently affect the ability of Atlantic Canadian firms to do business in international markets.

Commercialization

There is no mechanism in Atlantic Canada for commercialization and government attitude to commercialization needs reassessed. For many smaller companies the cost of applying for funding often outweighs the support obtained, if approved. SMEs do not need an "advocate" but they do need a model with real power and "connections". Government can help develop markets through the use of environment-based policies and as "first-users".

Atlantic firms need to improve marketing, business capabilities, risk management and entrepreneurship. Regional SMEs often lack business domain expertise and experience, placing them at a severe competitive disadvantage. Some companies do not have the right management team, and some may lack awareness of the expertise required to be effective in the environmental technology market place. SMEs who want to take part in partnerships often only the vaguest notions of what their value is and hence are in a poor negotiating position from the start. Local companies are often ill prepared, and lack business and presentation skills which mean that they are not attractive to investors or customers.

SMEs who want to take part in partnerships often only the vaguest notions of what their value is and hence are in a poor negotiating position from the start.

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The economic drivers of Atlantic Canada's environmental technology industry sector include export markets, regulation and enforcement and municipal projects. Atlantic Canada's unique capabilities include natural resources, agri-food, fishing, forestry, and waste materials.

There is a culture of "grantpreneurs", dependant on government grants, typically researchers who know how to get R&D funding but not how to develop a business. Although, this is not unique to Atlantic Canada as the SBIR program in the U.S. proved.

Small firms require a more focused, hands-on approach that includes deep mentoring and peer support. They need a more disciplined approach, and support services that work with companies from early stage development to maturity. There is a need to find efficiencies in exporting, e.g., send sector leaders to define opportunities, define clusters of technology and build programs around them, etc.

Government-led trade mission opportunities and priorities are not clear and appear to be changing, e.g., waste water, solid waste, water management. Market opportunities include waste management, sustainable processing, life cycle management and recycling / re-use and target geographic markets may include New England, and the Caribbean as well as other locations. China will soon become the world's biggest environmental technology market. CIDA is currently focusing on western China however, eastern China is where the population is concentrated, and that part of the country has industrial parks with populations of over 600,000 people living and working in them. Additionally, CIDA's major geographic focus is Africa and on social policy development. The IFI financial capacity requirement presents a market barrier to regional SMEs but is also an incentive for them to collaborate and form project partnerships.

Marketing is a major continuing issue for Atlantic region environmental technology firms. It is very expensive to access new world markets such as Asia. Canada is not perceived as really "plugged" in to some niche technologies, e.g., marine navigation. Canada lacks national focus and places no priority on such niche technologies that exist within Atlantic Canada, despite strong world demand.

Atlantic Canada will continue to lose many of its highly qualified people to other jurisdictions. There is a huge absence of commercial scientific expertise in firms and Atlantic Canada's firms need such expertise to provide the know-how required to manage the commercial research agenda. Consequently, firms frequently lack a clear commercial end point and the discipline to drive to that end point. Research can often be curiosity-driven, rather than commercially driven.

New start-ups have a high failure rate. One person interviewed mentioned that confidence is a missing ingredient, that there is an inclination by some to avoid risk and be overly cautious. There is a need to think outside the box, to create an appropriate commercialization model for the environmental technology sector, but the region is not noted for that kind of innovation.

Marketing is a major continuing issue for Atlantic region environmental technology firms.

Innovation drives growth.

Collaboration and clustering provide strategic focus.

Innovation and Growth

Environmental technologies impact many activities. They enable the better use of resources; allow a shift in focus from commodities to value-added processing; allow improvements in land use; remediation; pollution prevention; and contribute to advances in lean product development and implementation.

Collaboration and clustering are becoming increasingly important factors in environmental technology development. A move to industry cohesiveness around areas of strategic focus, such as remediation, and waste water treatment, offer significant potential. Local industry leaders, engineering firms, international market partners have the potential to collaborate within defined industry clusters and focus their energies to encourage new technology firms and initiatives.

Atlantic Canada's natural resources and industry base offer a focus for environmental technology development. The region's environmental technology strengths (human resources, engineering and engineered products, technology, universities - strong engineering school, skilled academics and researchers, and research organizations) provide significant innovation advantages.

It is questionable whether Atlantic Canada's SMEs, on their own, can take on significant research and development, due to limited resources and expertise. Environmental regulatory organizations need to invest in R&D to stimulate value-added manufacturing and provide new employment opportunities.

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"We need to identify additional angels and develop a formalised angel network. With respect to venture funding, there is no interest from outside of Atlantic Canada and inside Atlantic Canada the venture funds are weak in dollars and in deal numbers."

From a venture capital perspective, the deck is stacked against environmental technology firms in Atlantic Canada. ET is generally perceived by the venture capital industry as a sector in which it is difficult to make a return on investment.

Access to Finance

Access to financing is a problem. An Atlantic approach to venture capital is required and a "venture-risk" system should be put in place.

Lack of access to patient angel capital and to knowledgeable (VC) capital by Atlantic Canadian technology firms are significant problems. Technology investing is a high stakes game, e.g. it can take from \$10 to \$30 million to develop a technology-based business (excluding investment leveraged through partnerships.)

Canadian venture funds raised approximately \$2 billion in 2003. Labour sponsored fund legislation accounted for about \$1.8 billion of this amount and only about \$200 million was raised from other investment sources, such as pension funds and other institutional investors. Labour sponsored funds are very complicated, e.g., special legislation, labour union involvement, government operating requirements, pacing requirements, etc.

Capital formation sources include pension funds and other financial institutions but pension funds have moved away from early stage venture investment and all are moving "upstream" to mezzanine investments.

Atlantic Canada has a small institutional market with alternative (i.e., high risk) asset investment policies in place. Examples of funds large enough to have such policies would include New Brunswick Investment Management, the Newfoundland and Labrador Provincial Fund, Nova Scotia Association of Health Organizations and the Newfoundland and Labrador Public Pension Fund. Poor timing of market entry resulted in a negative experience in at least one case in which a regional pension fund participated. Most venture capital in Canada was raised in the 1999 – 2000 timeframe. Generally, pension funds have had a bad experience with venture capital nationally.

Over the past five years (1999 to 2003), there have been over \$1.5 billion of successful exits within Atlantic Canada; examples include Clearwater Seafood Income Fund, Spielo Manufacturing Inc., Sparkling Springs Water and Johnson Insurance.

There is a need for incentives, e.g., the Small Business Investment Companies (SBIC) Program within the U.S. government. The SBIC puts in up to one-third of required capital if the firm provides the rest. It also helps firms to select other funds and support programs, leveraging incentives. SBIC also provides guarantees against loss, e.g., up to 25% of risk exposure. One option might be to consider incentives (subsidies) to help reduce exposure of investors to risk, such as the cost of management fees.

Few funds exist with the critical mass required to support technology sector development in Atlantic Canada. For example, the Atlantic Capital Fund of \$30 million is too small to provide continuing investment support to the sector. An optimal "generalist" venture fund for Atlantic Canada should be in the range of \$75- \$100 million to meet the needs of technology firms.

There is a need for a community of venture funds to be developed in Atlantic Canada to diversify risk through partnerships and investment syndication and to provide critical networks required to help build companies within the region. It will take time to build a community of venture funds in Atlantic Canada.

The venture capital industry is currently in narrow, sectoral-based silos, e.g., investing in software development, life science or manufacturing verticals. No venture capitalist has a vertical in environmental technologies in Atlantic Canada. Consequently, no matter how good a technology is, firms cannot access venture funding to develop it. As a result, environmental technology firms are restricted to other local sources of capital.

Prior to 1996, only about \$11 million of Canada's venture capital was invested in Atlantic Canada. By contrast, from 1996 to 2001, approximately \$450 million of venture capital was invested in Atlantic Canada – virtually all in technology. In 2001 the "technology meltdown" occurred.

From a venture capital perspective, the deck is stacked against environmental technology firms in Atlantic Canada. Environmental technology is generally perceived by the venture capital industry as a sector in which it is difficult to make a return on investment; payback is often not visible at the time investment decisions are made. It is frequently hard for venture capitalists to see the value proposition of environmental technologies from the perspective of ROI.

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The regulatory environment and enforcement are often questionable and weak. There can be a lack of clarity with regard to who the buyers (customers) of environmental technologies are going to be. The compelling reason for buyers to acquire the technology is often unclear or missing and the timing of buying decisions – a critical factor for venture capitalists, is often not articulated. As well, the financial ability of customers to buy environmental technologies is often not demonstrated (e.g., budget capacity and flexibility).

There is a lack of financing to support the growth stage of the business. Atlantic Canada is perceived as having bright people but being under capitalized. One entrepreneur indicated that his firm had tried to get a new product manufacturing business going, and that ACOA had contributed funding, but he lacked enough financing to commercialize it successfully.

Cash flow is a constant challenge for early stage technology companies. There is a lack of harmonization, coordination and communication of federal-provincial funding programs. Technology developers frequently do not know where funding is available or how to work the system. Long-term government funding support is needed. Scientific tax credits need to be easy to use, not requiring too much paper. Environmental technology firms in Atlantic Canada lack a mechanism to help them lever available federal funding.

SDTC is based in Ottawa with a \$350 million budget and serves a national mandate. Atlantic Canada needs an organization akin to NRC-IRAP, but specifically geared for the environmental technology sector.

Financial institutions are increasingly interested in environmental technologies due to increased liability exposure for potential environmental impacts of their investments. A whole series of investment funds have collaborated in the Carbon Disclosure Project to promote more focus on this concern.

Environmental technology firms in Atlantic Canada lack a mechanism to help them lever available federal funding.

There is a need to use government resources to the best strategic advantage for Atlantic Canada's environmental technology sector.

Access to Government Programs and Services

ET firms in Atlantic Canada need streamlined, simplified access to government programs and services. They need a "one-stop-shop" with a service attitude and they need to leave with something tangible.

There are so many programs, trade shows and opportunities that no company can keep track. Many government programs appear to be designed with minimal or no input from industry. Industry should be consulted on federal/provincial programming and this would result in a better take up of programs.

There is a need for a coordinated interface between government and technology developers. From a small company perspective, government funding agencies are too complicated, and take too much time. One entrepreneur indicated that it is often easier to deal through universities who handle the government paper work. Government grants are too complicated and are often perceived as constituting a "very expensive loan". Government programs sometimes conflict with each other, e.g., economic development versus environmental assessment.

There is a need to use government resources to the best strategic advantage for Atlantic Canada's environmental technology sector. Centralized bureaucracy and financial controls are not responsive to the region's environmental technology needs.

Government support organizations and agencies keep changing, and appear to be interested only in advancing proven technologies as opposed to new ideas. Federal and provincial government agencies are generally not perceived as strongly proactive partners, and do not appear to have a mandate to foster environmental technologies. Their orientation is trade-focused, i.e. international versus domestic opportunities within Canada.

There is a basic and simple need for a single Atlantic Canada web site that brings all the program information together in a simple, easy to access way; promotes collaboration; and supports program applications.

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A lack of cohesion exists between governments on regulatory matters – province to province, federal-provincial – which is counter-productive to commercialization.

Government Policies, Priorities, and Regulatory Framework

Regulation drives commercialization, especially in the area of environmental technologies.

Environmental regulations exist, but enforcement and disincentive are low. The regulatory framework is not aligned with small business growth opportunities and timing requirements, and sometimes forces SMEs to shut down or spend resources unnecessarily. There is also a lack of flexibility in the regulatory system and in the area of new technology development, often regulatory staff does not know which “box” to categorise the innovation into – “pioneers pay the price”.

A lack of cohesion exists between governments on regulatory matters – province to province, federal-provincial – which is counter-productive to commercialization. The environmental technology sector requires harmonization and common standards but government priorities are not clear to technology developers.

The federal government does not do things in alignment with the region and hence there is a mismatch of programming. There is a need for a shared strategic focus for environmental technology development by federal and provincial governments across the Atlantic region. A strategic focus would set a clear direction and priorities.

Customer Orientation

Customer, i.e. SME-centred business development services is needed.

The lack of services, e.g., business planning, available to technology developers is a barrier to growth. Atlantic Canada has multiple environmental technology disciplines, is geographically scattered, often at long distances from each other. There is a need to assess current commercialization services and potential to determine their efficiency, effectiveness and marketability.

A disconnect exists between government services and what is needed, governments are really about regulating the “end of pipe”, as opposed to prevention, efficiency and sustainability; engineering departments are not teaching enough of it.

One entrepreneur suggested development of a waste management park to include an R&D facility, commercialization support, land fill and recycling services.

Buyer networks of all levels of government (federal, provincial and municipal) and the private sector should be fostered.

SME Business Capabilities

SMEs face an array of challenges to their capabilities which include:

- “Savvy” management is needed - true entrepreneurs keep on despite encountering difficulties;
- Assessing whether the company can take concept to commercialization;
- Breaking into a market;
- Understanding engineering / reliability requirements – key in all environmental situations, e.g., oil and gas, aquaculture;
- Strategic partnering – at all levels, e.g. inventors need strategic alliances with engineering designers;
- Demonstration projects are very important;
- Understanding the market – is there a market for the technology? There is a need to understand the nature of the target industry and its readiness to accept new technology;
- Need an “A” team to help define the company’s financial need, how to pitch, how to do marketing, pick a limited number of SMEs each year and help them in-depth; and
- SMEs have access to very limited resources for commercialization.

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Partnerships and Collaboration Are Required

There is a real opportunity to work together on parallel and/or overlapping activities but stakeholders in the environmental technology sector need to harmonize what they do, and need synergy and cooperation between levels of government.

Municipalities

Regional municipalities lack the capacity of larger cities, e.g., Vancouver and Toronto each have sustainability offices. Municipal officials are risk averse in using new technology, and therefore government needs to provide support to encourage risk taking.

Public Awareness and Engagement

Public awareness and engagement are important factors in development of the environmental technology sector. The environment is of large and growing importance to society and is continuing to become a higher political priority. The Kyoto accord will lead to new initiatives. People are much more attuned and sensitive to issues such as the economy versus the environment.

3.4 Critical Issues

Examination of the discussions with industry stakeholders and the results of the industry survey, point to a select number of critical issues that will need to be addressed by and through a model that has as its major theme assisting SMEs in the Atlantic Region in innovating and commercializing environmental technologies.

These issues are presented in **Table 7**.

Table 7: Critical Issues for Environmental Technology SMEs (Source: ÆGIS Management Consulting Group (2004) Inc.)

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Industry-Driven Approach

Atlantic Canadian environmental technology firms need a commercialization model with a strong business focus. It should adopt an industry-driven, private sector philosophy and approach to operating.

A commercialization presence in each province, a designated budget, and personnel dedicated to environmental technologies are basic requirements of the model.

Atlantic Canadian firms will require the model to have three core functions –

1. The support of a focused industry development strategy designed to enhance the ability of local firms to enable businesses to succeed and penetrate world markets;
2. Practical day-to-day operational support tools and expertise, e.g., templates, diagnostics, etc., and
3. Client service staff who really know specific industry sectors and how they operate at a practical level.

Regulatory Environment

The need is for all levels of government (federal, provincial and municipal) to act in a coordinated and consistent manner, preferably on a pan-Atlantic basis. More flexible municipal, provincial, and federal regulations to allow for the development, demonstration, establishment and operation of environmental technologies are necessary for ET growth in Atlantic Canada. Small companies do not have the resources of larger corporations and can ill-afford spending time and finances on moving through a many-layered and incoherent regulatory system. A mechanism to give smaller companies a better, earlier analysis of the potential outcome of an application is needed.

Atlantic Canadian environmental technology firms need a commercialization model with a strong business focus.

More flexible municipal, provincial, and federal regulations to allow for the development, demonstration, establishment and operation of ETs are necessary.

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ISSUE & NEED

Access to Capital

Access to financing and/or capital investment is a significant barrier to growth of the environmental technologies sector.

Atlantic Canada is missing a focused, coordinated regional financing strategy that can deliver improved access to the capital required to develop the region's environmental technology sector. A regional approach to address the lack of access to capital is critical and with provincial collaboration can be accomplished.

Individual provincial investment programs have not been successful, e.g., PEI Investment Fund, NB Investment Fund. There is a need to mobilize the private sector through the tax system, i.e., more favourable tax treatment for technology companies and for innovation. There is a need for pools of angel investors to share risk and opportunity. Typically angel investors do not act together although there are technology examples, e.g. an angel investor group of about 30 persons is allied with the Houston Technology Center, U.S.

There is an immediate priority to identify commercializable intellectual property, products, processes, services that exist in universities.

Market Understanding and Competitiveness

Atlantic Canadian environmental technology firms frequently encounter resistance to the adaptation of newer, innovative technologies. Hence, understanding markets and marketing requirements and competition/competitiveness are crucial to business success.

SMEs market intelligence needs to be at a depth not reflected by current funding support - they must assess competitors and competing technologies, determine who is likely to be in the business, and understand key global markets.

Strategic thinking is a weakness in Atlantic Canada. There is a need for an ET "think tank" possibly formed by government but including experts in business and competitive intelligence and to use this as a defence against competing regions who have world beating technologies, markets, and management teams.

There is a need to better package what the region has to offer, e.g., process optimization, environmental improvement, and eco-efficiency, etc., and integrate this with economic development and finance ministries strategic focus.

Focused Collaboration

There is a need for focused collaboration among all regional stakeholder groups - universities, industry, and government. This should be based on a clear understanding of regional capabilities and capacities, the environmental issues facing Canada and world markets. There is an immediate priority to identify commercializable intellectual property, products, processes, services that exist in universities.

Barriers to collaboration such as perceived or real loss of autonomy must be taken down. There needs to be agreement on how to set up a formal in-camera information-sharing process so that different agencies/departments can work collaboratively on a file.

The new model should provide a mechanism to encourage partnering e.g., awareness and understanding of need for engineering, understanding of industry and market. Utilizing the capacity of the university system, some universities are setting up environmental engineering programs, environmental research institutes.

Any new model must deliver coordinated access to government programs and services.

Access to Programs

Any new model must deliver coordinated access to government programs and services.

It should also examine how national programs can be "moulded" to suit the needs of Atlantic Canadian SMEs. Government has a role to play in the early adoption, demonstration, showcasing and facilitation of pilots of innovative technologies.

Programs designed to help SMEs with regulation and certification processes for environmental technologies, e.g., regulatory approvals before going to market, are required. There is currently a lack of flexible programs and funding to encourage the adoption of innovative environmental technologies.

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It would be desirable to decrease the level of needless regulation and to encourage the harmonization and integration of industry regulations in Atlantic Canada. Regulators should be encouraged to give advance opinion on new environmental technologies, or a defined trials process. Environmental regulators currently sit on the fence.

Federal programs tend to focus on products while universities focus on R&D and testing. There is a need for greater recognition that the innovation and commercialization process is a continuum with defined stages, each requiring specific resources and expertise.

Different government departments are perceived to push different issues but they are really complementary and need a more customer centred approach. Harmonization and alignment of funding programs, government direction and priorities, regulations impacts on venture capitalists' commitment to take informed risks.

Awareness and communication of support programs and services, market based incentives are critical. Trust needs building as entrepreneurs often do not trust government; fear their ideas will be stolen. Hence there is a need for education, and understanding of roles, and for secure intellectual property protection.

Human Resources

Environmental technology firms need qualified human resources. The Atlantic region's technology firms frequently lack strong business domain experience at both the governance and senior management levels.

The scientific and technical expertise available in Atlantic Canada through the education system is recognized globally as being of an excellent and high standard, and the region is noted for its R&D capabilities. However, the same cannot be said of the level of business and management experience within companies started up by this type of individual. ET companies require help with the management and market analysis aspects of innovation and commercialization.

3.5 Comparable Models and Mechanisms

In this section we provide a short descriptive (**Table 8**) on a select number of organizations in Canada, the U.S. and Europe, which have as their core service the development of technology-based companies. In the closing section (**Table 10**) we summarise these using the Commercialization Model Criteria Matrix (CMCM).

The logical end-result of this comparative analysis would be to partner the proposed new Atlantic Canada model with an identified successful and/or complementary model in another jurisdiction. The aim of such a partnering would be to increase access to private funding; and to market and collaboration opportunities.

Table 8: Comparative Models of Commercialization in Canada, the U.S. and Europe
(Source: ÆGIS Management Consulting Group (2004) Inc.)

MODEL	DESCRIPTIVE
OCE-CRETEch www.crestech.ca	CRETEch, a division of the Ontario Centres of Excellence (OCE) Inc., helps Ontario firms and organizations grow by finding solutions for their innovation challenges. OCE-CRETEch has been in existence since April 2004 and has dispersed \$6.5 million in 45 projects. Over the next five years, CRETEch will invest in over 150 innovative R&D projects at Ontario universities and deliver \$25-million value to its partners in market-driven clusters. CRETEch's innovation and commercialization services, offered in partnership with Ontario's university and college community, help

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MODEL	DESCRIPTIVE
	<p>firms and organizations to:</p> <ul style="list-style-type: none"> ▪ Clarify innovation plans and medium-term challenges; ▪ Assemble partners and resources to develop solutions; ▪ Build collaborative R&D teams to develop technology; ▪ Access early-stage commercialization support; and ▪ Engage students as future employees to build organizations <p>CRESTech engages firms and academic partners in the following market-driven strategic clusters:</p> <ul style="list-style-type: none"> ▪ Clean water technologies, resource management (deep mining operations, forest management, mineral exploration and earth resources, security technologies for international water boundaries, integrated data management systems); ▪ Sustainable agriculture and agri-food (the Ontario greenhouse initiative and the autonomous robot greenhouse, agricultural bioproducts); ▪ Sustainable energy solutions (risk assessment and mitigation, greenhouse gas mitigation and risk management, Canadian energy partnership for environmental innovation; and <p>Sustainable infrastructure (redevelopment, green roof technologies, water and sewer infrastructure).</p>
<p>Ontario Centre for Environmental Technology Advancement (OCETA) www.oceta.ca</p>	<p>OCETA is a private sector, not-for-profit Ontario Corporation with a mandate of providing business services to entrepreneurs, start-up companies and small to medium sized enterprises (SMEs) to assist the process of commercialization of new environmental technologies and to support sustainable economic development both domestically and internationally. OCETA maintains its public-policy mandate through four business areas including:</p> <ul style="list-style-type: none"> ▪ Technology commercialization; ▪ Sustainable development and pollution prevention; ▪ Technology verification; and ▪ Information services. <p>OCETA is a catalyst for action on environmental issues such as climate change, energy efficiency, technology verification, greenhouse gas reduction, site remediation & brownfields redevelopment, solid waste exchange, sustainable development, and water/wastewater treatment.</p> <p>The organization develops alliances between business corporations, industrial associations, universities, research centres, and governments accessing leading edge environmental technologies and expert advice on both a national and international platform.</p> <p>Since 1999, OCETA has been retained by Government to deliver and market program initiatives to improve the energy and sustainable performance of the Canadian manufacturing sector. A major component of these programs is the organization and</p>

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MODEL	DESCRIPTIVE
	<p>delivery of workshops to plant managers, energy managers and company executives, in a variety of sectors. These initiatives, which focus on SMEs, include:</p> <ul style="list-style-type: none"> ▪ Natural Resources Canada's (NRCan) Industrial Energy Audit Incentive Program (delivered across Canada); ▪ Energy Efficiency and Innovation Programs for the Ontario Food Processing Industry; ▪ Toronto and York Region Pollution Prevention Programs; ▪ Regional Municipality of Waterloo Business Water Quality Program; and ▪ Environment Canada (Ontario Region) Business Air Quality Program for south western Ontario. <p>OCETA also co-manages the "about Remediation" web site and is a leader in the development of the Canadian Brownfields Network. The organization provides environmental, technical and business services to SME clients working closely with these clients to analyze their specific requirements and development status, to develop a custom-made suite of services.</p> <p>Since 1994, OCETA's consulting services have assisted an average of 150 SME clients annually. OCETA provides free initial consultations and mentoring services to SMEs to understand the stage of development of the technology, the market that the SME wants to enter and the status of financing within the company. Two of OCETA's main products are:</p> <ul style="list-style-type: none"> ▪ The Technology Profile - a concise, one-page double-sided, independently reviewed, technical description of a product or process; and ▪ The Business Profile - a one-page double-sided, detailed review of a company's services, specialties, and areas of expertise. <p>OCETA helps SME clients identify the most appropriate source of government funding and assists in the preparation of the application for grants and loans. It can also identify and organize suitable partnerships, with the aim of demonstrating technologies in the field. With its wide network of partners OCETA can assist the SME with starting a small business in Ontario, business plan development, market research, prototyping, patent protection, technology leasing, business insurance and risk reduction, research and development tax credit assessments, and financing (both angel and venture financing and introduction to the Business Development Bank of Canada).</p> <p>To further assist the SME, OCETA has the exclusive license to deliver the Federal Government's Environmental Technology Verification (ETV) program. This program is delivered through ETV Canada Inc., a subsidiary of OCETA. ETV Canada provides third party independent verification of performance claims made by technology proponents. Successful companies can then use the performance guarantee and the ETV logo to market their product, knowing it has been fully tested and verified.</p>

Enviro-Access

www.enviroaccess.ca

The mission of Enviro-Access is –

To foster the emergence and support the development of innovative projects and companies contributing to the improvement of the quality of the environment and to sustainable development on a local, national and international scale.

Enviro-Access has several levels of support for SMEs -

- **Strategic Support** - this service supports development and commercialization of environmental technologies. It ensures regular, personal contact with an Enviro-Access advisor while providing complementary professional support needed to maximize the chances of success. The company can also access a pool of professional expertise with in-depth knowledge in the environmental sector, as well as network of experts;
- **Advisory Committee** - an Enviro-Access team member organizes and takes part in an advisory committee comprised of at least three competent specialists, with the aim of providing strategic advice required for company development; and
- **Professional Support** - Enviro-Access provides assistance with business plans, search for financing; market research; search for partners; and creation of alliances with other companies

The company may also access the Enviro-Access network of environmental experts offering complementary technical, financial, legal and business services.

Enviro-Access offers access to the **Environmental Technology Verification** (ETV) Program to environmental businesses who wish to go through this accreditation process.

Enviro-Access publishes and distributes -

- **Fact Sheets** - publishes fact sheets displaying various commercial environmental technologies available through Quebec and Atlantic Canada enterprises. Each fact sheet describes the technology, performance and application limits, installation and use, costs and other useful information;
- **Business Directory** - publishes a directory of environmental technology companies and product categories; and
- **Fiscal Guide** - publishes a guide intended to support R&D activities by making it easier to claim tax credits.

Through the Enviroclub, Enviro-Access assists small and medium sized companies (SMEs) to implement profitable pollution prevention projects.

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InNOVAcorp
www.innovacorp.ca

InNOVAcorp helps early stage Nova Scotia companies commercialize their technologies and succeed in the global marketplace. InNOVAcorp's High Performance Incubation Model fosters innovation and entrepreneurial success. The organization focuses on three areas to help business succeed: incubation facilities, mentoring and investment. These resources help entrepreneurs overcome traditional hurdles to business growth.

- Incubation Facilities - through its incubation facilities, InNOVAcorp provides the environment needed to help emerging technology companies grow. These facilities deliver office, laboratory and industrial space. They also offer a blend of business opportunities, resources and synergies that enhance entrepreneurial success. InNOVAcorp manages two incubation facilities - the Technology Innovation Centre in Dartmouth targets companies in the information technology and engineering industries, and the BioScience Enterprise Centre in downtown Halifax focuses on companies in the life sciences industry.
- Mentoring - InNOVAcorp takes a hands-on approach in developing new and growing existing profitable ventures through business advisory services and a relationship management network. InNOVAcorp's mentoring function helps entrepreneurs progress through the early stages of growth. Direct support is provided one-on-one to entrepreneurs through expert staff and a network of business advisors, and through partnerships with organizations like NRC's Industrial Research Assistance Program (IRAP) and Canadian Technology Network (CTN). The organization offers business counselling, business planning support, competitive analysis, and access to an extensive network of affiliates and business contacts.
- Investment - InNOVAcorp is an active venture capitalist, managing the Nova Scotia First Fund (NSFF), an early stage source of capital for Nova Scotia businesses. The portfolio consists primarily of investments in the information technology and life sciences sectors. The NSFF will consider venture investments in the range of \$100,000 to \$1,000,000 in early stage for fast growing companies that are based in Nova Scotia, have a commercially viable product or process, have a fully developed business plan and viable financial and business model, and have capable management.

Telecommunications Application
Research Alliance (TARA)
www.tara.ca

TARA, NS is a unique facility that combines cutting-edge telecommunications research and development equipment with seed investment funding and business mentoring resources.

The organization hosts Canada's only Cisco Certified Internetworking Expert (CCIE) Certification Lab, as well as the Master of Engineering in Internetworking program in affiliation with Dalhousie University.

TARA is a private enterprise made up of an alliance of Members and Affiliates and to date TARA has more than 40 Member

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organizations, each enrolled under one of four membership levels. This distinctive structure, coupled with the technical and business expertise of TARA's staff, enables it to fulfill its mandate –

To assist its members in the development and exploitation of communication network applications and services.

TARA's tagline "Networking through Partnership" reflects its unique role as both a place to develop applications and services for telephony and Internet-based computer networks as well as a place to form dynamic connections with other member organizations.

As Associate Members of TARA, companies have access to TARA's own Venture Capital Fund as well as the TARA/InNOVAcorp Investment Fund. Created in 1999, the TARA/InNOVAcorp investment alliance provides capital to IT companies with high growth potential. Under the agreement, TARA is responsible for investigating, analyzing and recommending suitable investment opportunities to a joint subcommittee.

TARA also makes awards of \$5000 scholarships to students throughout Atlantic Canada which are designed primarily to stimulate the creation of new ideas in the communications/IT sector. It is TARA's hope that these scholarships can help foster strong relationships between students, their universities and TARA's member companies by providing both mentorship and occasional commercial opportunities.

TARA's Telephony and IP Test and Research Facility - this facility has 40,000 square feet of office and laboratory space, with an additional growth capacity of 10,000 square feet within the facility. The centrepiece is a Nortel Networks DMS-100 (class 5) switch, connected to the PSTN, and equipped with full range of Residence and Business Centrex services (LEC017 Software). It provides Analog and Digital trunk connections with Frame Relay, T-1, ISDN BRI and PRI and GR303 interfaces. In addition to the hardware there are trained experts who can configure the live DMS-100 as required. The labs are state of the art with copper and fibre to a telecommunications company that is located in an adjacent building. It is fully cabled including raceways with CAT 5/5E and Fibre cabling and wheel mounted racks allowing for easy adjustments to the space as projects might require.

Genesis Group, NL
www.genesis.mun.ca

There are two core elements to the Genesis Group –

1. Genesis Research; and
2. The Genesis Centre.

Genesis Research, as its primary goal, identifies and commercializes promising technologies arising from research at the University.

Areas of expertise include biotechnology and medicine, physical sciences and engineering and information technology and communications. In addition to its central role of transferring technology to the private sector, the research group assists the province's small and medium size businesses to access the vast physical and human resources of the University.

Genesis Research focuses on new technologies, processes, services and products that enhance, improve and/or diversify an

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existing industry's capability. In some instances it may create a new enterprise, which does not compete with the existing private sector.

The Genesis Centre is a support network for technology-based ventures which have high growth potential and are seeking business guidance and capital. It provides a wide range of resources and services for its clients with a long-term goal of preparing its clients to become "investor ready".

Genesis offers a range of resources aimed at increasing the company's likelihood, rate and degree of success. These resources include -

- Business resources (world-class mentors, experienced advisory boards, help with business plan development, learning & networking events);
- Technical & scientific resources (of Memorial University, e.g. the Manufacturing Technology Centre, C-CORE, the Statistics Consulting Centre);
- Physical resources (such as office space & equipment; computer equipment; board rooms; videoconferencing facilities); and
- The intangible benefits of being part of a well-regarded entrepreneurial community, e.g. credibility, synergy, confidence, vision.

Entrance to the Genesis Centre is a competitive process administered by a selection board of experienced business people. It is restricted to entrepreneurs and businesses pursuing technology based opportunities with high growth potential. Admission to the Genesis Centre is based on an assessment of the entrepreneur, the technology, and the growth potential of the business opportunity.

The Genesis Centre seeks entrepreneurs who can drive a venture in its early stages. The entrepreneur must therefore understand the importance of all business disciplines required to launch and operate a venture. While the Centre does not expect the entrepreneur to be able to do everything, that person must be able to lead the company to the point where other people can be recruited.

On the recommendation of Genesis Centre staff, an applicant is given the opportunity to present to the Centre's Selection Board. The technology is assessed in terms of its Intellectual Property, its industry application and the ability to protect or produce that technology. A new application of an existing technology often provides the basis for initial products or services offered by Genesis Clients.

The growth potential of the business opportunity is assessed based upon projected market size. Genesis Clients have the potential to achieve multimillion-dollar annual revenue within a few years of commercialization.

Houston Technology Center,
U.S.

www.houstontech.org/

The Houston Technology Centre (HTC) and Rice Alliance for Technology and Entrepreneurship, Rice University (RATE) are separate and autonomous organizations who work closely to accelerate the growth of emerging technology companies in Houston. They are an excellent example of university-incubator-

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Rice Alliance for Technology and Entrepreneurship

www.alliance.rice.edu/alliance/default.asp

industry collaboration

HTC is a non-profit corporation supported by more than 300 corporations, leading academic institutions, the Greater Houston Partnership, the Texas Medical Center the Johnson Space Center and the City of Houston.

Houston is home to entrepreneurs and companies that are developing major technological advances in the key fields of energy, life sciences, information technology, nanotechnology and NASA-originated technology. HTC was formed to help accelerate the commercialization of these technologies. To do this, HTC provides numerous educational opportunities for entrepreneurs and maintains staffs that work individually with HTC Client Companies. HTC's mission is to -

- Accelerate the growth of emerging technology companies;
- Communicate Houston 's technology successes; and
- Educate entrepreneurs and the underserved communities of Houston in order to help "bridge the digital divide."

Since its inception in 1999, the Houston Technology Center has become the centre of technology entrepreneurship in Houston. HTC has helped more than 150 emerging technology companies raise more than \$400 million in capital and create about 1,000 new jobs to grow businesses in key technology sectors including energy, information technology, life Sciences, NASA-originated technologies and nanotechnology.

HTC assists emerging technology entrepreneurs by providing in-depth business guidance, including setting operational goals, advising and consulting on strategic business matters, serving as a coach for the entrepreneur, and by facilitating access to capital sources and professional services.

HTC is an accelerator not an incubator. Businesses must have a working prototype, and have raised some equity. They are entered into a two (2) year Accelerated Business Program. HTC works with the company to find the resources (technical, financial, management, etc.) it requires to grow and we subject the firm to regular reviews. Of the last five (5) applicants HTC passed on 1; four (4) entered the program and three (3) secured funding. After "graduation" firms either move on for growth outside of HTC or are acquired. The average funding range is from US\$750,000 to \$5 million.

The Rice Alliance for Technology and Entrepreneurship is Rice University's flagship initiative devoted to the support of technology entrepreneurship. The Rice Alliance supports entrepreneurs and early-stage technology ventures in Houston and Texas through education, collaboration, and research.

The mission of the Rice Alliance is –

To support the creation of technology based companies and the commercialization of new technologies in the Houston and Southwest Region.

It achieves this through assisting in the launch of technology-based ventures in Houston and Southwest; providing a collaborative network and access to human and financial capital

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	<p>needed for success; serving as a vehicle for education and support of inventors and entrepreneurs in their pursuit of new business concepts; and supporting the creation of new jobs and new source of wealth for Houston and the Texas economy.</p> <p>Since inception in late 1999, the Rice Alliance has assisted 140 new technology companies and raised more than \$63 million in early stage funding. Over the past 4 years, the Rice Alliance has conducted over 60 programs attended by over 12,000 individuals. Over 11,000 individuals subscribe to the Rice Alliance Digest email newsletter. The Rice Alliance provides entrepreneurs with a collaborative network and forum for support, education, and exchange of ideas.</p> <p>The approach used by the Rice Alliance consists of six stages:</p> <ol style="list-style-type: none">1. Identify candidate innovations;2. Form teams (networking opportunities for linking technical talent with business talent);3. Analyse potential of innovations and formalize the business plan (supported by courses on entrepreneurship and a speaker series);4. Showcase the business plan to the partner network (VCs, angels, alumni etc);5. Assist in commercialization of early-stage business (provide additional technical and/or management talent, and assistance with prototype/beta version development); and6. Support company growth (through customer acquisition and capital for expansion).
<p>TEKES, Finland www.tekes.fi</p>	<p>TEKES (Finland) Technology Programs are focused on a key technology sector and implemented in cooperation with companies and research units. Each program lasts 3-5 years; there are 23 ongoing programs; and about 2000 applications are received annually.</p> <p>Tekes is the main public funding organisation for research and development in Finland; it funds industrial projects as well as projects in research organisations, and especially promotes innovative, risk-intensive projects. Tekes offers partners from abroad a gateway to the key technology players in Finland.</p> <p>The competitiveness of Tekes' customers is based on knowledge and skills and on the innovative utilisation of different technologies and business competences.</p> <p>Tekes' primary objective is –</p> <p style="padding-left: 40px;">To promote the competitiveness of Finnish industry and the service sector by technological means.</p> <p>Activities aim to diversify production structures, increase production and exports, and create a foundation for employment and societal well-being.</p> <p>Tekes invites technology-oriented foreign entities to work with it and will assist foreign companies and research organisations in their search for the most suitable Finnish partners.</p> <p>Technology programmes are used to promote development in specific sectors of technology or industry, and to pass on results of the research work to business in an efficient way. Technology programmes are planned in cooperation with companies, research</p>

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organisations. Each technology programme has a steering group, a co-ordinator and a responsible person at Tekes. The duration of the programmes ranges from three to five years; their volumes range from \$15 million to \$1200 million. Tekes usually finances about half of the costs of programmes with the second half coming from participating companies.

Tekes has technology units at 14 regional Employment and Economic Development Centres (known as the T&E Centres) throughout Finland. The main aim of these centres is to keep close to the entrepreneurs and innovative talent across Finland. Tekes and its partners generate added value for customers right through the innovation chain.

Selective project funding is the basis of Tekes operations. Funding and expert services are channelled to technological R&D projects run by companies, research institutes, and universities. Tekes assists companies in their search for ideas, the finalisation of business plans, and their quest to conduct meaningful and valuable research. Tekes does not derive any financial profit from its endeavours, nor does it claim any intellectual proprietary rights, these stay strictly with the enterprise that Tekes is working with at that point in time. Completed project proposals are evaluated internally by Tekes business and technology experts and then each project is designated a Tekes expert to assist with the project and monitor progress.

Tekes funding is intended for challenging and innovative projects, some of which will hopefully lead to global success stories. Funding may be in the form of a low-interest loan or a grant, depending on the stage of the innovation and the nature of the proposed project. Tekes offers companies grants, capital loans and industrial loans.

The results of R&D investment are clearly visible in the structural change of the industry and in the wide range of Finnish high-tech exports. Tekes' role is to ensure the competitiveness of traditional industrial clusters, and at the same time, to create and oversee the growth of new industry. Finland has world-class technology in clusters such as - information and communications; metal; forest; welfare; bio and chemistry; environment; energy; real estate and construction; and food.

3.6 Commercialization Model

Stakeholders identified a range of functions a commercialization model for environmental technology SMEs in Atlantic Canada would need to consider and these are presented in **Table 9**.

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Table 9: Innovation and Commercialization Model Functions (Source: AEGIS Management Consulting Group (2004) Inc.)

FUNCTION / DESCRIPTIVE	
Primary customer/user group should be ET SMEs, start ups and emerging companies.	Strategic Focus <p>The model should have a strategic environmental technology sector focus and its primary customer/user group should be ET SMEs, start ups and emerging companies. It should target growth-oriented⁵ firms which would be identified by a diagnostic⁶ and assist them to build and achieve critical mass. The focus should be on product development not services development.</p> <p>The model should define a strategic role for Atlantic Canada in ET e.g., R&D, product development, etc., and the unique inputs whereby Atlantic Canada will achieve competitive advantage in a global market.</p>
	Commercial Process <p>A function of the model would be to facilitate and coordinate policies and programming that supported the stages in the ET commercialization process (as illustrated in Figure 4) and to develop a "Roadmap" of the ET Commercialization Process."</p>
	Comprehensive Client-Centred Services <p>Firms require specific help for each stage of development and personal service, i.e. a facilitator/value-added service broker who would bring the right skills and tools to the table at right time.</p> <p>The need of SMEs is for a facilitation and coordination model/mechanism that works to create synergy with other government and industrial partners. A "one-stop" facilitation and coordination service must not result in "one more" stop, as has been the case with past initiatives and does not imply that SMEs will not have to work with other agencies.</p> <p>Other services could include -</p> <ul style="list-style-type: none">▪ Development of business domain expertise;▪ Facilitated guidance through the support systems and programs;▪ Deep mentoring;▪ Virtual incubator/portal;▪ Facilitated collaboration between SMEs, R&D, universities, etc.;▪ Practical business skills development, risk mitigation;▪ Improved tax environment;▪ Better access to capital;▪ Integrated location combining R&D facilities, demonstration projects, "best practice" showcasing, commercialization support (e.g., product development, marketing, operations), e.g., waste management, wind power, etc.;▪ Support for R&D: innovation, deployment;▪ Need to look at existing programs to identify any gaps;▪ Pre-commercial funding for SMEs (SDTC supports large projects only, funds sure things, need SME version); and▪ Credible hand off –adopt a coordinated and collaborative approach (all agencies such as provincial economic development departments, ACOA, NRC-IRAP, BDC, InNOVAcorp, Genesis, etc. are currently chasing the same thing).

Primary customer/user group should be ET SMEs, start ups and emerging companies.

Firms require specific help for each stage of development and personal service.

⁵ In our view the principal determinants of whether a SME is considered "growth-oriented" are primarily (1) the commitment to grow as expressed by its owners/senior executives (2) the availability of a commercializable platform technology and (3) the ability to access resources (human, financial and marketing) appropriate to the company's stage of development.

⁶ This diagnostic would be developed as part of the "toolbox" available to the proposed model's on-the-ground officers.

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Funding for programs is required but it must facilitate, not impair, SME strategic business direction.

The model should create networks in identified key markets such as the larger environmental firms, municipalities, universities and government departments. It should be linked nationally and internationally.

FUNCTION / DESCRIPTIVE

Funding

Funding for programs is required but it must facilitate, not impair, SME strategic business direction. Funds are required to bring SMEs and researchers to promote collaboration, partnering, regional collaboration on shared problems and for collaborative technology programs, e.g., technology development, technology applications, etc.

As an example, NRC and ACOA might consider a partnership by coming together to fund R&D / technology development across disciplinary and organizational boundaries.

Public-Private Partnerships

Partnerships should be a key focus and be a team effort with a multi-disciplined, cross boundary approach. Commercial rules should apply, i.e. get the right people to do the job, and then ideas and money will flow.

The model should create networks in identified key markets such as the larger environmental firms, municipalities, universities and government departments. It should be linked nationally and internationally.

Strategic partnering, e.g., seed, angel, venture capital, and institutional, at each stage of development from innovation to commercialization is needed to secure accelerated growth. Consideration should be given to establishing a \$75 to \$100 million Atlantic region venture capital fund specifically for the ET sector.

There is an urgent need to address the issue of intellectual property ownership at universities which is an obstacle from an investor's perspective. The lack of a clear, consistent policy increases risk and discourages investment.

Communication, Coordination and Promotion

Develop an international market image and profile, e.g., via awards programs, and leverage their marketing value. Promote awareness to ET firms, and stakeholders (including the community.)

Organization

The sector has expressed a strong wish for direct contact with the new entity and therefore the model should have a person based in each province⁷ whose roles should include assessing and providing support requirements for activities such as - developing technology, exporting, business development, partnerships, promotion, program coordination, regular face to face discussions, and networking events.

The model should include an environmental management advisory team to include all key stakeholders including target market representation.

3.7 Summary

This final section of the research findings provides a concise overview (**Table 10**) of the key requirements and critical issues that the consultation and research process has brought forward and which should form the basis for any proposed model to foster environmental technology innovation and commercialization in Atlantic Canada.

⁷ We see a need for three persons who would be located in New Brunswick, Newfoundland and Labrador and Nova Scotia/ Prince Edward Island. There may be an argument for phasing the engagement of these persons to match the level of company use of the model's services.

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Table 10: Summary of Critical Issues and Needs (Source: AEGIS Management Consulting Group (2004) Inc.)

CRITICAL ISSUES	NEEDS
<p>1. The regulatory environment at all levels of government; coordinated access to government programs and services.</p>	<p>1.1 Streamlined and simplified access to government programs and services. 1.2 Focus government support policies, priorities and regulatory framework. 1.3 More flexible municipal, provincial, and federal regulations to allow for the development, demonstration, establishment and operation of environmental technologies. 1.4 Adopt “first user” policies for government (federal, provincial and municipal) purchasing. 1.5 Promote public support for the ET sector. 1.6 Customer (SME) centred business development services are needed.</p>
<p>2. Understanding markets, competition and marketing requirements is crucial to business success.</p>	<p>2.1 Help firms compete in global markets. 2.2 Help Atlantic Canadian firms to improve marketing and business development capabilities and capacity. 2.3 Fostering and building of partnerships (regional, national and international) and collaboration.</p>
<p>3. Access to financing and capital investment is a significant barrier to growth of the environmental technologies sector.</p>	<p>3.1 Improve access to financing by qualified Atlantic Canadian firms. 3.2 Preparing growth-oriented firms to access financing sources. 3.3 Ensure access to financing support all growth stages at the scale and timing required 3.4 Coordinate investment infrastructure and climate.</p>
<p>4. An industry driven approach to commercialization is needed, tailored to the needs of Atlantic Canada’s environmental technology firms.</p>	<p>4.1 Provide early stage business development services and support. 4.2 Leverage Atlantic Canada’s natural resources and industry base. 4.3 Clearly define Atlantic Canada’s ET industry and the commercialization potential of current research directions. 4.4 Develop business risk capabilities, risk management and entrepreneurship.</p>
<p>5. Need for focused collaboration between industry, universities and research organizations, and government on regional, national and international levels.</p>	<p>5.1 Enhance technology transfer from post-secondary institutions to firms in Atlantic Canada. 5.2 Provide resources for</p>

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CRITICAL ISSUES	NEEDS
	demonstration/pilot projects, and the showcasing of “best practice.” 5.3 Help Atlantic Canadian firms to grow through innovation.

In **Table 11** we represent the Comparative Model Commercialization Matrix (CMCM) but with the addition of a column for the proposed Atlantic Canada model, highlighting those areas that it should focus on and which should be undertaken by external (professional service providers) or internal resources.

Table 11: Comparative Model Commercialization Matrix including the Atlantic Canada Model (Source: AEGIS Management Consulting Group (2004) Inc.)

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CRITERIA	OCE-CRESTECH	OCETA	ENVIRO-ACCESS	INNOVA-CORP	TARA	GENESIS GROUP	HTC/RICE ALLIANCE	TEKES	ATLANTIC MODEL
INNOVATION & COMMERCIALIZATION STAGES COVERED:									
Concept development	No	No	No	No	No	No	Yes	No	No
R&D/Technology Transfer	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	E & I
Early stage (Incubation/Start up)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	E & I
High Growth/Venture Capital	No	No	No	Yes	Yes	Yes	No	Yes	E & I
Maturity/Expansion	No	No	No	No	No	No	No	No	No
ACCESS TO RELEVANT KNOWLEDGE & EXPERTISE:									
Business	E & I ⁸	E & I	E & I	E & I	E & I	E & I	E & I	E & I	E & I
Scientific	E & I	E & I	E & I	E & I	E & I	E & I	E & I	E & I	E & I
Commercialization/Marketing	E & I	E & I	E & I	E & I	E & I	E & I	E & I	E & I	E & I
Commercialization/Financial	E & I	E & I	E & I	E & I	E & I	E & I	E & I	E & I	E & I
Commercialization/IP	E & I	E & I	E & I	E & I	E & I	E & I	E & I	E & I	E & I
CLIENT FOCUS:									
Environmental technology entrepreneurs	Yes	Yes	Yes	No	No ⁹	Yes	Yes ¹⁰	No	Yes
Quality assurance (ISO)	No	No	No	No	No	No	No	No	Yes
RANGE OF SERVICES (DIRECT DELIVERY):									
IP services	E ¹¹	E	E	E	E	E	E	E	E
Start up assistance/programs	Yes	Yes	Yes	No	No	No	No	No	E & I
Access to experts & mentors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	E
Online information & commercialization resources	Yes	Yes	Yes	Yes	No	No	No	No	E & I
Incubation/Acceleration Facilities	No	No	No	Yes	Yes	Yes	Yes	No	E

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Venture Capital	No	No	No	Yes	Yes	No	No	No	E
Leverage other financial sources	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	E & I
Partnering & collaboration services	Yes	Yes	Yes	Yes ¹²	No	Yes	Yes	Yes	E & I
R&D (funding & services)	Yes	Yes	Yes	No	Yes	Yes	No	Yes	E & I
HR Governance/management	No	No	No	Yes	Yes	Yes	Yes	No	Yes
MODEL FUNDING SOURCES:									
Main funding source	G ¹³	G	G	G	G & P	G	G & P	G	G
EFFECTIVENESS:									
Success rate ¹⁴	-	-	-	80% ¹⁵	-	-	75-80%	-	E & I
Economic impact ¹⁶	-	-	-	-	-	-	-	-	E

4. MODEL RECOMMENDATIONS

In this final chapter the principles and recommendations derived from the various consultation processes are consolidated and a model for the fostering of environmental technology innovation and commercialization in Atlantic Canada SMEs is proposed together with suggested support mechanisms and implementation pathway. The model proposed focuses on facilitation and coordination and on creating added-value through building synergistic partnerships with resources already in-place.

4.1 Principles and Recommendations

The “hot” issues for Atlantic Canadian firms are the regulatory environment, marketing and sales, capital investment, commercialization, and collaboration/partnering. Current commercialization resources are seen as inadequate, ineffectively communicated, and inefficiently used¹⁷. The exception is the NRC-IRAP program. Environmental technology firms in Atlantic Canada need streamlined, simplified access to government programs, services and funding. The environmental technology sector requires the harmonization and enforcement of common standards and regulations for the protection of the environment. However, to date the government priorities are unclear to technology developers.

The environmental technology focus of Atlantic Canadian companies – remediation, environmental testing, renewable energy, waste and wastewater treatment, and waste services are all identified as global growth areas. However, a focused definition is required of Atlantic Canada’s environmental technology’s direction with reference to global markets. There is a need for a selective and targeted approach. A strategic focus on collaborative opportunities is required and one which relates to the region’s input advantages and its unique advantages. More use should be made of sector leaders in the defining of new technology and market opportunities. The Atlantic Canada environmental technology sector needs to develop its own value network to enable synergies and focused growth.

A practical interface between the customer and government programs is needed, i.e. a seamless delivery system. The environmental technology sector would benefit greatly from coordinated access to federal programs, agencies and departments involved in providing support for environmental technology and in fostering environmental technology innovation. The need is for a “customer-centric” approach. Our principal recommendation is therefore -

The “hot” issues for Atlantic Canadian firms are the regulatory environment, marketing and sales, capital investment, commercialization, and collaboration/partnering.

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Principal Recommendation: The industry requirement for a strategic, selective and targeted approach to markets and partnering; and streamlined access to government programming would be best served through the institution of a specialized entity and/or mechanism which would be industry-driven.

Further, we have made 14 supporting recommendations on issues that will direct the initiation, content and future direction of the “model”. The recommendations are presented in full below and in summary in **Table 12**. We have further divided the recommendations into three categories – those that are critical to the model; those that are important; and those that are optional.

4.2 Critical Supporting Recommendations

The Atlantic Canadian environmental technology industry is missing a “mittelstand” or middle ground of companies that are in the 20 – 150 employee range and are growing through innovation and commercialization. Apart from exceptions, such as ADI Group, NB, CBCL/EGCL, NS, and Hi-Point Industries, NL, the current industry structure is one of extremes, i.e. dominated at one end by micro-SMEs with less than 50 employees (and in many instances less than 10 employees) and scarce resources and at the other end by a select group of larger, mature companies such as Dillon Consulting, and Jacques Whitford, who are mostly in consulting engineering.

Recommendation 1: The focus of the new organization should be -

- 1. Facilitating the stimulation of innovation and new entrants; and*
- 2. The identification and growth of innovative SMEs from micro-SMEs to “middle-ground” companies capable of competing globally.*

A commercialization model is needed that is appropriate for Atlantic Canada and the model must encourage new entrants and growth.

Recommendation 2: Provide a Centre of Excellence and Demonstration Network¹⁸ for Environmental Technology R&D Commercialization in Atlantic Canada.

The infrastructure - university R&D, government and private sector research organizations, incubators, programming, etc., for such an entity is mostly in-place but lacks coordination, a focused strategy and a resources program. The new organization should be an “innovation and commercialization” champion in Atlantic Canada. It also needs to define the industry, i.e. who are the actual growth-oriented players? Where are they located? Are there potential clusters? Which firms can be “converted” to growth?

There is a need for a shared strategic focus, which would set clear directions and priorities, for environmental technology development by federal and provincial governments across the Atlantic region. Collaboration and clustering are important factors in environmental technology development. The government (federal and provincial) departments and agencies should support a move to industry cohesiveness around areas of strategic focus, such as

The Atlantic Canadian environmental technology industry is missing a middle ground of innovative ET companies.

The infrastructure for a model is mostly in-place but lacks coordination, a focused strategy and a resources program.

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remediation, renewable/environmental energy and water/waste water treatment, which offer significant potential.

Recommendation 3: Develop and implement an Environmental Technology Strategic Action Plan for Atlantic Canada focusing on key sub-segments and global market demand. It should also be based on a clear understanding of the region's input advantages, SME business capabilities and intellectual property generation.

Atlantic Canada's ET sector needs a shared strategic focus and an understanding of its competitive advantage.

This plan would focus the capabilities and efforts of public, private sector and university research. It would seek to clarify what Atlantic Canada's "input advantages" are, i.e. what factors are required for regional competitive advantage - natural environment, research, corporate business, specialist skills/people, industry capacity, etc. There is also a concurrent need to undertake an SME business capabilities mapping and environmental scan of the regions intellectual property, research directions and future potential. Industry and government need a better understanding of what "clusters" or pockets of synergy exist and how they can accelerate growth.

4.3 Important Supporting Recommendations

The aim of the new model is to add value to current resources and not duplicate resources or infrastructure already in place.

Recommendation 1: The organization's personnel should be appropriately located within current organizations such as Genesis (NL), InNOVAcorp (NS), RPC (NB) or NRC-IRAP and hence have access to their networks. The new entity should be a "one stop shop" for industry and not an additional link in an already confused chain.

Demonstration projects and showcasing of "best practice" should also be organized and funded through the new entity.

Recommendation 2: Demonstration projects and showcasing of regional excellence are essential elements in developing environmental technology growth. The new organization should champion new technologies and be the centre for demonstration projects and showcasing Atlantic Canadian ET best practice.

Standardised policies, programs, regulations, enforcement and environmental technology priority purchasing policies are vital to the growth of the sector. Companies want - unified regulations within the Atlantic region to level the uneven playing field and reduce the "regulatory quagmire"; more flexible regulations to allow for development demonstration, establishment and operation of environmental technologies; the government to be knowledgeable on and have a flexible approach to the categorizing of new environmental-based innovations; updates to government regulations to promote environmental technologies; the harmonization and enforcement of common standards for protection of the environment. Economic drivers of Atlantic Canada environmental technology include export markets regulation, and municipal projects. Although economic imperatives are coming to the fore

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in driving environmental technology commercialization; to date regulations have driven and will continue to drive commercialization.

Therefore, the provincial governments need to be encouraged to (1) create a more supportive regulatory framework for environmental technology innovation and commercialization and (2) to develop environmentally-favourable purchasing policies and adopt a proactive role as a “first-user”.

Recommendation 3: As a priority, the appropriate government departments should be engaged in streamlining provincial and pan-Atlantic Canada policies, programs and regulations for the environmental technology sector. Use should be made of the Council of Atlantic Premiers (CAP) to initiate this process.¹⁹

To support market-based, accelerated growth, funding from federal/provincial departments/agencies should be more balanced in the emphasis placed on the market/business and technical/science challenges. Environmental technology firms in Atlantic Canada lack a mechanism to help them lever available federal funding. The model should consider the issue of investment attraction and the development of innovative approaches to securing capital at each stage of the innovation to commercialization continuum.

The region’s capacity for innovation would benefit from a cultural change in SMEs with respect to their attitude to R&D. This can be accomplished through specific programming, such as demonstrated by the Environmentally Superior Products Programme (Ireland).

Recommendation 4: The new organization should have as a priority the coordination of funding at each stage of the continuum from innovation to commercialization. A small seed fund should be provided to the model to allow the leveraging of other funding options (private and public sector).

Atlantic firms’ marketing experience is limited yet due to the region’s peripheral location. Local companies are often ill prepared, lack business and presentation skills and they are often not attractive to investors or export customers/markets.

Recommendation 5: the new entity should provide funding and resource support for preparation of applications for funding, business plans etc. Market and competitive analysis should be integral to the proposed model.

The sector needs to develop a partnering model featuring innovation networks, university partnering and technology transfer, and partnerships with Venture funds (venture forums).

Recommendation 6: Partnering (R&D, market, financial, etc.) should be encouraged, fostered, funded and facilitated through the new entity.

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Incubation is not a sufficient strategy for Atlantic Canada. The region needs to accelerate company growth if it is to gain a competitive advantage in the global economy.

4.4 Optional Supporting Recommendations

Incubation is not a sufficient strategy for Atlantic Canada; the region needs focused resources and the acceleration of companies if it is to gain a competitive advantage in the global economy. There is a need to assess current commercialization services and potential to determine their efficiency, effectiveness and marketability.

Tools such as a sector program “roadmap” and use of the Internet for enhancing ongoing awareness, communications, understanding and collaboration opportunities are important.

Recommendation 1: Develop diagnostic tools and programs to assess and support the acceleration of innovative firms and technologies.

Recommendation 2: Develop a sector “roadmap” similar to “Charting the Course - A Program Roadmap for Canada’s Transition to a Hydrogen Economy” for the environmental technology sector in Atlantic Canada as practical tool for companies and researchers.

Recommendation 3: Develop an Atlantic Canada environmental technology information and collaboration portal. Examples such as www.aboutremediation.com and www.faraday.com could provide a starting point.²⁰

Recommendation 4: The organization should undertake a review of current programming to determine if a program exists or can be adapted to encourage companies to be more competitive in their target market through R&D innovation. A demonstration and commercialization program similar to SME-IDEA: Environmental Component is recommended.

The recommendations and their salient issues are summarised below in **Table 12**.

Table 12: Summary of Recommendations and Issues Addressed (Source: ÆGIS Management Consulting Group (2004) Inc.)

REC. #	RECOMMENDATION	ISSUE ADDRESSED
1	The industry requirement for a strategic, selective and targeted approach to markets and partnering; and streamlined access to government programming would be best served through the institution of a specialized entity which would be industry-driven.	Program access; targeted approach to growth.
CRITICAL SUPPORTING RECOMMENDATIONS		
1	The focus of the new organization should be - 1. Facilitating the stimulation of innovation and new entrants; and 2. The identification and growth of innovative SMEs from micro-SMEs to “middle-ground”	Sector growth of SMEs.

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REC. #	RECOMMENDATION	ISSUE ADDRESSED
	companies capable of competing globally.	
2	Provide a Network Centre of Excellence and Demonstration for Environmental Technology R&D Commercialization in Atlantic Canada.	Showcasing excellence.
3	Develop and implement an Environmental Technology Strategic Action Plan for Atlantic Canada focusing on key sub-segments and global market demand. It should also be based on a clear understanding of the region's input advantages, SME business capabilities and intellectual property generation.	Strategic focus; understanding of competitive advantage and capabilities.
IMPORTANT SUPPORTING RECOMMENDATIONS		
1	The organization's personnel should be appropriately located within current organizations such as Genesis (NL), InNOVAcorp (NS), RPC (NB) or NRC-IRAP and hence have access to their networks. The new entity should be a "one stop shop" for industry and not an additional link in an already confused chain.	Alignment with current resources.
2	Demonstration projects and showcasing of regional excellence are essential elements in developing environmental technology growth. The new organization should champion new technologies and be the centre for demonstration projects and showcasing Atlantic Canadian ET best practice.	New technology championing.
3	As a priority, the appropriate government departments should be engaged in streamlining provincial and pan-Atlantic Canada policies, programs and regulations for the environmental technology sector. Possible use could be made of the Council of Atlantic Premiers to initiate this process.	Reducing the regulatory quagmire.
4	The new organization should have as a priority the coordination of funding at each stage of the continuum from innovation to commercialization. A small seed fund should be provided to the model to allow the leveraging of other funding options (private and public sector).	Funding at all stages of growth.
5	The new entity should provide funding and resource support for preparation of applications for funding, business plans etc. Market and competitive analysis should be integral to the proposed model.	Funding/resources for program application and market-industry analysis.
6	Partnering (R&D, market, financial, etc.) should be encouraged, fostered, funded and facilitated through the new entity.	National and international partnering.

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REC. #	RECOMMENDATION	ISSUE ADDRESSED
OPTIONAL SUPPORTING RECOMMENDATIONS		
1	Develop diagnostic tools and programs to assess and support the acceleration of innovative firms and technologies.	Accelerated environmental technology growth.
2	Develop a sector “roadmap” similar to “Charting the Course - A Program Roadmap for Canada’s Transition to a Hydrogen Economy” for the environmental technology sector in Atlantic Canada as practical tool for companies and researchers.	Practical programming SME tools.
3	Develop an Atlantic Canada environmental technology information and collaboration portal. Examples such as www.aboutremediation.com and www.faraday.com could provide a starting point.	Practical collaboration and information tools.
4	The organization should undertake a review of current programming to determine if a program exists or can be adapted to encourage companies to be more competitive in their target market through R&D innovation. A demonstration and commercialization program similar to SME-IDEA: Environmental Component is recommended.	Matching federal programs to regional needs.

4.5 The Model

In this section we consider the key elements of the proposed model under the headings – mission, objectives, organizational structure, key business functions, supporting mechanisms, funding commitment and evaluation and monitoring.

The mission of the **Atlantic Environmental Technology Commercialization Partnership (AETCP)**²¹ is proposed as -

To support the creation, and growth, of environmental technology-based SMEs in the four provinces – New Brunswick, Newfoundland & Labrador, Nova Scotia and Prince Edward Island, of Atlantic Canada, and accelerate their development by facilitating focused commercialization and innovation.

We believe that this mission encapsulates the sector feedback and priorities that evolved during the consultation process. It also sets the foundation for the organizations key objectives as described in later sections.

AETP’s focus is on facilitating and coordinating access to existing programming and services and not program delivery which is seen as being undertaken by potential AETP partners.

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The need in the development of Atlantic Canada's environmental technologies capacity in innovation and commercialization is for an "accelerated, focused and collaborative" model or mechanism. "Average" growth strategies will not develop Atlantic Canadian firms into world-beaters.

The core objectives proposed for the new entity are aimed at accelerating growth -

1. To create a strategic and focused plan for industry development and collaboration;
2. To facilitate seamless and coordinated access by Atlantic Canadian SMEs to government programs and services and to provide a mechanism for the rationalizing of these programs and services to suit the Atlantic Canada environment. And as key sub-objectives of this to:
 - Provide leadership and direction in the area of the rationalising and harmonizing environmental regulations and enforcement across all Atlantic Canada's provinces, and
 - Facilitate access to (and to lobby for) financing at all stages of the continuum from innovation to commercialization in a coordinated and sustainable manner and to bridge the gap between research and commercialization of new technologies through early stage investments and public-private sector partnerships.
3. To accelerate the development of enabling environmental technologies, leading to the commercialization of new products, processes and services through the organization and coordination demonstration projects and the showcasing of best practice;
4. To support the development of firms' knowledge, understanding and experience in key markets and to encourage international partnering and collaboration networks through alignment with other regions that have identifiable synchronicities; and
5. To accelerate the growth of the environmental technologies sector by creating a collaborative network of government, buyers/customers, suppliers and service providers, and research institutions through focussed collaboration and partnering.

AETCP should be structured as an industry-driven, autonomous, not-for-profit company. The organization should be industry-led and have national, international and regional representation. Our opinion is that AETCP should be formed with –

- A six-member Executive consisting of four industry²² and two research/academic representatives; and

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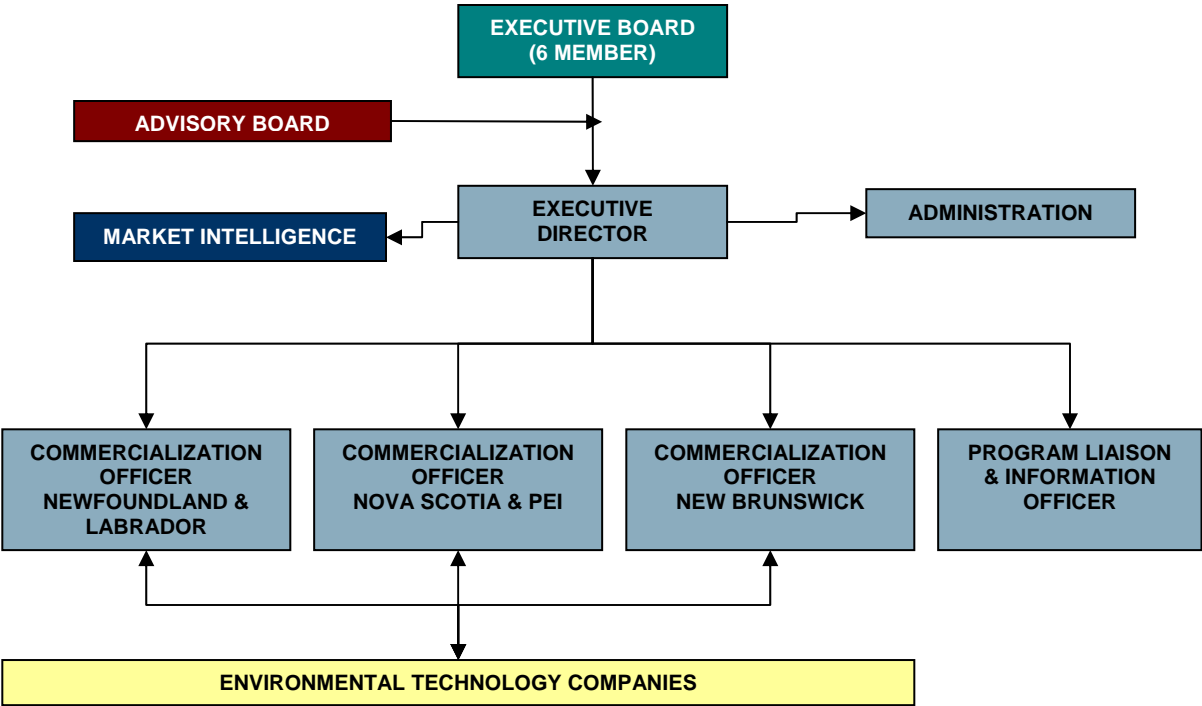
- An Advisory Board²³ consisting of a wider spectrum of representatives from the sector’s key stakeholder groups in academia, government²⁴, industry, research organizations and the community.

The micro-structure (i.e. small SMEs) of the industry points to a need for local management and locally-based and accessible personnel. The most successful program in Atlantic Canadian appears to be NRC-IRAP and this is due largely to –

- Its credibility with industry;
- The high level of “on the ground” presence; and
- The expertise and experience built up within that program.

Our proposed organization/model features brokerage services provided by “on the ground” commercial officers who will be supported by virtual (internet) and administrative/management resources and tools.

The organizational chart proposed is provided in **Figure 2** below.



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Figure 2: Proposed Organization Chart for the Atlantic Environmental Technology Commercialization Partnership (Source: ÆGIS Management Consulting Group (2004) Inc.) We would envisage the organization's commercialization officers being located in each of the provinces and "embedded" within current organizations, such as InNOVAcorp (NS), Genesis or NATI (NL), RPC (NB). Our expectation is that the administration function of the new APETC would be sub-contracted to the organization within which it is located.

The key roles in the organization's staff should be -

Executive Director: management of the organization; facilitating regulatory support for new environmental technologies; strategic initiatives – demonstration projects; "excellence" ET identification and showcasing; sectoral opportunity identification; commercialization funding and partnering initiatives; financing partnership collaborations and development of the public/private sector infrastructure for funding; ET industry strategic planning; international partnering; communications and PR;

Commercialization Officer²⁵: the "on-the-ground" interface between industry and government; diagnostic assessment of company needs; support on program application; business case plan development; technology assessment and validation; business partnering, accessing research & funding sources (public/private); and

Program Liaison & Information Officer: management of web-site; research on and distribution of federal and provincial program information to the Commercialization Officers; ensuring support tools and diagnostics are available; and government program coordination.

Market Intelligence: the organization will require access to in-depth marketing intelligence services to provide operational and strategic advice on industry structure, technology competitiveness and market entry strategies. This should be accessed through a database of consultants with recognized skills and experience in delivering this service in an international context.

The key business functions derive from the organization's stated objectives.

1. Clearly defining the Atlantic Canada environmental technology industry; the unique inputs afforded by the region's natural resources and industry base; and the commercial potential of its research capacity and directions;
2. Working with government regulators at all levels (municipal, provincial and federal) to facilitate an efficient and supportive regulatory approval process for SMEs;
3. Accessing coordinated funding for growth-oriented SMEs in Atlantic Canada, who are undertaking or have the potential for environmental technology innovation and commercialization, at all stages of the firm's development cycle;
4. The resourcing and coordination of environmental technology pilot/demonstration projects in partnership with innovative regional

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- SMEs²⁶; and showcasing of environmental technology excellence and the provision of a technology assessment validation service;
5. Partnership and collaboration (regional, national and international) including fostering and enhancing university-industry technology transfer;
 6. Facilitating streamlined access to government programs and services; support in business case diagnostics and planning; and program application support;
 7. Higher level support for marketing and business development; market opportunity assessment; and entrepreneurship; and
 8. Ensuring industry and public awareness of the APETC and its services through ongoing communications.
-

There is an abundance of programming and tools that relate or can be applied to the environmental technology industry. The problem largely is not one of choice but one of appropriate selection, application and use. In essence the sector has a “carpenter’s toolbox” of tools but lacks an experienced tradesperson to select and use the “right tools for the right job at the right time”.

Atlantic Canadian environmental technology SMEs needs four specific development tools –

1. An Atlantic Canada Environmental Technology Web-portal – this would serve as a management tool for the AETCP; an information source for the commercial officers and for industry; a depository of “tools and diagnostics”; a partnering and collaboration tool; and a bank of technical and market information;
2. Diagnostics – we have estimated that the active environmental technology sector in Atlantic Canada contains fewer than 100 companies and at any time probably less than half will be actively pursuing innovation and commercialization. The AETCP will require diagnostics to determine who the active SMEs are, what their needs are, and how these needs can be addressed;
3. An Environmental Technology Road Map for Atlantic Canadian ET Firms – the sector is dominated by small (less than 50 employees) and micro (less than 10 employees) SMEs with limited resources and therefore we anticipate a low usage of the web-portal from these companies. However, information needs to be provided to this segment in a clear and defined manner and we propose that a “Road Map” should be developed which would set out the innovation-commercialization continuum, the programming available at each stage, key stage contacts and funding options; and
4. Business Acceleration Program – our research points clearly to the fact that successful initiatives have (a) clearly defined objectives or goals, and (b) a defined (and short) timeline. Our suggestion is that the AETCP develops a two-year Business Acceleration Program in

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partnership with other agencies (ACOA, EC, IC, NRC-IRAP, universities), and other commercialization models, aimed at accelerating the development of companies who have demonstrated a clear environmental technology market opportunity and who have been able to raise a defined level of private sector funding. This could be based on the Houston Technology Centre model or an adaptation of the High Performance Incubation model currently used by InNOVAcorp.

Funding: the model, as is the case for all comparable models, will require ongoing government funding. AETCP may obtain revenue streams from several of its activities but is unlikely to achieve self-sustainability during its life-cycle.

The most recent CETAC proposal²⁷ suggests an annual funding requirement of \$2 million per CETAC. Our own estimate of the financial requirement of the proposed model is more conservative than this, as seen in **Table 13**.

We estimate that the model would require funding of \$770,000 in Year 1 and - \$706,000 per year for year 2+. This should be committed for a minimum of five years with a total cost of \$3.594 million.

The majority of federal funding initiatives do not address commercialization issues (e.g. the requirement for strategic studies, adapting new technologies to meet market demands, communications, technology trends analysis, development of technology marketing plans, etc.) or the need for pre-commercialization funding.

Table 13: Overhead & Project-Related Costs for AETCP (Source: ÆGIS Management Consulting Group (2004) Inc.)

	ITEM	ESTIMATED COST	
		Year 1	Year 2+
1	Salaries and wages (executive director, 3 COs and 1 PLO)	\$420,000	\$441,000
2	Administration & operational costs (e.g. location-related expenses such as rent, utilities, communications, etc)	\$75,000	\$75,000
3	Travel-related costs	\$75,000	\$50,000
4	Market intelligence costs (third party consultants)	\$50,000	\$65,000
5	Promotional budget	\$75,000	\$35,000
6	Special projects budgets (Strategy, Web Site, Road Map, Diagnostics etc.)	\$75,000	\$40,000
	TOTAL COST²⁸	\$770,000	\$706,000

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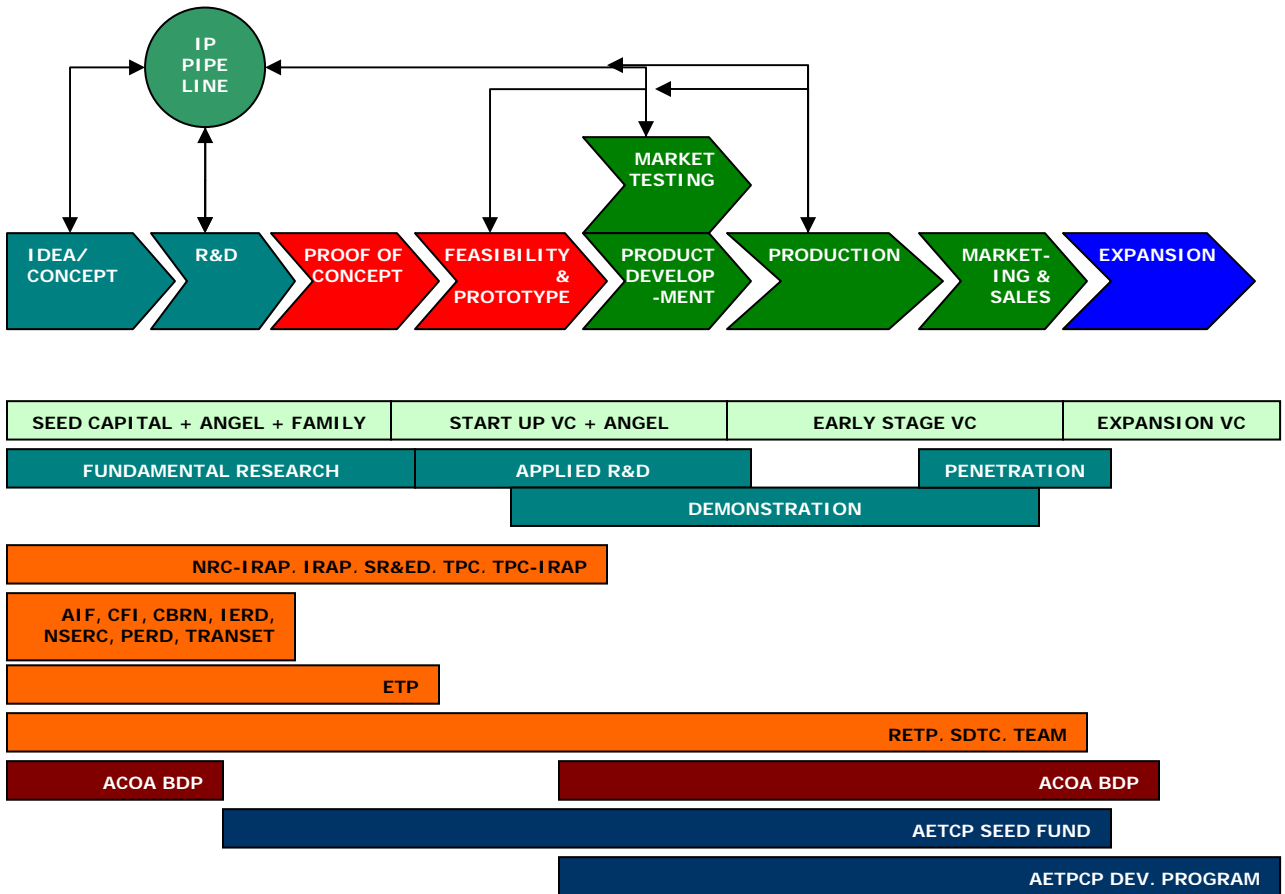
The AETCP should have access to and manage two specific programs to facilitate closing the commercialization gap –

1. Atlantic Canada Demonstration and Commercialization Development Program (DCDP) – this would be similar to the SME-IDEA: Environmental Component Program; would fund projects up to \$1 million in eligible costs; and be fully repayable based on commercial success; and
2. Atlantic Canada Environmental Technologies Pre-Commercialization Seed Fund (ETPCSF) - a small pre-commercialization investment fund which would be used to leverage or match funds provided through other government and/or private sector resources. The pre-commercialization fund should be a \$3 million fund “topped” up annually by the equivalent amount utilised less any repayments. The main aim of this fund would be to lever other funding and therefore the maximum percentage that this fund should contribute to an investment package would be 25 percent. Funds contributed to a project would be in the form of an equity investment with a time limit of five years; after which the investment (plus an agreed dividend based on the success of the project) would be repayable to the Seed Fund.

The place of each of these on the development continuum (**See Annex B: Figure 5**) is illustrated in **Figure 3** below. The aim of the two programs is to draw from existing programs on the well-served portions of the continuum and to provide funding for identified “gaps” in provision; this providing specific sector-based support for Atlantic Canadian environmental micro- and smaller-SMEs from idea to market expansion.

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Figure 3: Innovation to Commercialization Development Stages & Sources of Funding Including the Proposed AETCP Seed Fund & Development Program
 (Source: ÆGIS Management Consulting Group (2004) Inc. & Industry Consultation)



The organization should be accountable to its public sector funding partners and to the industry. Therefore a priority for the organization will be to agree and establish practical measures of performance against which its success will be judged. In order to be effective the organization will need to be seen to be clearly focused and practical in its delivery to the industry on its key functions.

Success parameters should include:

- Progress on implementation of the Environmental Technologies Strategic Action Plan;

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- Increase in new entrants to the Environmental Technologies sector;
- “Graduation” of micro-SMEs to “mid-sized” (20-50 person) companies;
- Progress on the standardising of environmental regulation related issues;
- Investments made by the Seed Fund;
- Projects supported by the Demonstrations & Commercialization Development Program;
- Increased ET partnering and collaborations (national and international);
- Use of the commercial officers (company visits, actions taken, etc.); and
- General use of programming:
 - Web site “hits”,
 - Diagnostics undertaken by COs,
 - Demonstration projects and showcases organized (national and international),
 - Road Maps Issued, and
 - Informational and promotional events organized.

Our recommendation is that the organization itself undertakes an Annual Review of Performance and that an independent performance review is undertaken at the close of its third year.

4.6 Synergy with Existing Resources

The aim of the AETCP is to build on the resources already available and to add incremental value to them through a select and focused number of activities and support mechanisms. As such, a priority during the early phases of the new entity will be to reassure organizations such as Springboard, AESN, NRC-IRAP, Atlantic Canadian technology incubators, etc. of this intent and to enable and encourage strong working relationships with these organizations.

4.7 Implementation Pathway

The environmental technology sector is a sub-sector of larger sector – environment, and covers a wide and diverse range of products and services. It is not well defined in terms of capacity, company structure or focus and does not form partnerships, collaborations or clusters readily.

There are two possible alternatives to the establishment of the new model entity –

1. Establish an environmental technologies strategy for the region and then roll-out the model as part of this strategy; or
2. Establish the model and develop a regional strategy as part of the model’s scope of operation.

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Sound arguments can be made for both options. However, our sense from government, industry and academia, is that the preferred option is the latter. The proposed model flows from and aligns with recommendations made by previous reports such as “Beyond the Horizon”²⁹ and “Decade of Challenge”³⁰ and also is confluent with the recent formation of the Minister’s Expert Panel on Commercialization.

Bearing this in mind, we have suggested that the key milestones are as set out in **Table 14** below; and that these stages should be considered as the development of a “critical path” for implementation of the proposed environmental technologies commercialization model.

Table 14: Major Implementation Milestones of the Atlantic Environmental Technology Commercialization Partnership (Source: AEGIS Management Consulting Group (2004) Inc.)

ACTION #	ACTIVITY/MILESTONE	COMPLETED BY/RESPONSIBILITY
1	Review and acceptance of report and recommendations. Establishment of an Atlantic Canada Working Group to carry the recommendations forward.	Summer/Fall 2005 AETAN Steering Committee
2	Negotiation with government funding partners (ACOA, Industry Canada, Environment Canada, NRC-IRAP) to obtain a commitment to multi-year funding. Funding to include: 1. Operational funding of the organization, 2. Establishment of a small seed fund to leverage and coordinate funding resources at each stage of the innovation-commercialization continuum, 3. Project-based funding to support preparation of model support tools (including assistance for application, business plan and market development). And 4. Establishment of funding to support and facilitate partnering.	Fall 2005 AETAN Steering Committee / Third Party Advisor
3	Recruitment of “start up” AETCP Executive Board, Chair and Executive Director. Registration of AETCP and governance issues.	Fall/Winter 2005 AETAN Steering Committee / Third Party Advisor
4	Establish collaborative agreements with operational partners such as Genesis Group, InNOVACorp, IPC, NRC-IRAP, etc.	Fall 2005 Chair & Executive Director, AETCP / AETAN
5	Recruit Commercial Officers	Fall/Winter 2005 Chair & Executive Director, AETCP / AETAN

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ACTION #	ACTIVITY/MILESTONE	COMPLETED BY/RESPONSIBILITY
6	Launch of the Atlantic Partnership for Environmental Technology Commercialization (AETCP)	Winter 2005 Chair & Executive Director, AETCP / AETAN Partners / Third Party Advisor
7	Development and launch of an <u>Environmental Technology Strategic Action Plan</u> for Atlantic Canada.	Spring 2006 Executive Director, AETCP / AETAN / Third Party Advisor
8	Development and launch of a <u>Sector Roadmap</u> as a first practical tool for Atlantic Canadian environmental technology SMEs.	Winter 2005 Executive Director, AETCP /AETAN / Third Party Advisor
9	Development of a schedule of development, diagnostic and promotional activities such as – 1. Development of an information and collaboration web portal, 2. Championing of new technologies, demonstration projects, and showcases, 3. Alignment of environmental policies, programs and regulations between the four Atlantic Provinces, 4. Development of diagnostic tools to assess and support acceleration of innovative firms and technologies, and 5. Review of current programs to determine ways to enhance SME competitiveness through R&D innovation.	2005-2006 AETCP/AETAN/Third Party Advisor

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ANNEX A: METHODOLOGY

In this annex we provide some additional detail and comment on the purpose and scope of the project, its objectives, deliverables, challenges and methodology.

Statistics Canada's definition of the environmental sector focuses on "end-use", i.e.:

Environmental goods and services are goods and services that are used, or can potentially be used to, measure, prevent, limit or correct environmental damage (both natural or by human activity) to water air, soil as well as problems related to waste, noise and ecosystems. They also include clean or resource-efficient (eco-efficient) technologies that decrease material inputs, reduce energy consumption, recover valuable by-products, reduce emissions and/or minimise waste disposal problems³¹.

The term "environmental technologies" as used in this study is defined as technology products, equipment, processes and systems that:

- Decrease material inputs, reduce energy consumption, recover valuable by-products, reduce or control emissions and effluent discharges, and/or minimize waste disposal problems;
- Prevent, limit or clean up environmental damage (from natural and human activity), through pollution prevention, pollution control and clean up, i.e. remediation and restoration; and
- Are applicable towards detection, monitoring, measurement and assessment of environmental conditions, including resource and energy efficiency, and the release of toxics and greenhouse gases.

Environmental technologies are generally also classified under four (4) broad sub-sectors:

1. Pollution avoidance (P2) technologies, e.g. alternative and renewable energy, non-renewables, energy end-use, and waste management ;
2. 'End-of-pipe' pollution control technologies, e.g. atmospheric pollution control, wastewater treatment and effluent control, and water supply and purification;
3. Remediation and restoration (or "cleaning up technologies"), e.g. decontamination, remediation (groundwater, soil, surface water, and

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seawater), site remediation (contaminated sites and Brownfields) and rehabilitation; and

4. Monitoring and assessment technology systems, e.g. cross-cutting technologies such as sensors (e.g. atmospheric pollution and greenhouse gas monitoring technologies) and controls.

The purpose and scope of the study was –

To identify a model and/or mechanism(s) that would effectively engage and support Atlantic Canadian firms, particularly SMEs, in environmental technology innovation and commercialization.

The focus of the project was to arrive at a model that had industry support and whose output would be practical as well as strategic.

The goals of the study were -

1. To identify and confirm the needs of SMEs to support their environmental technology innovation and commercialization;
2. To analyse a variety of model/mechanisms that exist regionally, nationally and internationally to stimulate environmental technology innovation and commercialization;
3. Recommend appropriate models/mechanisms to stimulate environmental technology innovation and commercialization in Atlantic Canada; and
4. To identify the partners, polices, operational structure and any other resources required to support this model.

The chapters following concentrate on these goals; present our proposed model; and develop strategic and operational recommendations for the environmental technology sector in Atlantic Canada.

In developing our methodology and approach to this study it was decided, in consultation with the Steering Committee, to widen the industry and stakeholder consultation to include those sectors, such as forestry, energy, and agri-food, where firms may not be strictly defined as an “environmental technology” business but whose technologies and/or processes may have an environmental technology application or impact on the environment.

The methodological approach comprised six (6) stages:

1. Undertake a document, file and Internet review;

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2. Conduct primary data collection using strategic interview, survey and workshop processes;
 3. Select comparable models for investigation;
 4. Produce a draft report which will provide a practical and strategic interpretation of the results and conclusions, and propose a model to foster environmental technology innovation and commercialization;
 5. Present the proposed model at an Industry Stakeholder Forum; and
 6. Revise the Draft Report in light of feedback from the Forum and deliver a Final Report and PowerPoint Presentation.
-

We received a considerable listing of documentation from the project Steering Committee and augmented this with our own library resources, Internet searches and documents recommended by stakeholders during the individual interviews to give a comprehensive review of publications appropriate to the study.

Primary research used in the study incorporated stakeholder consultation (direct interviews and forum), an online industry survey, and use of a commercialization matrix to compare national and international models and programs.

The key to successful primary data collection is the development of a listing of relevant stakeholders or representatives from industry, academic, research institutions and federal, municipal and provincial government departments and agencies. With the help of the project Steering Committee, and using our own network and contact lists, we developed a comprehensive database of stakeholders (**Annex C**). From this master database and in consultation with the AETAN Steering Committee we prioritised the listing and short listed a select group for interview.

Once the master listing of contacts had been developed, it became apparent that by restricting the interview listing to 20 – 30 persons, we might miss a wide spectrum of opinion. The use of focus groups/forums to tap into this mine of opinion was considered and indeed one session was delivered in Fredericton, NB. However, although the input from those participating was excellent, attendance was low and it became logistically impossible to arrange the other provincial forums at this time in the project.

Therefore an Industry Forum was held in Halifax, NS to augment the interviews. At this Forum the study's findings and model recommendations were presented. Sector firms and industry associations participated in the forum and were able to provide valuable feedback to the consultants.

In consultation with the Steering Committee, an industry survey consisting of 22 questions, which could be completed in 10 - 15 minutes was developed

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and distributed online. The survey link, with accompanying explanation of the project purpose and objectives, was emailed to 68 selected environment companies (**Annex D**) and eight (8) industry associations³² in Atlantic Canada with a request that they distribute the link to their membership. 17 companies (25 percent) and two associations completed the survey.

Our first step in evaluating comparable models or mechanisms was to develop a **Commercialization Model Criteria Matrix** (CMCM). A copy of this is provided in **Annex E**. The model criteria focused on seven (7) categories/functions:

1. Coverage of key stages of business innovation;
2. Access to relevant knowledge and expertise;
3. Client focus;
4. Range of services provided;
5. Financing;
6. Quality management; and
7. Effectiveness.

The model allows for a qualitative investigation of the effectiveness and applicability of models and mechanisms. Comparable organizations/programs selected for investigation included:

- aboutREMEDICATION (AR), ON (<http://www.aboutremediation.com/>);
- Advanced Technology Program (ATP), U.S., (<http://www.atp.nist.gov/>);
- Canadian Initiative for International Technology Transfer (CIITT), (http://www.nrcan.gc.ca/es/etb/cetc/ciitt/htmldocs/index_e.html);
- Enterprise Ireland, Environmentally Superior Products Grant Scheme (<http://www.enterprise-ireland.com/Grow/Finance/EnvironmentallySuperiorProducts.htm>);
- Enviro-Access, QU (www.enviroaccess.ca);
- Genesis Group, NL (www.genesis.mun.ca);
- Houston Technology Center, U.S. (<http://www.houstontech.org/>);
- InNOVAcorp, NS (www.innovacorp.ns.ca);
- OCE-Crestech (www.crestech.ca);
- OCETA (www.oceta.on.ca);
- Small Business Innovation Research (SBIR) Program, U.S. (<http://www.sba.gov/sbir/indexsbir-sttr.html>);
- The Rice Alliance for Technology and Entrepreneurship, Rice University, U.S. (<http://www.alliance.rice.edu/alliance/Default.asp>);

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- Telecommunications Applications Research Alliance (TARA), NS (www.tara.ca); and
- Tekes (National Technology Agency of Finland), www.tekes.fi/eng.

The key challenges of the study related to industry “tiredness’ with being asked to participate in numerous studies and surveys; and to the sheer volume of information available concerning the environment industry. The latter is somewhat counterbalanced by a lack of agreed, and up to date, specific data/statistics globally.

ANNEX B: LITERATURE REVIEW - DETAIL

The 1999 Report from the Canadian Advisory Council on Science and Technology, the 2000 and 2001 reports produced by the House of Commons Standing Committee on Industry, Science and Technology, the 2001 Speech from the Throne, and Canada's Innovation Strategy, all identify commercialization as an important contribution to Canada's economic and social well being.

"The single largest impediment to commercialization is access to early stage seed capital to develop technologies from a crude lab bench concept to a point where industry/financial interest can be attracted. There is a huge gap between discovery made at lab bench funded by a national granting agency and a technology that is sufficiently "polished" to be commercially viable."

Paraphrased from Industry Comment

In 2002, revenues from environment-related activities were \$15.8 billion and represented 54 percent of total revenues reported by firms that make up Canada's environment industry. Environmental services represented 44 percent of revenues and environmental goods 42 percent. Within the category of environmental services, waste services accounted for 72 percent of total environmental services revenues³³. A key niche was the sale of technologies to reduce greenhouse gas emissions (\$364 million) of which fuel cells and other alternative fuel technologies accounted for \$118 million and solar and wind energy systems and equipment were valued at \$112 million. Small establishments make up 93 percent of the industry and earned a total of 54 percent of total industry revenues. Export markets represent 9 percent of environmental revenues in 2002. Total employment reached 159,720 in 2002.

The federal government is the key player in science and technology with over \$5 billion spent annually through a multitude of programs and agencies. Federal (and provincial) government programming for the environmental sector is comprehensive but considered unfriendly and confusing to smaller companies. **Table 15** lists the main programs.

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Table 15: Key Programming for the Environmental Sector (Source: Various; http://www.ec.gc.ca/fund_e.html; <http://www.ic.gc.ca/cmb/welcomeic.nsf/icPages/Programs>; http://www.cbsc.org/english/search/display.cfm?code=3011&coll=FE_FEDSBIS_E)

PROGRAM	VALUE (\$)	APPLICATION	FUNDING AVAILABLE UNTIL:	STAGE OF COMPANY DEVELOPMENT	TYPE OF FUNDING (GRANT/REPAY-ABLE)
Regional:					
Atlantic Innovation Fund (AIF) http://www.acoa.ca/	\$300 million (5 year fund)	Innovation in natural and applied sciences	Currently fully committed	R&D but must have a commercialization "component"	Grant; Project must be over \$500K; AIF will cover 30-75% of eligible costs
Federal:					
Buildings Energy Technologies Program www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/funding_programs_betp_e.html	For fiscal year 2002/2003, approximately \$2 million was available	Focuses on supporting the development and commercialization of energy-efficient and environmentally responsible technologies for residential and large buildings. Projects include R&D and field trials of emerging technologies, the development of design tools, and technology-transfer activities.	-	R&D to pre-commercialization	Projects are usually cost-shared at no more than 50%
Canadian Foundation for Innovation (CFI) http://www.innovation.ca/	\$2 billion (over past 5 years)	Mandate is to strengthen the capacity of Canadian universities, colleges, research hospitals, and non-profit research institutions to carry out world-class research and technology development. The Innovation Fund enables eligible institutions to strengthen their research infrastructure in	Ongoing	NA	Grant Funds up to 40% of a project's infrastructure costs; 60% through other partnerships, e.g. industry

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PROGRAM	VALUE (\$)	APPLICATION	FUNDING AVAILABLE UNTIL:	STAGE OF COMPANY DEVELOPMENT	TYPE OF FUNDING (GRANT/REPAY-ABLE)
		priority areas as identified in their strategic research plan.			
CBRN Research & Technology Initiative (CRTI) http://www.crti.drdc-rddc.gc.ca/about/about_e.html	CRTI coordinates a five-year \$170 million science and technology fund	Invests in three project categories – (1) Technology Acquisition; (2) Technology Acceleration; & (3) Research and Technology Projects to close the gaps in knowledge and capabilities of the S&T and operational communities so as to enable effective response to future CBRN threats.	2006	R&D	Grant
Emerging Technologies Program (ETP) www.nrcan.gc.ca/es/etb/cetc/cetc01/html/docs/funding_programs_etp_e.html	For fiscal year 2004/5, \$400K was allocated to support industrial initiatives.	Identifies and eliminates technical barriers to increasing energy efficiency of Canadian industries ETP supports the development and implementation of technological solutions that contribute to a cleaner environment, improved energy efficiency and productivity, higher quality products, reduced waste, and a stronger market position for Canadian companies	Ongoing	R&D	Up to 50% of funding Repayable from revenue or cost savings
Federation of Canadian Municipalities (FCM) Green Municipal Funds www.fcm.ca	Green Municipal Investment Fund (GMIF) - \$200 million; revolving fund Green Municipal Enabling Fund (GMEF) - \$50 million	Help municipal governments improve air, water & soil quality, promote the climate and promote the use of renewable resources	-	Not applicable to SMEs except by indirect work awarded on contracts	GMEF is a grant- max. \$350,000/ project; up to half of eligible cost GMIF is repayable loan

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PROGRAM	VALUE (\$)	APPLICATION	FUNDING AVAILABLE UNTIL:	STAGE OF COMPANY DEVELOPMENT	TYPE OF FUNDING (GRANT/REPAY-ABLE)
Industry Energy R&D Program (IERD) www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/funding_programs_ierd_e.html	\$3.5 million (2004/05)	Supports innovative SME R&D Development & use of energy-efficient processes, products, systems & equipment Help Canadian companies increase their market competitiveness	-	Research & Development	35% of project costs repayable
Industrial Research Assistance Program (IRAP) www.nrc.ca/irap	\$100 million budget for client contributions in 2004/05	Stimulate wealth-creation through technological innovation Supports more than 12,000 SMEs/year Delivered through national network of Industrial Technology Advisors	Ongoing	R&D to pre-commercial	R&D – grant (3–50%) Pre-commercial activities – repayable, one-third support
National Science & Engineering Council of Canada (NSERC) www.nserc.ca	\$850 in investments (2004/05) \$39 million/yr from 2004 Budget	Invests in university and company R&D Jointly funds collaborative R&D between companies & universities	Ongoing	“Idea to innovation” Early stage R&D funding	Grant Companies are expected to match NRC funding on programs such as CDR (Collaborative R&D)
Panel for Energy Research & Development (PERD)	\$58 million annually	Sustainable energy future for Canada	Ongoing		
Renewable Energy Technologies Program (RETP) www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/funding_programs_retp_e.html	For fiscal year 2003/2004, \$5 million was available	Supports development & commercialization of advanced RE technologies Energy industry eligible recipients include: manufacturers, developers, consultants, utilities, provincial & other federal departments	Ongoing	R&D to commercialization	Repayable on case-by-case basis
Renewable & Electrical Energy (NRCan)	REDI (\$51 million)	Renewable Energy Deployment Initiative (REDI)	2006	Not applicable: funds are used	Refund of costs

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PROGRAM	VALUE (\$)	APPLICATION	FUNDING AVAILABLE UNTIL:	STAGE OF COMPANY DEVELOPMENT	TYPE OF FUNDING (GRANT/REPAY-ABLE)
www2.nrcan.gc.ca/es/erb/english/View.asp?x=469&oid=111 http://www.canren.gc.ca/wp/pi	WPPI (\$260 million) MIP	Wind Power Production Incentive (WPPI) Market Incentive Program (MIP)		to encourage use of RE sources by companies/utilities	
Scientific Research & Experimental Development (SR&ED) Program www.ccr-aadrc.gc.ca/sred	-	Tax incentive for experimental research, basic research, applied research & support work Eligible project areas - experimental development; basic research; applied research	Ongoing	R&D	35% on the first \$2million in qualifying expenditures for SMEs with less than \$300K in income (for post 2003 taxation years); 40% cash back on qualified capital expenditures
Sustainable Development Technology Canada (SDTC) www.sdtc.ca	Total of \$550 million to date [\$350 million + \$200 million (Budget 2004)] \$72 million Allocated as of Sept 04	Climate Change & Clean Air, Water & Soil Technologies Development & demonstration; emphasis on strong partnerships Eligible sectors - hydrogen economy, cleaner fossil fuels, air quality improvement, energy end-use technologies, renewable energy technologies, clean water & soil (water quality and quantity improvement, waste management, & soil quality improvement)	2002-2009	Early stage R&D to demonstration	Grant (33-50% of project costs)
Technology Early Action Measures (TEAM) www.climatechange.gc.ca/english/team/	Initial Investment of \$60 million (1998-2001, 1st Round of CCAF). Renewed at \$35 million for 3 years (2001-2004, 2nd	Technology demonstration & late state development to reduce GHG emissions Technology focus areas - cleaner fossil fuels, advanced energy efficiency, biotechnologies, hydrogen economy, & decentralized energy	2008	Early to late stage R&D & demonstration	Grant (but could be repayable element)

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PROGRAM	VALUE (\$)	APPLICATION	FUNDING AVAILABLE UNTIL:	STAGE OF COMPANY DEVELOPMENT	TYPE OF FUNDING (GRANT/REPAY-ABLE)
	Round of CCAF); renewed at \$63 million for period 2004-2008, from Budget 2003	production			
Technology Partnerships Canada (TPC) http://tpc.ic.gc.ca	As of March, 2004, TPC had committed a total cumulative investment of close to \$2.4 billion (excludes TPC-IRAP), of which approx. 19% went towards environmental technologies	Designed to complement other federal government funding programs, and most projects work in conjunction with an SR&ED tax credit. Invests in R&D and technology innovation; 3 funding areas - enabling, 15-20% environmental, aerospace & defence. At May 2004, 45 environmental projects out of a total of 242, of which 30 were to SMEs out of a total of 169 to SMEs	Ongoing	R&D to pre-commercialization	25 - 30% of eligible R&D costs Repayments only if commercially successful
TPC-IRAP www.nrc.ca/irap	\$30 million per year, funded 50-50 by TPC and IRAP	Targets SMEs – pre-commercial development of new products/processes, demonstrations or pilots Available to SMEs with less than 500 employees SME projects < \$3M by IRAP-TPC	Ongoing	Early stage R&D to pre-commercialization	Contributions are repayable based on royalties on company gross revenues
Transportation Energy Technologies Program (TRANSET) www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/funding_programs_tetp_e.html	-	Development of alternative transportation fuels such as natural gas, propane and new liquid fuels, and advanced transportation systems, including electric vehicles, fuel cells, hydrogen and hybrids	-	R&D	Repayable

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The quality of applications (or proposals) received from Atlantic Canadian firms is poor and proposals often do not meet eligibility criteria. This is due to a combination of lack of experience, an inability to form partnerships and the small size of the applicants and hence the limited resources available to devote to the application process. The most successful federal program in Atlantic Canada is NRC-IRAP. It is the only program where companies in Atlantic Canada achieve a better level of funding than would be expected (as judged on a per capita basis.) The success of this program is largely attributed to the high number of Industrial Technology Advisors (ITA) "on the ground" in Atlantic Canada.

Successful "roadmaps" align federal programming, commercial/market opportunity, and technology development.

Examples of practical attempts to cull the enormous volume of information and programming provided by federal government agencies into a format that would be of use to industry can be found in the Canadian Fuel Cell Commercialization Roadmap (CFCCR)³⁴ and Charting the Course³⁵ documents. The Fuel Cell Roadmap was the first to focus on commercialization challenges and solutions while recognizing that technical challenges also need to be addressed.

The CFCCR document identified the macro market drivers for commercialization as government policies, legislation and incentives; and micro market drivers as the needs of the market and the ability of the industry to meet these needs. The roadmap proposed five support areas – stimulating early market demand, improving product quality while reducing costs, financing, creating supporting infrastructure, and collaboration.

Commercialization issues for Canadian Companies have been identified as³⁶:

- The non-linearity of innovation does not fit with current federal programming and funding initiatives;
- Key factors in the decision to commercialize are - strategic considerations, market need, availability of financing, cost/benefit analysis and "fit";
- Inadequate (or no) business plan/market analysis was the dominant reason for not commercializing a product;
- The main triggers of innovation are first, the customer³⁷ and second, competitors; and
- The best incentives for commercialization are –
 - **Increased government funding, direct funding, fiscal policy, and taxation,**
 - **First buyer/demonstrator support,**
 - **Decrease obstacles to government funding, and**
 - **Government matching venture capital funds.**³⁸

In 2003-2004 there were 157 commercialization specific initiatives (CSI) totalling \$1.45 billion provided by federal and provincial government. Of these there were 76 federal CSIs (\$1.2 billion) and 81 provincial initiatives valued at

Commercialization incentives priorities –

- * Increased government funding.
- * First-buyer/demonstrator support
- * Decrease obstacles to government funding.
- * Government matching VC funds.

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\$240 million³⁹. The Atlantic Canadian provinces had a total of 16 initiatives (20 percent of the total) valued at \$18.5 million (8 percent of the total value).

The major forms of commercialization assistance are –

- Counselling/brokerage services/information;
- Repayable contributions; and
- Grants or non-repayable contributions.

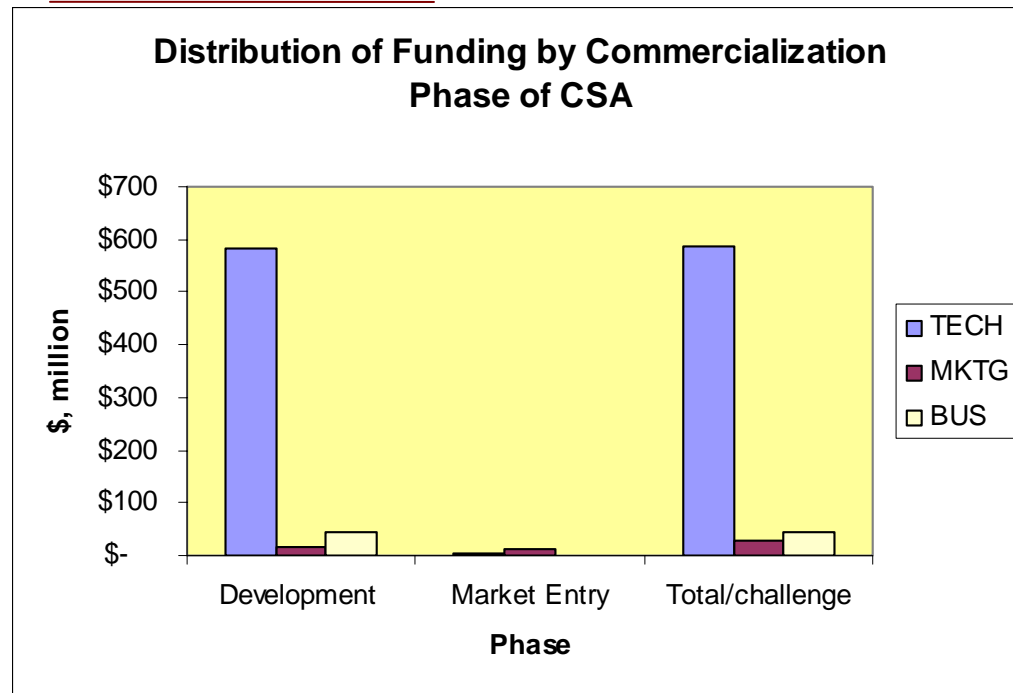
The main end-uses of the commercialization specific assistance (CSA) are –

- Financing and human resources (federal initiatives); and
- Financing and alliance formation (provincial initiatives).

Analysis of the distribution of funding by commercialization phase, i.e. development or market entry and by key challenge, i.e. technical, marketing or business, shows a strong and clear bias towards the support of technical challenge research which accounts for 89 percent (\$585 million) of total spending on initiatives (see **Figure 3**).

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Figure 4: Distribution of Funding by Commercialization Phase of Commercialization Specific Assistance, CSA (Source: Federal Government Internal Publication, 2004)



The commercialization of technology has been identified as a key government commitment. The 2004 Speech from the Throne reinforced this with the aim of –

... making Canada a world leader in developing and applying path-breaking environmental technologies.

The 2004 Budget 2004 reaffirmed the government's commitment to the development of environmental technologies with -

- \$1 billion over seven years for environmental technologies;
- \$39 million per year to NSERC towards increasing resources for research, development and demonstration projects of innovative environmental technologies; and
- \$250 million for Venture Capital (via BDC) to create access to capital for the commercialization of technologies.

The Throne Speech (2004) committed the Government to press forward with programs to improve the commercialization of new environmental technologies funded in part through the sale of Petro-Canada.

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“People say that government should not pick winners in industry but government has a responsibility to pick winning industries.”

Mr. Paul Martin,
Prime Minister,
2004

In support of this, a speech by the Honourable Stéphane Dion had as its theme that the environment is a key driver of creativity, of innovation and competitiveness globally. He pointed out that other nations' goals may leave Canada at a competitive disadvantage and that increasingly investors see the rising risk to corporate earnings from environmental factors and liability. He also added that the ability to trade will become increasingly dependent on export of sustainable products.

Studies by the British Columbia Working Group⁴⁰ and the Western Canadian Forum⁴¹, on fostering environmental technology development made a number of recommendations and highlighted key action areas which included -

- A policy of government “green procurement”;
- Demonstration projects that illustrate the effective promotion of ETs;
- Centres of Excellence that are market driven and could house “best practices”;
- The review and improvement of trade programs;
- Market intelligence;
- Review funding and incentive programs with the aim being to remove barriers to access;
- Fiscal incentives promoting investment and adoption of ETs in the earliest stages of commercialization;
- Revise and update government regulations to promote environmental technologies;
- Develop initiatives to promote risk-sharing between government, banks and other financial services providers; and
- Harmonized and supportive regulatory, policy and program mechanisms across all levels of government.

The need is to make government procurement policies consistent with sustainability goals; make programs accessible and applicable to SMEs; address regulatory regimes that present barriers; provide fiscal incentives; create centres of excellence and clusters; build international recognition; support demonstration projects; and support training and retention of skilled workers.

Most government programs are not tailored to SMEs who have unique strengths and challenges. Most have developed in response to local needs as driven by regulations; tend to be in locations with industry receptor capacity for their goods and services; and are innovative, forward looking and niche-oriented.

SME challenges include factors such as –

- Their size restricts their market focus;

Small company
challenges –

1. Size.

2. Key
management
team.

3. Government
programming.

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- They are largely established by skilled technical professionals who may be aware of global opportunities but lack the resources (financial, human, and marketing) to pursue the opportunities; and
- They need programs geared to SMEs such as business skills development, marketing, building collaborative networks, and access to capital.

SMEs are the true innovators. Current “disruption” theory sees new product development as a “danger” to established firms and usually carried out by smaller more flexible companies whose antennae are more attuned to quantum leaps in technology development. The traditional customer-market focus of identifying new innovations used by more mature technology companies is more likely to produce improvements in process that disrupt neither the customer nor the supplier but which may not in fact deliver the best solution.

“Our venture markets are immature and senior capital sources do not pay much attention to this sector.”

John Wiebe,
President &
CEO of Globe
Foundation of
Canada, 2004

In Canada, universities are the source of 21 percent of all R&D activity; 31 percent of R&D jobs; and 21 percent of gross R&D expenditures. Industry sub-contracts about 5 percent of its R&D work to universities and finances about 12 percent of other university-base R&D work. Canadian universities disclose as many inventions as their counterparts in the U.S. and create 2.5 times more spin-off companies but only generate about half the license revenues of U.S. universities. This is thought to be due to the less favourable commercial environment in Canada and the lack of receptor capacity.

There have been two recent initiatives in Atlantic Canada with a focus on delivering better collaboration between university and industry – The **Atlantic Environmental Science Network** (AESN) and **Springboard**⁴².

The AESN mission is:

To facilitate excellence in cooperative and strategic environmental research, development and training, thereby building effective partnerships and enhancing knowledge-based environmentally sustainable development in Atlantic Canada.

The organization’s objectives are to:

- Facilitate active linkages and communications among research institutions, governments and industry associations;
- Enhance student education, professional development and training in environmental sciences;
- Promote research to address environmental issues in Atlantic Canada;
- Act as a resource for environmental information; and
- Develop and promote a proactive environmental research agenda for Atlantic Canada and facilitate its applications.

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The recent establishment of Springboard – a university-based initiative, funded by ACOA has as its purpose:

To enhance the efficiency and effectiveness of technology transfer at all universities in Atlantic Canada and to promote and accelerate the commercialization of technologies by Atlantic Canadian companies.

The activities of Springboard include - delivering educational programs relative to IP and running networking events; liaison with industry and facilitation of industry sponsored research; the assessment of discoveries and protection of IP; development and management of proof of concept projects; the marketing and licensing of technologies to industry and entrepreneurs; and supporting the creation of new companies based on platform technologies. ACN is unlikely to be a significant player in the commercialization arena in the immediate future due to its “newness”.

Innovation is a complex multi-layered system and therefore elements of commercialization such as the identification and assessment of markets and market potential may need to be undertaken prior to research and development. Funding innovative R&D in environmental technologies is problematic as the return on income (ROI) is often not sufficiently attractive enough.

The environmental technology sector needs targeted tax incentives specifically related to the innovation and commercialization process and a review of current federal programming to tailor them to environmental technology innovation and commercialization.

Examples of international programs⁴³ that were developed to address the commercialization aspect of funding development are the **Small Business Innovation Research Scheme (SBIR)**, US, the **Advanced Technology Program (ATP)**, US, the **Yozma Venture Capital Program**, Israel, the **Heznek Program**, Israel and the **Environmentally Superior Products Program**, Ireland. We have also included the **SME-IDEA: Environmental Component**, Quebec as an example of a provincial program tailored to provide funding for demonstration and commercialization of environmental technologies.

These are summarized in **Table 16**.

“Once we solve the problem of angel investors and mezzanine financing, we get to the real problem – the penetration of foreign markets.”

Mr. Paul Martin,
Prime Minister,
2004

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Table 16: International Commercialization Funding Programs (Source: EEC Canada Inc., 2003, Enterprise Ireland)

PROGRAM	DESCRIPTIVE	STRENGTHS	WEAKNESSES
<p>Small Business Innovation Research Scheme (SBIR, U.S.) http://www.sba.gov/sbir/</p>	<p>U.S. Federal agencies with large R&D budgets are required to allocate a proportion to U.S. owned SMEs to undertake research with commercial potential.</p> <p>Phase 1: US\$100,000 Phase 2: US\$750,000 (2 years) Phase 3: Private funds or government contracts</p>	<p>SMEs have greater access to federal R&D programs. SMEs have incentive to focus on innovation. Stimulates a competitive environment for government R&D needs Developed a class of “boutique” firms that specialize in R&D with relatively stable source of revenue, i.e. government.</p>	<p>“Fuzzy” objectives – there is conflict over the innovation and commercialization objectives. Has not stimulated entrepreneurial culture among SMEs Less than 20 percent of firms get to commercialization. Created a class of firms that are very adept at getting government R&D awards.</p>
<p>Advanced Technology Program (ATP, U.S.) http://www.atp.nist.gov/</p>	<p>Similar to Technology Partnerships Canada (TPC) Main aims to:</p> <ol style="list-style-type: none"> 1. Bridge the gap between research and commercialization through early stage investments and public-private partnerships. 2. Accelerate the development of enabling technologies, leading to the commercialization of new products, processes and services. 3. Stimulate industry to undertake higher risk projects. 4. Foster collaboration. 	<p>ATP undertakes ongoing evaluation and assessments of projects. Commercialization and collaboration intents are laudable.</p>	<p>Lacks clearly stated objectives which “blurs” its assessments. Similar initiatives were being undertaken nationally, so program due to terminate in 2005.</p>

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PROGRAM	DESCRIPTIVE	STRENGTHS	WEAKNESSES
	Max. award is US\$2 million over 3 years.		
Yozma Venture Capital Program (Israel) http://www.yozma.com/overview/	<p>Objective of the program was to create a venture capital market to stimulate the development and growth of innovative Israeli companies.</p> <p>US\$100 million investment company established. This invested in 10 closed, one-time venture capital funds with private sector partners.</p> <p>This incentives' program induced entry of high quality, professional agents and VC management teams domestically; and of significant 'intelligent' capital from abroad.</p> <p>Has been adopted as a model by New Zealand, Australia and Denmark.</p>	<p>Single focussed objective.</p> <p>Highly specific, predetermined exit strategy for government.</p> <p>Adequate incentives for the private sector.</p> <p>Economic and social context in Israel were favourable.</p> <p>It overcame 'coordination & other failures' associated with achieving critical mass; collective learning; cluster effects and economies of scale.</p> <p>It tackled specific VC industry characteristics & constraints e.g. creation of a professional industry based on 'intelligent', networked capital and assuring a patter of investment which followed a strict definition of VC.</p>	<p>Time-limited.</p> <p>Took place in the background of a very favourable set of conditions.</p> <p>Israeli VC policies are not directly replicable elsewhere.</p>
Hezneq Program (Israel) http://www.moital.gov.il/CmsTamat/search.aspx?w=Hezneq	<p>Launched in 2002.</p> <p>Seed fund designed to induce private sector investment in start up companies by sharing the risk.</p> <p>Government provides matching funds for the private investor and takes a stake in the firm.</p>	<p>Clear goal.</p> <p>Identified life-cycle.</p> <p>Addressed a need for the sharing of investor risk to encourage investments and increase the number of start-up companies.</p> <p>Clear target company size.</p>	<p>Was in place for a limited time period to support new start-up companies.</p>

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PROGRAM	DESCRIPTIVE	STRENGTHS	WEAKNESSES
	<p>Target was R&D companies in existence for not more than 6 Months or whose total expenditures have not exceeded \$250,000.</p> <p>Up to \$1.5 million per company per 2 year period that will finance up to 50% of the approved work program; and the expenditures supported will be those related to R&D.</p>		
<p>Environmentally Superior Products Program - Enterprise Ireland (Ireland)</p> <p>http://www.enterprise-ireland.com/Grow/Finance/EnvironmentallySuperiorProducts.htm</p>	<p>To make Irish companies more competitive the Irish Government set up a program, the ESP focusing on improving the environmental performance of products which would then give the company a competitive advantage in its target markets.</p> <p>The support was \$35,000 and was to be matched 50:50 by the company.</p> <p>Approximately 40-50 companies have participated in the program to date.</p>	<p>Program is still in place after almost 10 years.</p> <p>Participating Companies have good market knowledge.</p> <p>ESP stimulates R&R with a specific focus.</p> <p>Success rate is about 75% (as judged by expanded sales).</p> <p>Has effected a positive cultural change in the way SMEs view R&D.</p> <p>Program is well-communicated through advisors/brokers.</p>	<p>Low volume through the program, average 5 per year.</p> <p>Low level of funding.</p>
<p>SME-IDEA: Environmental Component</p> <p>http://www.gc.ec.gc.ca/dpe/Programme/pr og2_e.asp</p>	<p>Financial advice and assistance for the demonstration and commercialization of environmental technologies.</p> <p>Target is SMEs <200 employee</p> <p>As part of a cooperation agreement with EC, CED & EC, Quebec established</p>	<p>Assists projects of up to \$1 million in eligible costs; maximum of 50% of total eligible costs.</p> <p>Assistance is for –</p> <ul style="list-style-type: none"> ▪ Strategic studies and plans to develop 	<p>Contribution refundable in full.</p> <p>Had to reduce communications efforts as the community's expectations were beginning</p>

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PROGRAM	DESCRIPTIVE	STRENGTHS	WEAKNESSES
	<p>priority areas of activity in environmental and sustainable development matters.</p> <p>Between 1997 & 2003 there was a specific communications strategy targeting for the environmental industry support. Strategic partnerships were developed (Réseau Environnement, BRI, CANMET, NRC-IRAP, AAC, etc.) and key initiatives such as Enviroclub.</p> <p>An administrative amendment to SME-IDEA was made to include testing and experimentation.</p> <p>Most of the projects under this component are SD projects.</p>	<p>environmental technologies;</p> <ul style="list-style-type: none"> ▪ Adapting new technologies to meet market demands; ▪ Technology demonstrations; identifying and evaluating new technologies; ▪ Studies on technology trends/evolution; ▪ Communicating results; and ▪ Developing and implementing technology marketing plans. <p>It reached 20% of contributions under the SME-IDEA contribution component compared to a previous level of less than 5%</p> <p>Future aim is to be more selective and focus on climate-change related priorities.</p>	<p>to exceed budget capacity.</p>

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The key Canadian incentives for innovation are:

- **SR&ED** - provides tax incentives to encourage firms to undertake or increase their R&D initiatives. The original intent was good but is based on a focus that R&D is the key to increased productivity and competitiveness in contemporary economies which is now seen as no longer adequate to foster and grow an innovative economy. Successful innovation requires a holistic approach and systemic analysis with measures to reflect this perspective. For SMEs, SR&ED incentives enabled investment in the development of projects but lacked equivalent measures to assist them through the commercialization phase. It may now be appropriate to have an “innovation” tax incentive; and
- **TPC-IRAP** - is perceived to provide assistance closer to the commercialization phase. IRAP-TPC Program is available to SMEs (defined as companies with 500 or fewer employees). Total eligible project costs under IRAP-TPC Program may not exceed \$3,000,000. The Environmental Technologies component encourages and supports the development and application of innovative technologies that contribute to the achievement of sustainable development, or that have significant environmental benefits. It involves projects in priority environmental areas such as - the development of sustainable alternatives (better conservation of energy, water and non-renewable resources), pollution prevention through the development of clean process technologies (including clean car technologies) and pollution abatement (technologies that reduce waste or harmful emissions), and pollution remediation.

In Atlantic Canada there are two key federal programs:

- **Business Development Program (BDP)** - ACOA under the BDP provides provisionally repayable pre-commercialization support but this is seen, by some, as not being properly aligned to the needs of SMEs particularly over the time period that may be needed for commercialization, i.e. 5-7 years.
- **Atlantic Innovation Fund** – is an excellent program that encourages industry-university collaboration. It asks proponents to consider commercialization and market-demand but does not provide funding for commercialization-related activities. Of the 55 projects funded in the second round of the Atlantic Innovation Fund, nine (valued at \$17 million) could be classified as environment-related. Provincial projects include:
 - The Salmon River Salmon Association (SRSA), an internationally recognized non-profit, community-based organization, is conducting a pilot project aimed at using Cement Kiln Dust (CKD) to remediate rivers and streams affected by acid rain;

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- The University of New Brunswick is developing a new biological process for the treatment of biodegradable industrial wastewater;
- St. Francis Xavier University in Nova Scotia is developing models that estimate carbon dioxide emissions from soils as a function of land use and climate change. This project would build regional capacity to address the priorities of the Kyoto Accord and the National Climate Change Plan; and
- The Burin Campus of the College of the North Atlantic in Newfoundland and Labrador is developing a wave-powered pumping system to pump seawater onto the shore for uses such as aquaculture operations.

In 1993 three Canadian Environmental technology Advancement Centres (CETACs) were established by Environment Canada as not-for-profit, private-sector corporations with a mandate to:

Foster international competitiveness through the development, commercialization and application of environmental technologies.

The CETACs are founded on a “network-based collaborative business model” for capacity building and market development for SMEs. They are a neutral, third party intermediary between the technologies and the markets focused on filling gaps between research and the development of products and providing services. Their impact is considered to be on three levels –

- Market-based technology development;
- Capacity building (market intelligence, accessing financing, business and financial management); and
- Market development.

The search for sustainable funding has prompted the CETACs to broaden their scope. Although still environment related, the focus is now not totally within Environment Canada’s mandate. The broadening of scope to achieve funding stability could be perceived as a weakness and in the eyes of some observers the CETACS have not demonstrated a significant level of success. There would be some support in Atlantic Canada for the principles that underpin the CETACs, but such an entity would be required to have a closer “fit” with the specific needs and environment within the region.

Various publications estimate that there are about 850 environmental firms in Atlantic Canada which employ over 12,000 persons⁴⁴. The Atlantic Canada environmental market is valued at about \$1.3 billion annually with environmental firms in the region generating over \$700 million in revenues and according to Industry Canada, about 10 percent of companies are

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Atlantic Canada sectoral strengths –

- * Renewable energies.
- * Oil industry solutions.
- * Solid waste management.
- * Water/waste-water treatment.

involved in exporting with export revenues of over \$40 million⁴⁵. Strengths and regional focuses have been identified as –

- Environmental energy (e.g. PEI natural, renewable projects);
- Oil industry solutions (e.g. NL oil spill contingency planning and remediation);
- Solid waste management (e.g. NS has one of the highest diversion rates in the world); and
- Water and wastewater treatment (e.g. NB's extensive experience in the wastewater sector).

In 2002, a proposal for an Atlantic Canada CETAC identified the challenges for Atlantic Canadian ET firms as - adequately accessing federal development funding; inadequate connections to academic institutions; and lack of a strong technology champion who can provide both knowledge and expertise throughout the commercialization process⁴⁶. To a large extent the primary research in the next section confirms that the situation has not significantly changed or improved.

In the 1999 "Beyond the Horizon – A Strategy for AC's Environmental Industries" report it was proposed to -

Establish an Environmental Technology Centre of Excellence linking academic capacity and knowledge with industry to develop new and more competitive clean energy and environmental technologies⁴⁷.

Included in the report's listing of five "strategic pillars" was technology innovation, export market development, and environment industry collaboration. The report also commented that –

Although a number of local firms hold patents on niche technologies, much of the environmental technology, notably large equipment, in major infrastructure resource projects is imported. As a technology continues to become a greater and more important component of the environment sector, Atlantic Canada firms will be increasingly threatened.

Practical examples of commercialization models exist regionally, nationally and internationally. Most specialize in specific areas or stages of company development. Accessibility of capital is a clearly a problem and the need for

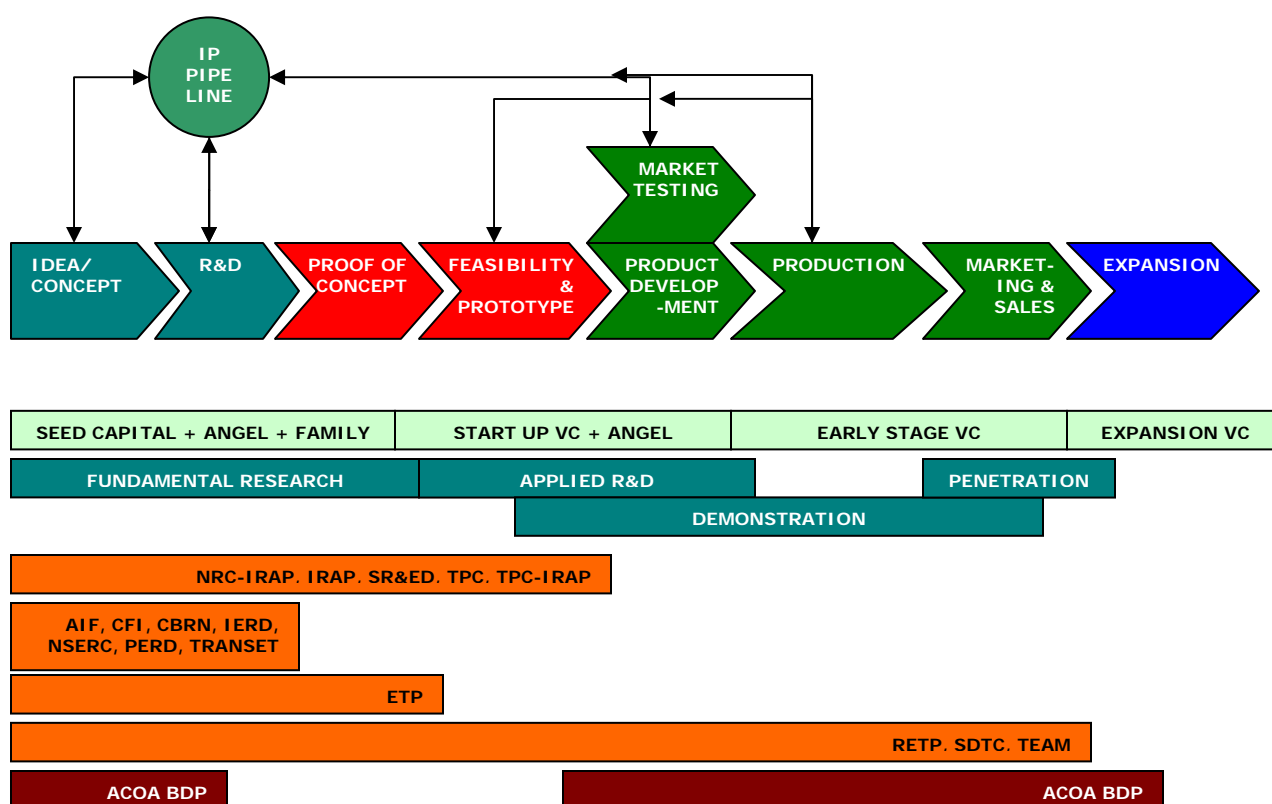
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financial incentives requires consideration. Collaboration and the investigation of strategic partnerships need attention on several levels, e.g.

- Coordinated development support, services & infrastructure (government-to-business);
- Business development (business-to-business);
- Availability of skilled personnel at all levels (government-to-business); and
- Codes, standards & regulatory environment (government-to-business).

The innovation to commercialization process is multi-layered and complex and therefore a comprehensive/holistic approach is required. Any new model/mechanism should understand the distinct development stages involved in innovation, from idea to market success and should take into consideration that each stage has its own requirements - financial, management, infrastructure, production, marketing, etc. **Figures 4 and 5** represent different viewpoints on how the continuum relates to government programming. **Figure 4** specifically considers the programs described in **Table 15**; and **Figure 5** is a wider view of the federal funding spectrum.

Figure 5: Innovation to Commercialization Development Stages & Sources of Funding
(Source: ÆGIS Management Consulting Group (2004) Inc.)

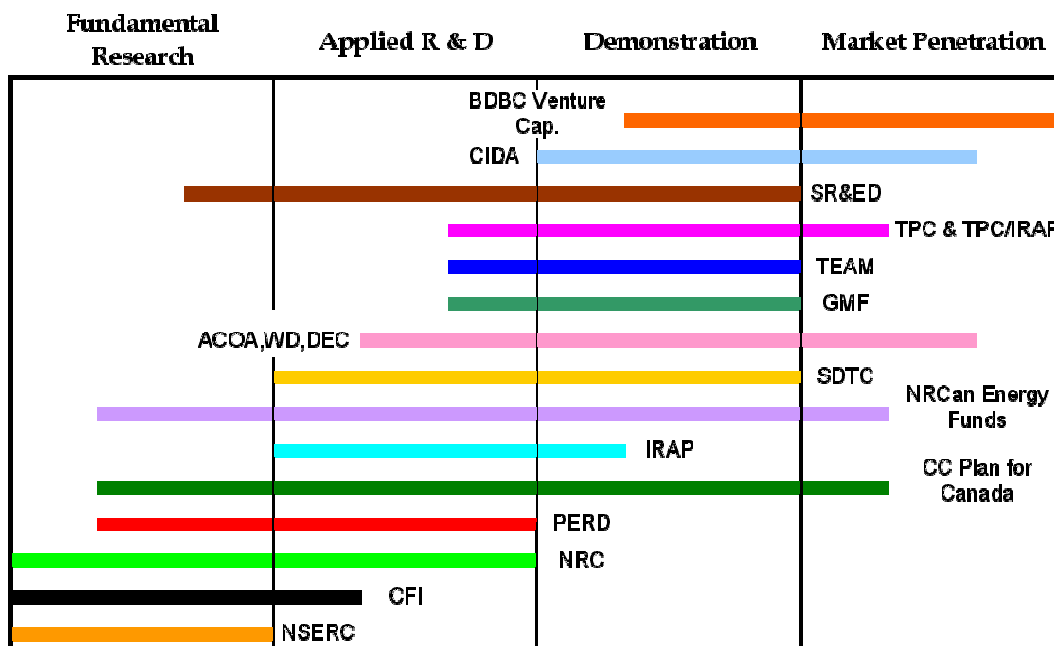


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The commercialization model will require a “managed risk” mitigation program that will encompass business capabilities development, strategic financing partnerships (public: private); an understanding of the global market; marketing; communications; business planning; knowledge of competitive innovation / disruptive technologies; and international partnering..

Any new model should be sustainable, and add value to existing services and infrastructure whether public or private. It should include an effective accountability framework with elements such as - evaluation (regular & periodic), performance measurement, model/mechanism effectiveness, and economic impact assessment.

Figure 6: Funding and Incentive Programs along the Federal Government’s Funding Spectrum (Source: Environment Canada)



ANNEX C: STAKEHOLDER INTERVIEW LISTING

	CONTACT NAME	ORGANIZATION/ COMPANY
PRIMARY LISTING		
1	Wade Aucoin	ACOA Moncton (Steering Committee)
2	Anne Thompson	Industry Canada, STSIB (Steering Committee)
3	Rodger Albright	Environment Canada (Steering Committee)
4	Nicole LeBlanc-Richard	NRC-IRAP (Steering Committee)
5	Yvonne Devine	ACOA (Steering Committee)
6	Robert Orr / Ross McCurdy	Ocean Nutrition Canada (ONC)
7	Larry LeBlanc	Renewable Energy Services Ltd.
8	Hollis P. Cole / Eric Winchester	ADI Group
9	Bill Borland	J.D. Irving Ltd
10	Byron Dawe	Rutter Technologies Inc.
11	Rod Vatcher	Abydoz Environmental Inc.
12	Mike Pearson	Geonet Technologies Inc.
13	Scott Llewellyn	MGI Ltd.
14	Rick Joseph	NSEIA
15	Charlie Riggs	NLEIA
16	Marvin Chaulk	NATI
17	Carol Tibbitts	NBEIA
18	Don McCallum	Canada Lands Inc., PEI
19	Cheryl Viney	Environment Canada
20	Abe Finkelstein	Environment Canada
21	Geoff Nimmo	Industry Canada - Commercialization & Innovation
22	Craig Morrison	Nova Scotia Department of Environment and Labour
23	Robert Anderson	Nova Scotia Department of Environment and Labour
24	Clair Gartley	New Brunswick Department of Agriculture, Fisheries and Aquaculture
25	Cecil Freeman	Business New Brunswick
26	Chris Payne	Technology PEI Inc.

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	CONTACT NAME	ORGANIZATION/ COMPANY
27	Dr. Doug House	NL Department of Innovation, Trade and Rural Development (ITRD)
28	Ann McLean	Canadian Federation of Municipalities - Green Fund
29	Carl Beckenridge	Dalhousie University - Office of Research Services
30	Jim Wright	MUN
31	Denise LeBlanc	NRC-IMB
32	Dr. Jim Smith	Food Technology Centre
33	Joel Hill	Research & Productivity Council (RPC)
34	David Healy	NRC-IRAP (Maritimes Region)
35	Yves Gagnon	New Brunswick Innovation Foundation
36	Ray Cote	Dalhousie University - School for Resource & Environmental Studies
37	Kelly Ashfield	Business New Brunswick
38	Michelle MacDonald	Team Canada Atlantic Secretariat
39	Linda Cooper	Atlantic Environment Science Network
40	Dave King	Genesis Group
ALSO:		
1	Brian Lowe	ImmunoVaccine Technologies
2	Ralph Tedesco	Nova Scotia Power
3	Ian Wilson	Wilson Fuels Co. Ltd.
4	Allan Shaw	Shaw Group
5	John Argall	Solanum Genomics International Inc./ BioAtlantech
6	Robert Kiely	Envirem Technologies Inc
7	Ted Robak	Force Robak Associates Ltd.
8	Tom Kaszas	McCain Foods Inc.
9	Paul Anderson	Blue Oceans Satellite Systems Inc. (BOSS)
10	Stephen Dempsey	Greater Halifax Partnership
11	John MacQuarrie	PEI Department of Environment, Energy and Forestry
12	Kandace McEntee	PEI Business Development
13	Don Jardine	PEI Department of Environment, Energy and Forestry
14	Paul Dean	NL Department of Environment and Conservation
15	Gail Dinter-Gottlieb	Acadia University
16	Dr. Aleks Patrzykat	NRC-IMB
17	Peter Fortin	ACF

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	CONTACT NAME	ORGANIZATION/ COMPANY
18	Barbara Girard	BioSeas Partnership
19	Michael Dennis	Genome Atlantic
20	Judith Whittick	C-Core
21	Matthew Brown	Trout River Industries

ANNEX D: COMPANY LISTING

	COMPANY	PROVINCE
1	ADM Systems Engineering Ltd.	NS
2	Abydoz Environmental Inc.	NL
3	ADI Group	NB
4	ARC Geobac Group Inc	NB
5	Aspen Environmental Inc.	NB
6	Agrapoint International	NB
7	Atlantic Bunker Gear Services Inc	NS
8	Atlantic Wind Test	PEI
9	Biomedica Rapid Diagnostic Systems	NS
10	Blue Oceans Satellite Systems Inc. (BOSS)	NL
11	Bridco Values Limited	NS
12	Britech Information Systems	NS
13	Cavendish Farms	PEI
14	ChitoXanSys Inc	PEI
15	CMT Inc	NL
16	Coburn Farms	NB
17	Concrete Solutions - see Warren Group	NB
18	Cormorant Ltd.	NS
19	Diversified Metal Engineering Inc. (DME)	PEI
20	Emera	NS
21	Engineering Technologies Canada Ltd	PEI
22	Envirem Technologies Inc	NB
23	EnviroSafe Recyclers Inc	PEI
24	EnviroSystems Inc.	NS
25	Environmental Proteomics	NB
26	Farnell Packaging Ltd.	NS

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	COMPANY	PROVINCE
27	Force Robak Associates Ltd.	NB
28	Fundy Engineering	NB
29	Geonet Technologies Inc.	PEI
30	GeoNet Technologies Inc.	NS
31	Genoa Design International Ltd.	NL
32	Green Power Labs Inc.	NS
33	Hi-Point Industries (1991) Ltd.	NL
34	IMirador	NL
35	ImmunoVaccine Technologies	NS
36	Impact Microbiology Services Limited	NB
37	IoSolutions Incorporated	NS
38	J.D. Irving Ltd	NB
39	King Metal Fabricators	NS
40	Maritime Electric	PEI
41	Maritime MicroBiologicals Inc.	NB
42	Maritime Paper Products Ltd.	NB
43	McCain Foods Inc.	NB
44	MGI Ltd.	PEI
45	North Atlantic Biopharma Inc. (NABI)	NL
46	North Atlantic Refining	NL
47	Nova Magnetics-Burgmann Ltd.	NS
48	NovaLIS Technologies	NS
49	Ocean Choice	PEI
50	Ocean Nutrition Canada	NS
51	Origin Biomedicinals	NS
52	Preferred Environment	PEI
53	PSC Analytical Services	NS
54	Rawdon Technologies Ltd.	NS
55	Refrigerant Services Inc	NS
56	Renewable Energy Services Ltd.	NS
57	Rutter Technologies Inc.	NL

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	COMPANY	PROVINCE
58	SCG Industries	NB
59	Seaforth Engineering Group Inc.	NS
60	Shaw Group	NS
61	Solanum Genomics International Inc.	NB
62	Technico Pty. Ltd	NB
63	Thermo Dyamics Ltd.	NS
64	Trihedral Engineering Ltd.	NS
65	Trout River Industries	PEI
66	Tubular Solutions Inc.	NS
67	Warren Group	NB
68	Wilson Fuels Co. Ltd.	NS
69	Woodtech Inc.	NB

ANNEX E: COMMERCIALIZATION MODEL MATRIX

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COMMERCIALIZATION MODEL CRITERIA

Objective: To provide a basis for evaluating alternative approaches to commercialization (moving a new product or process to market).

CRITERIA	COMMENT & RATING (OUT OF 5)
<p>1. Coverage of key stages of business innovation:</p> <ul style="list-style-type: none">• Concept development• Research and development• Business start-up• Business growth• Business maturity	
<p>2. Access to relevant knowledge & expertise:</p> <ul style="list-style-type: none">• Key personnel with directly related business experience• Appropriate science / technology expertise• Commercialization (investment, incubation, mentoring)• Business governance, leadership & management expertise• Key business functions, e.g., marketing, HR, etc.• IP, taxation, legal, government incentives & programs	
<p>3. Client focus:</p> <ul style="list-style-type: none">• Target client profile<ul style="list-style-type: none">○ Client recruitment policy○ Actual client demographic profile○ Number of clients (throughput)○ Evaluation of innovation: product / process• Client qualification process:<ul style="list-style-type: none">• Diagnostic assessment	

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<ul style="list-style-type: none"> ○ Leadership and management team capabilities ○ Technology assessment: due diligence, applications, foresighting ○ Commercially viable product/process ○ Business plan ○ Financial viability of business model ● Confirmation of commercialization relationship <ul style="list-style-type: none"> a. Contract / agreement: terms of reference b. Exit strategy ● Client relationship management: <ul style="list-style-type: none"> a. Defined commercialization process, performance objectives, deliverables & milestones b. Client services manager c. Progress reporting d. Contact management e. Accountability for results f. Roles, commitments, timeframes 	
<p>4. Range of services:</p> <ul style="list-style-type: none"> ● IP services <ul style="list-style-type: none"> a. Intellectual property protection / management (patents, trade-marks, copyrights, industrial designs and integrated circuit topographies) b. IP licensing / transfer agreements ● Business start-up assistance ● Access to business / technology advisors & consultants ● Access to mentors <ul style="list-style-type: none"> a. Provision of qualified mentoring expertise b. Access to partners' mentoring resources c. Peer-to-peer mentoring ● Online information & commercialization resources ● Incubation services <ul style="list-style-type: none"> a. Office and industrial space b. Laboratory facilities c. Administrative support staff and office equipment d. Access to meeting and conference space e. Specialized scientific resources f. Business-to-business networking, peer support and partnership 	

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<ul style="list-style-type: none">opportunitiesg. Professional development workshops / seminarsh. Business advice and referral servicesi. Marketing services, research, intelligencej. Programs for off-site clients• Investment services<ul style="list-style-type: none">a. Pre-commercialization / seed financingb. Angel financingc. Venture capitald. Investment syndication / partnerse. Business plan approvalf. Board of Directors participation• Partnering / collaboration services• Research and development:<ul style="list-style-type: none">a. Fundingb. Servicesc. Partnerships• Project management / product development services• HR management services<ul style="list-style-type: none">a. Organizational designb. Compensation and benefitsc. Recruitment and selectiond. Skills developmente. Labour / management relations	
<p>5. Financing:</p> <ul style="list-style-type: none">• Sustainability<ul style="list-style-type: none">○ Client pays 100%○ Government pays 100% (capital, operating grant or contribution)○ Repayable loan○ Co-pay (e.g., client / government / provider)○ Provider pays 100%○ Other revenue sources	

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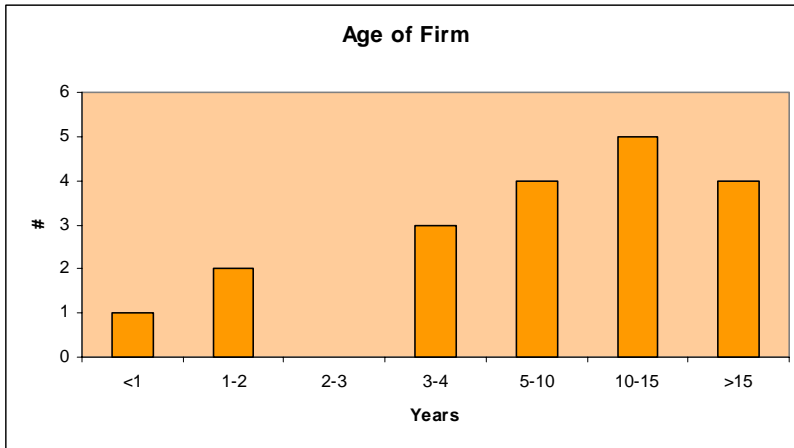
<ul style="list-style-type: none">• Relative cost<ul style="list-style-type: none">○ Capital○ Operating	
<p>6. Quality management process:</p> <ul style="list-style-type: none">• Standards• Documented procedures, performance standards• Quality audits• Follow up• External review	
<p>7. Effectiveness:</p> <ul style="list-style-type: none">• Success rate• Failure rate• Economic impact	

Rating system: 1= poor, 2= fair, 3=good, 4=very good, 5=excellent

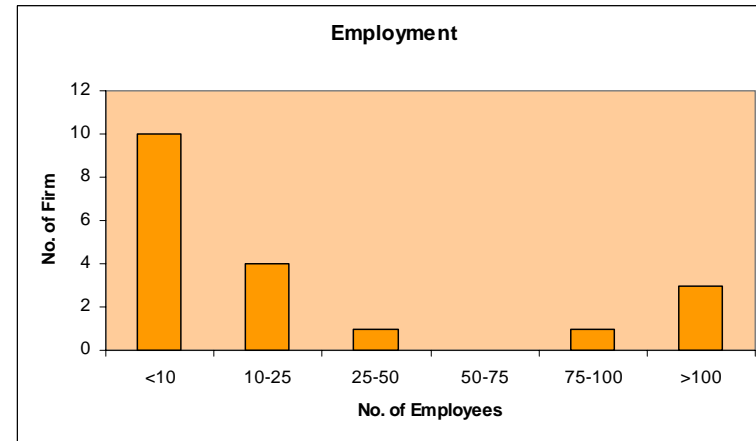
ANNEX F: INDUSTRY SURVEY (CHARTS)

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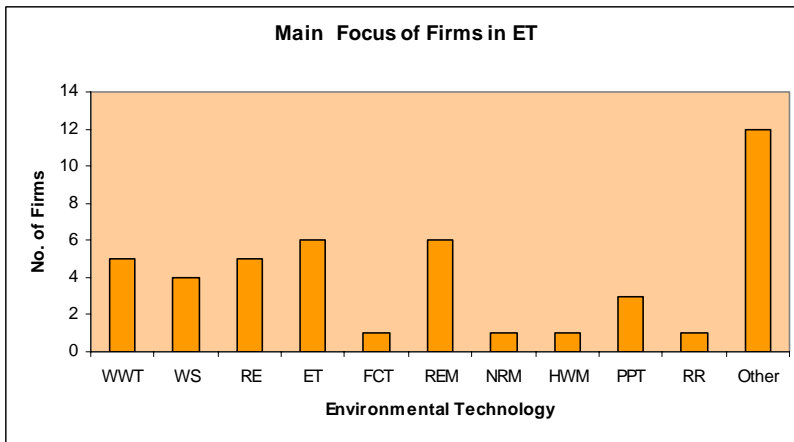
Q. How long has your company been in business?



Q. How many employees has your company?



Q. What is the main focus of your company's Environmental Technology?



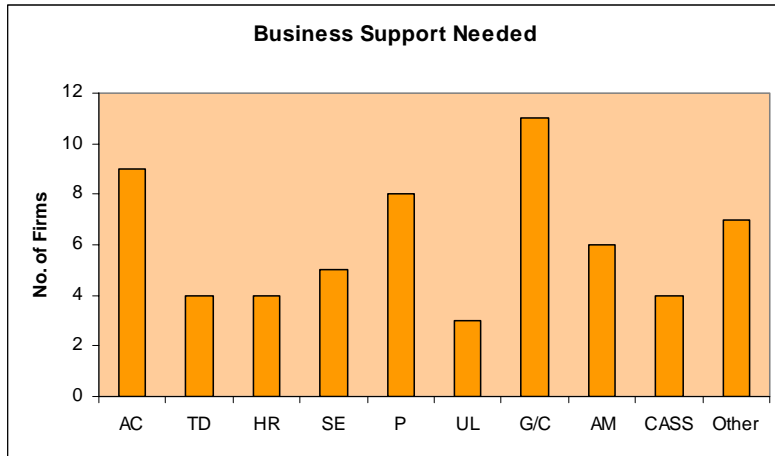
Q. Do you offer ET services or products?



(WWT = water/wastewater treatment, WS = waste services, RE = renewable energy, ET = environmental testing, FCT = fuel cell technologies, REM = remediation, NRM = natural resource management, HWM = hazardous waste management, PPT = process & prevention technology, RR = resource recovery)

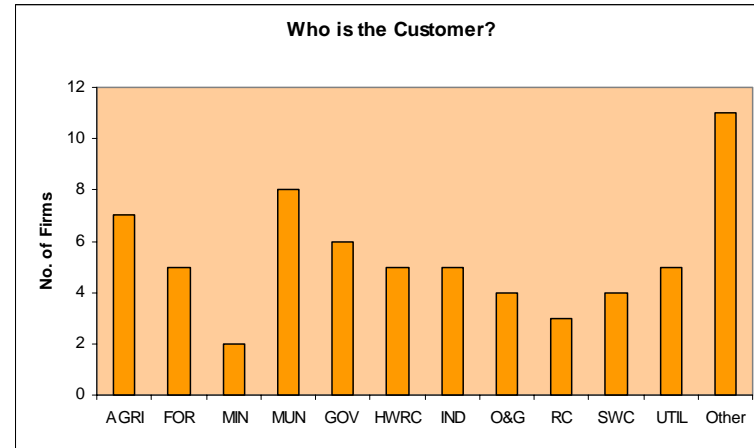
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Q. What does your business need to support ET innovation & commercialization?



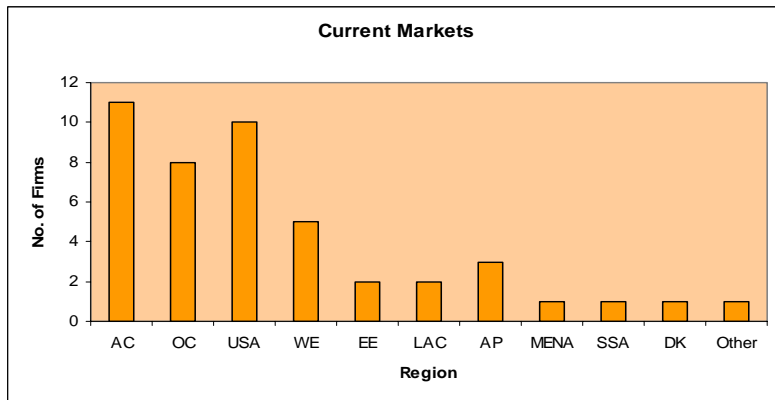
(AC = access to capital, TD = technology development, HR = human resources, SE = scientific expertise, P = partners, UL = university links, G/C = grants/contributions, CASS = coordinated access to support services) IND = industry, O&G =

Q. Who are your key customers?



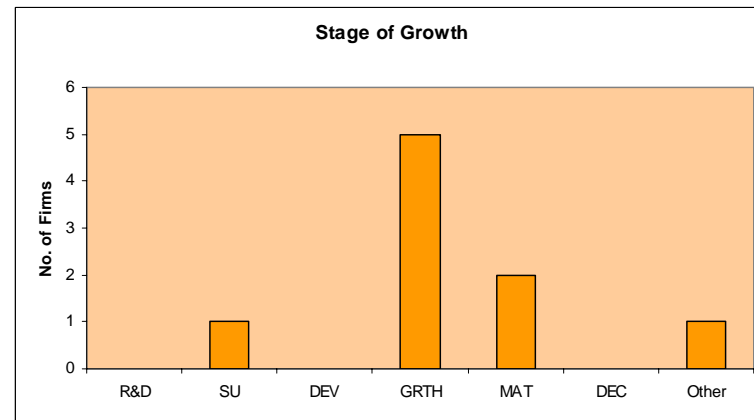
(AGRI = agri-food, FOR = forestry, MIN = mining, MUN = municipalities, GOV = government, HWRC = hazardous waste & remediation contractors, AM = access to markets, IND = industry, O&G = oil and gas, RC = regulated companies, SWC = solid waste companies, UTI = utilities)

Q. Where are your current markets?



(AC = Atlantic Canada, OC = other Canada, WE = Western Europe, EE = Eastern Europe, LAC = Latin America & Caribbean, AP = Asia-Pacific, MENA = Middle East & North Africa, SSA = Sub-Saharan Africa, DK = Don't Know)

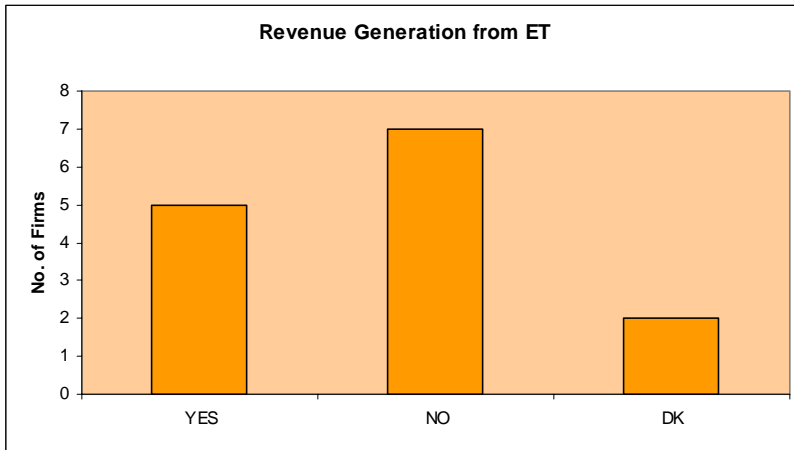
Q. Where is your firm in its current stage of growth?



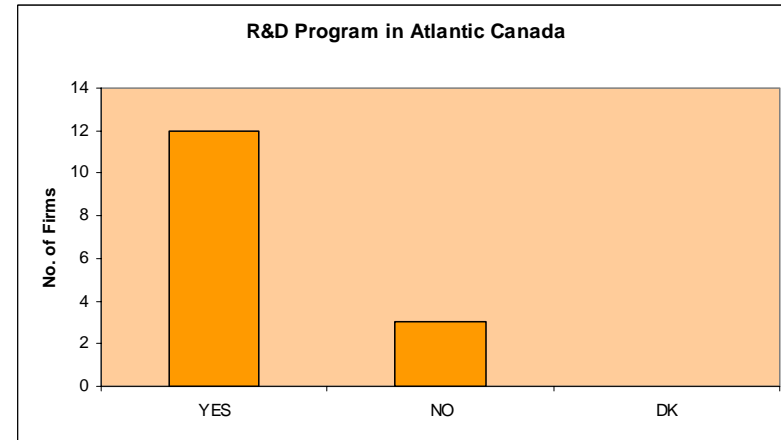
(R&D = research & development, SU = start up, DEV = development, GRTH = growth, MAT = mature, DEC = decline)

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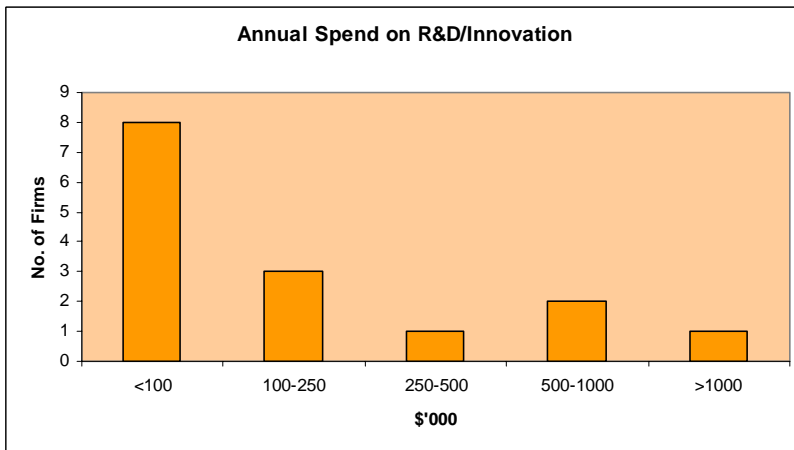
Q. Does your company generate revenue from ET Innovation & Commercialization?



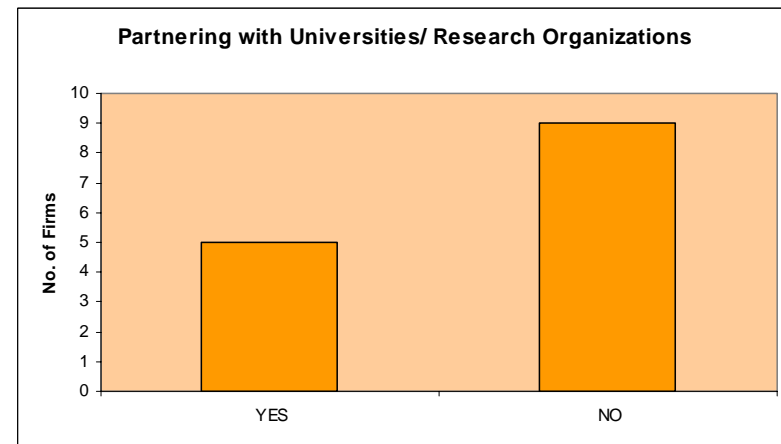
Q. Does your company have an R&D program in Atlantic Canada?



Q. How much does your company spend on R&D annually?

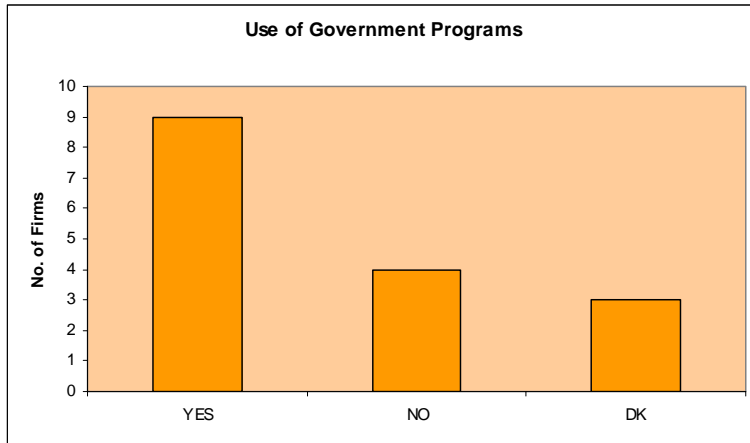


Q. Do you currently partner with universities and/or research organizations?

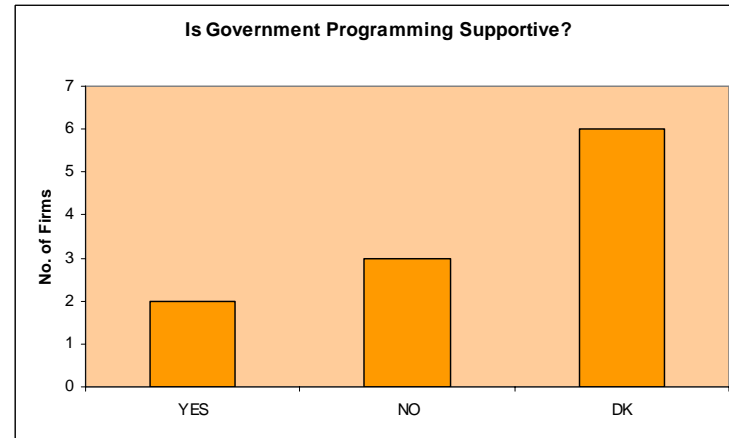


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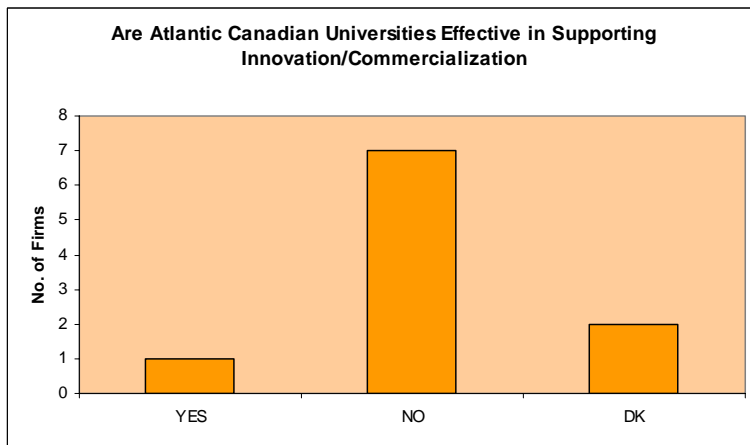
Q. Do you use/have you used government programming?



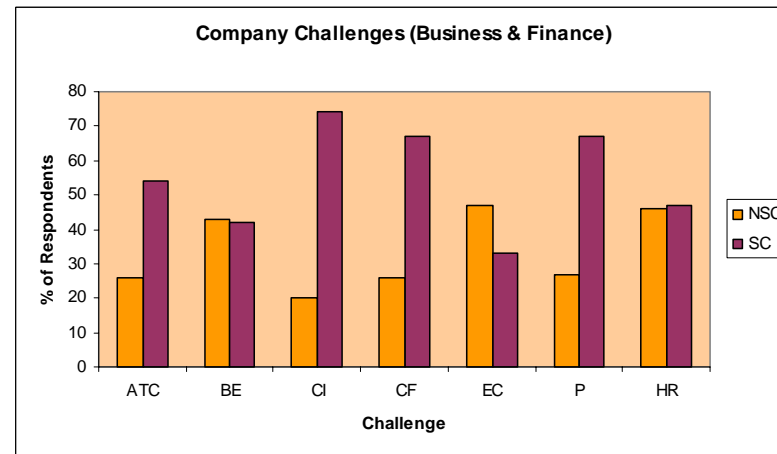
Q. Is government programming supportive of innovation/commercialization?



Q. Do AC universities effectively facilitate the transition from innovation to commercialization?



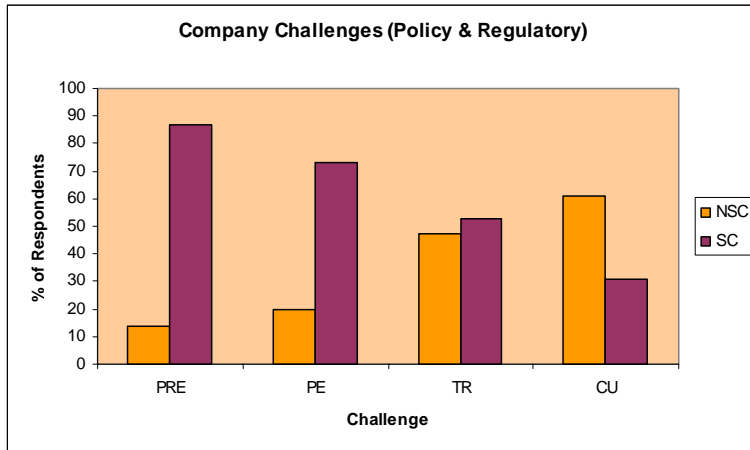
Q. What are your company's primary challenges/barriers (Business & Finance)?



(ATC = ability to commercialize, BE = business environment, CI = capital investment, CF = cash flow, EC = economic cycle, P = partnering, HR = human resources. NSC = not a serious challenge, SC = serious challenge)

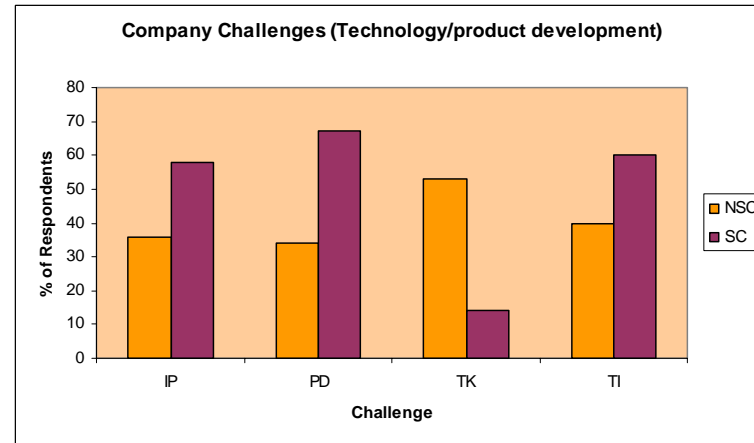
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Q. What are your company's primary challenges/barriers (Policy & Regulatory)?



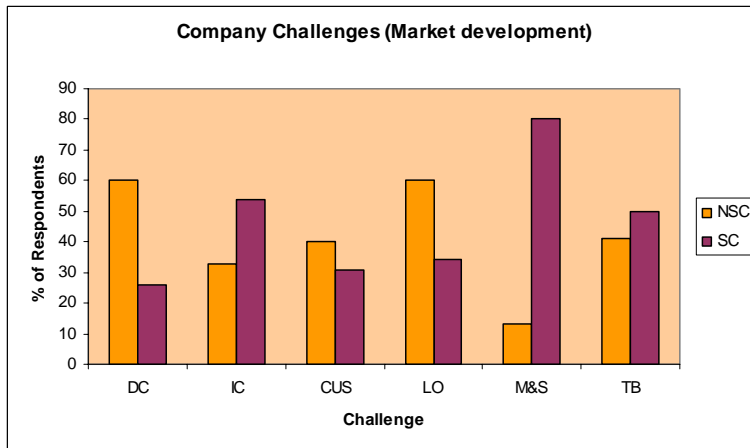
(PRE = policy/regulatory environment, PE = political environment, TR = tax regime, CU = currency)

Q. What are your company's primary challenges/barriers (Technology/Prod. Dev.)?



(IP = intellectual property, PD = product development, TK = technical knowledge, TI = technology investment)

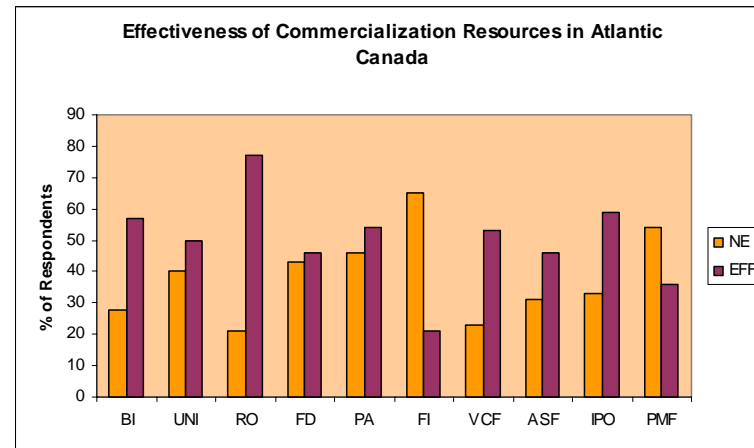
Q. What are your company's primary challenges/barriers (market development)?



(DC = domestic competition, IC = international competition, CUS = customers, LO = location, M&S = marketing & sales, TB = trade barriers)

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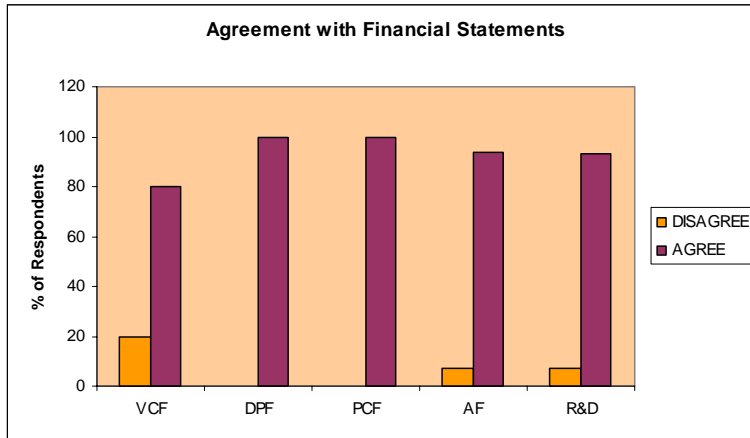
Q. How effectively do the following commercialization resources support environmental technology innovation and commercialization?



(BI = business incubators, UNI - universities, RO = research organizations, FD = federal departments, PA = provincial agencies, FI = financial institutions, VCF = venture capital funds, ASF = angel/seed funds, IPO = IP/Technology transfer organizations, PMF = professional management firms. NE = not effectively, EFF = effectively)

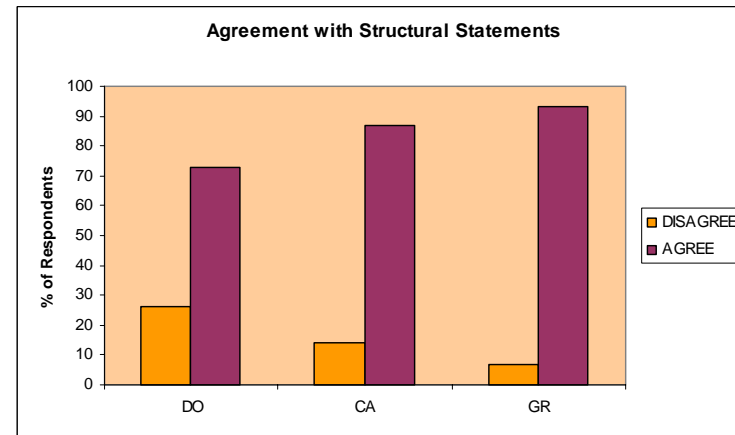
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Q. Do you agree or disagree with the following financial statements?



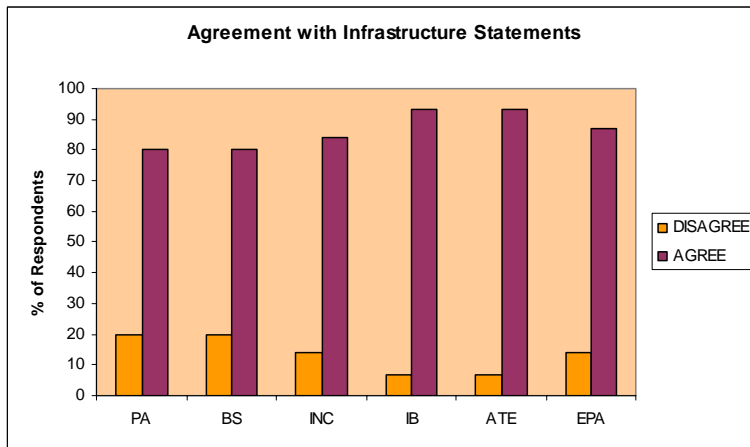
(VCF = A venture capital fund is required for ET businesses in Atlantic Canada.
 DPF = Financial support for demonstration projects is required.
 PCF = Pre-commercialization funding is required.
 AF = Assistance in accessing funding is needed.
 R&D = Funding for R&D is needed.)

Q. Do you agree or disagree with the following structural statements?



(DO = Atlantic Canadian firms require a dedicated organization focused on commercialization.
 CA = Coordinated access to government programs is needed.
 GR = The government role is to provide an early/ "first user" market for new ET.)

Q. Do you agree or disagree with the following infrastructure statements?



(PA = Partnerships are required.
 BS = Business mentoring & skills development support.

IB = International business development.
 ATE = Access to technological expertise

EPA = Environmental performance audits.
 INC = Incubation facilities are required)

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