

AN ASSESSMENT OF ALBERTA'S ENVIRONMENTAL TECHNOLOGIES INDUSTRY

Final Report

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EXECUTIVE SUMMARY

The Current Situation

- The roots of Alberta's environmental industry are in the province's significant endowment of natural resources, its concentration of technical expertise and its entrepreneurial culture. Environmental issues represent a cost to users, therefore, a strong regulatory framework has been and continues to be essential to the development of the environmental industry.
- The industry is vibrant and has experienced strong growth over the past two decades, with revenues growing from roughly \$650 Million in 1992 to \$3.2 billion a decade later. It is comprised of over 800 Small to Medium-sized Enterprises (SME's), with roughly half these firms having less than 15 employees.
- Over 80 per cent of Alberta's SME's provide services (e.g. consulting) as their primary business and just over 15 per cent are in the equipment and supply business, primarily developing and marketing technology based products. Although the majority of the industry's sales are in the Canadian market, the equipment and supply companies are more export market oriented, taking advantage of niche opportunities and their technical expertise.
- The environmental industry's access to a thriving energy sector has provided opportunities for the SME's to develop innovative solutions to local environmental problems. The combination of market access, strong technical skills and risk-taking culture has enabled the industry to strengthen its competitive capabilities and to transfer this expertise to international markets and to other sectors such as petrochemical, agriculture, urban and transportation sectors.
- The further development of Alberta's natural resources (e.g. oilsands, coal) combined with the strong intellectual assets in the province will continue to provide opportunities for environmental SME's to create innovative local solutions and to apply these to other sectors such as the urban water management and agriculture

wastes sectors. Nevertheless the major growth opportunities will be in export markets and these are considerably more difficult and costly to penetrate.

- While Alberta's environmental SME's compete well at home, in international marketplaces they face very strong competition against better capitalized and larger corporations with sophisticated marketing and business capabilities and considerable support from their governments. In Alberta, while limited government programs for launching new technologies in the environmental sector are available and helpful, they are not competitive with programs available in other countries. The programs are also viewed by many SME's to be cumbersome, bureaucratic and, in some instances, counterproductive. The international marketplace is therefore not an even playing field for the mostly small Alberta companies.
- The future growth and success of Alberta's environmental industry should not be taken for granted. Even after competencies in local markets are earned, the very small size of most SME's, the long distances to export markets and the competitive market conditions in international markets, make entry very costly and at a risk level that these companies cannot tolerate on their own.
- As documented in numerous studies over the past decade, Alberta's business environment to support the commercialization of technology by SME's needs to be significantly improved. The Innovation and Technology Commercialization process is not well defined and is therefore not being given sufficient priority when allocating fiscal resources for economic growth. Alberta has made significant progress in allocating resources to university research and innovation, but much less to the technology development and commercialization process that will bring the fruits of research and innovation to the marketplace.
- There is no time for complacency. The opportunity and challenge are now, while the energy industry and provincial economies are healthy and the intellectual assets are here. The opportunity is to build on the province's significant expertise and entrepreneurial spirit to stimulate the environmental industry to continue to realize strong growth and to make a greater contribution to the overall provincial and national economies.

Future Growth

- The SME's that provide environmental services, such as consulting, see modest growth over the next few years as the conventional energy sector reaches maturity and oilsands developments ramp up. Their growth opportunities are in other sectors (e.g. agricultural, transportation) or in global markets. Substantial growth is expected to come from sales to markets outside of Canada in specific niches where Alberta companies possess specialized competitive advantages. There are several examples of Alberta companies that have established international credibility in niche markets.
- The smaller SME's in the services sector are particularly challenged in capturing significant global market share since they are much more limited in terms of resources for acquiring market intelligence, carrying out marketing activities, managing growth, and securing the capital necessary to support marketing and growth initiatives.
- Although the equipment and supply SME's are a relatively smaller portion of Alberta's industry, the majority of this group (over 70%) is engaged in export markets. It projects continued growth, but primarily in markets outside of Canada and for companies with specific niche capabilities and products.
- SME's engaged in the supply of equipment and technology are faced with the additional challenges of accessing resources needed to fully commercialize their technologies. The October 2003 Doyletech Report found that SME's in this sector specifically require assistance with technology commercialization, suggesting that there is a need for a stronger technology commercialization infrastructure. This involves access to market research, business strategy development, management, access to capital and networking with peers and experienced business professionals.
- While Alberta is a relatively rich province with significant private capital, only in very exceptional cases is this capital accessible to fledgling companies in the environmental sector to support their innovation, development and commercialization

activities. The Alberta business environment does not provide much financial or business skills support for the start-up and small SME's.

- There is a strong consensus amongst SME's that outside intervention in the areas of marketing, business skills development and financial support must be extended to the environmental sector in order to achieve growth ambitions and expectations.
- If substantial growth is to occur in the environmental industry, Alberta's overall business environment must be significantly improved to encourage the private sector SME's to commercialize technologies and to apply the products and services in several sectors, such as the municipal, agricultural, transportation and renewable energy sectors. However, there is no single magic bullet to solve all the industry's challenges. In the spirit of continuous improvement, the time for decisive and visionary action on the industry's well documented fundamental issues is now, when the national and provincial economies are robust.
- The opportunity is to create a world-class environmental technology industry in Alberta. The province's resource endowments, entrepreneurial culture and technical skills provide a necessary but not sufficient foundation for growth in a highly competitive global environment. Alberta's strong technical expertise and entrepreneurial culture are increasingly being applied to other sectors than the energy sector, both locally and globally. However, substantial growth in the environmental technology industry will only be achieved with stronger and more effective government programs and incentives for business skills development and for private capital investment than are currently available to the small companies in the environmental sector.

Summary of Recommendations

1. **Review and strengthen current successful government funding programs** that provide support to the SME's in the continuum of activities from research through development and to commercialization. Examples of federal programs are IRAP, IRAP's Precommercialization Assistance (PA) Program and the Program for Export Market Development (PEMD).
2. **Significantly increase and sustain support for proven and existing skills development programs** delivered by not-for-profit organizations and **aimed at increasing the abilities of SME's to commercialize technologies, particularly aimed at export markets.** As a priority, support to programs that help SME's to develop their business and marketing skills, along the lines of those identified in the Doyletech Corporation's October 2003 Report, should be increased.
3. **Create instruments and incentives to encourage private capital injection into projects** that support both the development of technologies and the commercialization of those technologies into marketable products and services.

Other studies have reviewed financial incentives to support development in other sectors (e.g. fiscal regimes for oilsands developments) and recommended financial incentives such as a provincial R&D tax credit, renewable energy incentives etc. These and other recommendations from past studies should be revisited with respect to their overall economic impacts and the most feasible ones implemented.

4. Facilitate the **development of an "early adopter" program** that reduces the risks for the larger companies to partner with smaller SME's in the development of new environmental technologies.
5. Create a **stronger environmental technology commercialization infrastructure and culture based on a compelling vision** – a world-class environmental technology industry in Alberta.

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1. Purpose of Study

The purpose of this study is to identify the structure, performance and capabilities of Alberta's environmental technologies industry, with the objective of recommending where targeted actions should be taken to strengthen the industry. The assessment includes the following:

- The strengths and weaknesses of the industry
- The opportunities and threats facing the industry
- The relative competitiveness of the industry and key gaps in its capabilities
- Recommendations on improving innovation and commercialization in the industry.

2. Study Methodology

This assessment of the environmental industry in Alberta incorporates the results of past sector studies over the last ten years (and summarized in Appendix 1), as well as the results of a recent 2002 Environmental Services Association of Alberta (ESAA) survey. The scope of the environmental industry that was analyzed for this report therefore reflects the scope contained in the ESAA database.

In addition, this report summarizes the results of the Canadian Environmental Technology Advancement Corporation - West (CETAC-WEST) interviews with selected companies in several environmental sectors. CETAC-WEST also facilitated two workshops on October 8 and 22 with leaders in the environmental industry to obtain a broader perspective on capabilities, competitiveness and needs in the industry - these perspectives are also factored in this assessment.

3. Summary of Past Environmental Sector Studies in Western Canada (See also Appendix 1 for More Detail)

In addition to the recent ESAA 2002 survey, four major studies of the environmental sector in Western Canada have been conducted during the past ten years:

- “Building a Stronger Environmental Technology Exploitation Capability in Canada”¹, conducted in 1992 by Doyletech Corporation on behalf of Environment Canada and Industry, Science and Technology Canada.
- “The Western Provinces Environmental Industries Business Development Study” (WEIS)², conducted in 1993 by Sentar Consultants Ltd. on behalf of the governments of Alberta, British Columbia, Saskatchewan and Manitoba and for Industry, Science and Technology Canada and Western Economic Diversification Canada; and
- “A Survey of Innovative Environmental Technologies in Alberta”³, conducted in 1997 by CETAC-WEST, sponsored by Alberta Economic Development and Tourism, the Alberta Research Council and the Calgary Economic Development Authority.
- “An Assessment of CETAC-WEST’S Relevance Ten Years After Inception”⁴, Report of October 2003, conducted by Doyletech Corporation.

The key conclusions of these studies, which span a decade, can be summarized as follows:

- In 1993 environmental businesses represented a growing sector of the Western Canadian economy with annual growth rates expected in the range of 5-15% per annum over the next five years. There were an estimated 2000 firms in the

¹ Doyletech Corporation, “Building a Stronger Environmental Technology Exploitation Capability in Canada”, performed for Environment Canada and Industry, Science and Technology Canada, July 1992.

² Sentar Consultants Ltd., *Western Provinces Environmental Industries Business Development Study, Man Report*, performed for Alberta Economic Development and Tourism; British Columbia Economic Development, Small Business and Trade; Manitoba Industry, Trade and Tourism; Saskatchewan Economic Development; Industry, Science and Technology Canada; Western Economic Diversification Canada, January 1993

³ CETAC-West, *A Survey of Innovative Environmental Technologies in Alberta*, performed for Alberta Economic Development and Tourism, the Alberta Research Council, and the Calgary Economic Development Authority, 1997.

⁴ Doyletech Corporation, “An Assessment of CETAC-WEST’s Relevance Ten Years After Inception” , October 2003.

Western Canadian industry employing more than 20,000 people and with annual sales of between \$1.4 and \$1.8 Billion.

- The environmental industry was composed largely of Small to Medium Sized Enterprises (SME's) with less than 50 employees and with a heavy service orientation notably in the provision of consulting services. These small companies were usually undercapitalized and unable to conduct R&D.
- The industry was somewhat parochial with one third of the companies having no sales outside their own province, although the greatest growth opportunities were identified in terms of international business.
- In terms of its growth potential, the industry relied heavily on the health of the primary resource industries. The main driver of growth was related to government legislation and actions. The main hindrance to growth was the state of the economy.
- Companies across the provinces faced similar issues related to the legislative and regulatory environment, market development, access to capital, levels of R&D, liability and the role of government.
- The key issues identified at the start of the decade were still there five years later (1997) and ten years later (2003). For example, in Alberta, the most significant issues with respect to technology development and commercialization were related to marketing, business and management skills and access to funds.
- In Alberta, in order to facilitate the growth of the sector, the major needs of the SME's in 2003 included an "umbrella" or integrated suite of support services. These service needs were primarily in the areas of market niche identification, research and development, business strategy development, access to capital, managing the growth of operations, technology development, and networking opportunities.

4. Summary of CETAC-WEST's October 2003 Interviews and Focus Groups (See also Appendix 2 for more detail)

A summary of the key points in the CETAC-WEST's interviews and focus groups is as follows:

- Major strengths in the Alberta environmental industry were related to: access to a robust energy sector; high concentration of technical skills; a risk-taking culture; the blending of skills, culture and market access to provide unique, creative solutions in the energy sector and in other industries; positive image in global markets; access to influential expatriate Albertans in global markets; and current export orientation of environmental products companies that compete on the basis of their technologies.
- Major opportunities were identified: locally (related to new oilsands developments, new Northern pipelines, alternative forms of energy, Kyoto accord); globally (related not only to the energy sector but also to other industry sectors); and in linking capital from the healthy energy sector to needs of the SME's with appropriate incentives.
- Key challenges faced by the industry related to: the uncertainty with respect to the regulatory framework; the small size of the SME's and limited availability of people, marketing and business skills, money; financing on reasonable terms for risky product developments; low levels of R&D by the large energy firms and their reluctance to support new product developments; the high costs of penetrating export markets, the next level of growth beyond the local markets; weak market intelligence on global opportunities in other sectors apart from the energy sector; and the competitive advantages of the foreign firms in global markets, particularly on opportunities related to non-fossil fuels.
- Major initiatives were suggested in the following areas: strengthening current government programs to reflect the limited resources of small SME's; increasing the availability of a basket of services to strengthen the SME's capabilities, particularly in marketing, managing growth of their companies and financing risky

product developments; providing incentives to support an early adopter program to test new technology developments; linking capital available from the oilpatch with needs of the SME's through appropriate incentives; and increasing government financing available to SME's.

5. Summary of Global and National Environmental Industry Trends (See also Appendix 3 for more detail)

The global and national industry trends can be summarized as follows:

(a) Global Trends

- **Market Size:** Global market estimates for the size and forecasts of the environmental industry are varied due to the difficulties in defining and measuring the industry and the lack of universally accepted criteria for defining the boundaries of the industry. Estimates for the current size of the global industry range from over US\$ 500 billion⁵ to US\$ 800 billion⁶. The largest established markets are the US, Western Europe and Japan, accounting for roughly 80% of global expenditures. These markets are expected to grow at rates consistent with their economic performance, in the range of 3-5%.
- **Market Drivers:** The global markets for environmental technologies are driven by several important policy and market drivers, such as: growing industrialization, environmental awareness and legislation in emerging markets; liberalization of environmental technologies trade via bilateral and multilateral efforts; greater global interest in sustainable development; and broader application of environmental "best practices" by multinationals. Although greater demand for environmental products and services is expected from emerging nations in Asia and Latin America, significant tariff and non-tariff barriers could restrict this environmental trade.

⁵ Office of Environmental Technologies Industry, Trade Development, US Commerce Department, "Global Environmental Technologies, Trends, Markets and Prospects", *Export America*, November 2002.

⁶ Environmental Affairs Branch, Industry Canada, "Canada's Environmental Industry – At a Glance", February 2003.

- **Sector Demands:** The greatest global environmental demands are in the Water/Waste Water Management and in the Waste Management sectors, which account for almost 80% of global expenditures.⁷ These sectors are expected to continue to provide solid opportunities for exports, both in environmental goods and services. In the developed nations, rising demands are forecast for clean technologies and for green energy (e.g. biomass, wind, solar etc.), while the water market in emerging nations continues to be a significant opportunity for exporting firms.
- **Industry Structure:** The global environment industry is characterized by a large number of small to medium enterprises (SME's) and a small number of large companies that dominate a few market segments. The supply side is very diverse (from divisions of large chemical firms to individual consultants) and has a different structure of activities and size distribution in different countries. Large firms are more common in the German industry while small firms are more important in Canada, the US, Italy and Switzerland.⁸
- **Possible Changes in industry Structure:** The structure of the global environment industry is changing, with a shift from “end of pipe” equipment and clean-up services to integrated and “clean” environmental technologies. In the long term, this substitution may radically affect the structure of much of the industry by increasing the importance of research, design, consulting and other services, compared with clean-up and remediation-based goods and services. This structural change is being driven by the increasing policy focus on the diffusion of environmental technologies that is being integrated into industry production processes.⁹ This policy focus reflects societal concerns in the developed nations about clean water, clean air and climate change.

⁷ Environmental Affairs Branch, Industry Canada, *op cit.*

⁸ OECD, “The Global Environmental Goods and Services Industry”, 1996.

⁹ OECD, *op cit.*

(b) The Canadian Environmental Industry (as per Statistics Canada)

- **Canadian Position:** Canada is a relatively small player in the global market, supplying roughly 3% of the global market, compared to the US which is the world's dominant player, accounting for roughly 28% of the global market. Revenues from environmental related activities of Canadian companies were estimated at \$14 Billion for the year 2000.
- **Industry Markets:** Export markets represented 9% of Canadian environmental revenues, at \$1.3 Billion, mostly in the form of environmental goods (\$0.9 Billion). There was a healthy annual export growth rate of 15% between 1996 and 2000. The US remained Canada's largest export market, providing revenues of \$900 Million, followed by Europe (\$127 Million) and Asia (\$76 Million).
- **Industry Structure:** Small and medium sized firms (SME's, defined by Statistics Canada as under 500 employees) continued to dominate the Canadian environment industry, making up 96% of all firms in 2000. As in previous years, Ontario and Quebec generated the greatest environmental revenues in the year 2000, with Ontario accounting for \$6.2 Billion and Quebec accounting for \$3.2 Billion. Next were Alberta at \$1.9 Billion and British Columbia at \$1.7 Billion.
- **Export Revenues:** Ontario and Quebec also generated the dominant export revenues, with Ontario generating \$708 Million and Quebec generating \$266 Million. Next in line with export revenues were British Columbia at \$187 Million and Alberta at \$119 Million.

6. Position and Structure of the Alberta Environmental Industry

6.1 Position of the Alberta Environmental Industry

This analysis on the position and structure of the Alberta environmental industry is based on the results of a recent survey. The Environmental Services Association of Alberta (ESAA), which represents a significant number of firms providing environmental products

and services in Alberta, updated its environmental industry database with a survey conducted in late 2002. It should again be emphasized that, as noted in the past studies of the environmental sector, there are no agreed-upon criteria for defining the environmental industry, either globally or within Canada.

For example, the companies in the ESAA database are those that have self-identified as being in the environmental sector. Therefore, companies in sectors that create services or products that have positive environmental impacts but which do not believe they are “environmental companies”, would not be included in this database (e.g. companies in the fuel cell business or in alternative energy). This causes major problems in comparing studies done in different jurisdictions (such as in British Columbia, Alberta and Manitoba). As a result, relative comparisons of factors such as the size of the environmental sector, or the potential “environmental” opportunities in different jurisdictions could be very misleading unless definitions of the “environmental industry” are first normalized across the jurisdictions.

In the ESAA “Environment Industry Database”, the industry is defined by companies that provide services and products related to the environment. The original list of companies in the database was compiled by the provincial Ministry of Economic Development several years ago and has been updated by ESAA on several occasions. The ESAA classification system for the Alberta environmental sector uses eleven sectors or “Primary Businesses” for the companies that were surveyed.

Based on the ESAA survey data, the Alberta environmental industry can be positioned within a national context as shown below.

Comparison Between Alberta and Canada's Environmental Industry

	Alberta	Canada	Alberta as a % of Canada
Total Population	3,113,600	31,414,000	10
No. of establishments in the Environmental Industry 2002	800	9,500	8.4
No. of establishments per 100,000 population	25.7	30.2	>85
Env. Industry Employment	17,000	221,000	7.7
Total Employment	1,724,800	15,076,800	11.4
Env. Employment as a % total	1%	2.8%	35.7
Industry Revenues	\$3,200,000	\$30,000,000	10.7
GDP (2001)	\$150,500,000	\$1,092,246,000	13.8
Env. Industry Revenue as a % of GDP	2.1%	2.7%	77

6.2 Structure of the Alberta Environmental Industry

The environmental industry in Alberta is comprised of all companies operating in the province that provide services and products related to the environment. The industry in Alberta is dynamic and **has historically been based on the thriving oil and gas industry** in the province. It has leveraged various applications, particularly in products, from the local energy market to global niche opportunities in the energy sector and in other sectors.

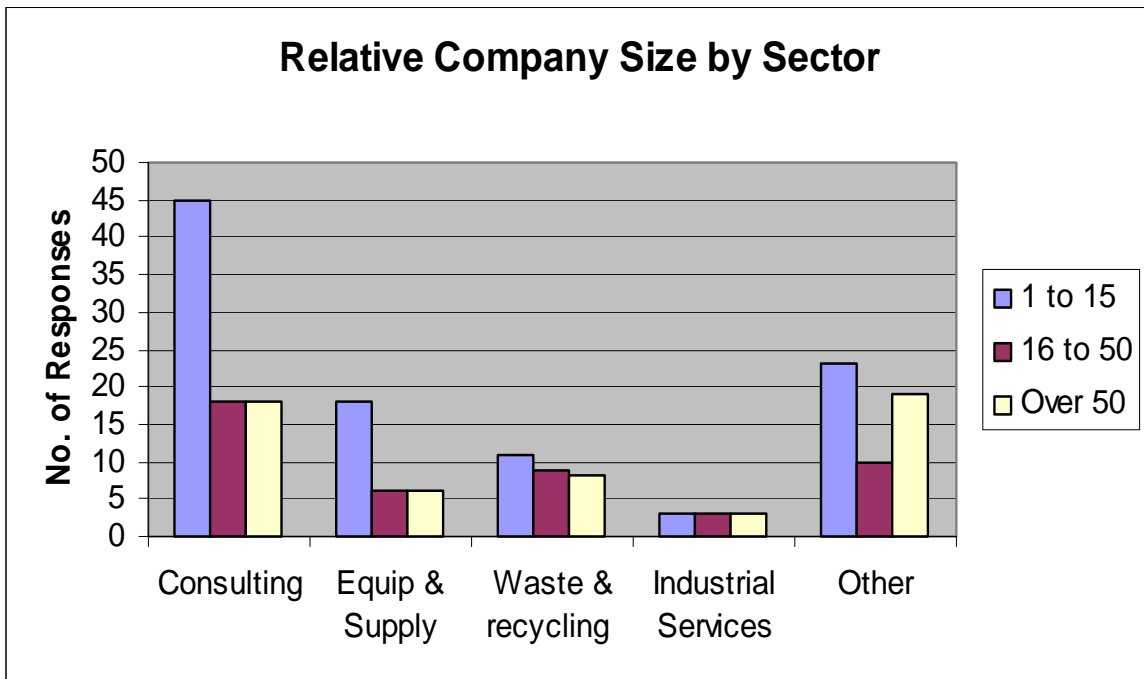
The industry has experienced strong growth over the past decade. Revenues in the industry were estimated at roughly \$3.2 Billion in 2001; this is an increase over the \$2.8 Billion estimated by ESAA in 1999/2000 and a significant increase from the \$650 Million estimated in 1992 (See the "Western Provinces Environmental Industries Business Development (WEIS) Study in Appendix 1). There were over **800 companies, with an estimated employment of over 17,000 people** in the year 2001.

Four “Primary Business” Sectors of the Environmental Industry in Alberta

Close to 70% of the companies surveyed by ESAA were in four “primary business” sectors. These sectors were:

- Consulting Services (40%)
- Equipment and Supply (15%)
- Waste Services (10%) and
- Recycling Services (5%)

As the chart below shows, smaller companies (SME’s with less than 15 employees) dominated the two leading “primary business” categories of “Consulting Services” and “Equipment and Supply”.



6.3 Dominance of SME's and Services Orientation of Alberta Companies

The Alberta environmental industry is dominated by SME's with less than 50 people. About half the companies surveyed had less than 15 employees and almost three quarters of the companies had less than 50 employees. The dominance of SME's in the environmental industry is consistent with the results of previous studies (as summarized in Appendix 1).

The industry is heavily services oriented, with over 80% of the companies surveyed noting their "primary business" as providing services. The dominance of the "services" companies is consistent with the results of past studies. On the other hand, **just over 15% of the companies surveyed noted their "primary business" as being in the "Equipment and Supply" sector** – this sector is largely technology driven.

Although the Alberta environmental industry has historically provided solutions for the oil and gas sector, it is not dominated by a single environmental activity and many firms provide more than one product or service. This would suggest that **the industry is branching out to solutions beyond those demanded by the oil and gas sector.**

6.4 Export Market Orientation of Technology -Based Companies

Two-thirds of Alberta company sales were under \$5 Million with roughly a third having sales under \$1 Million.

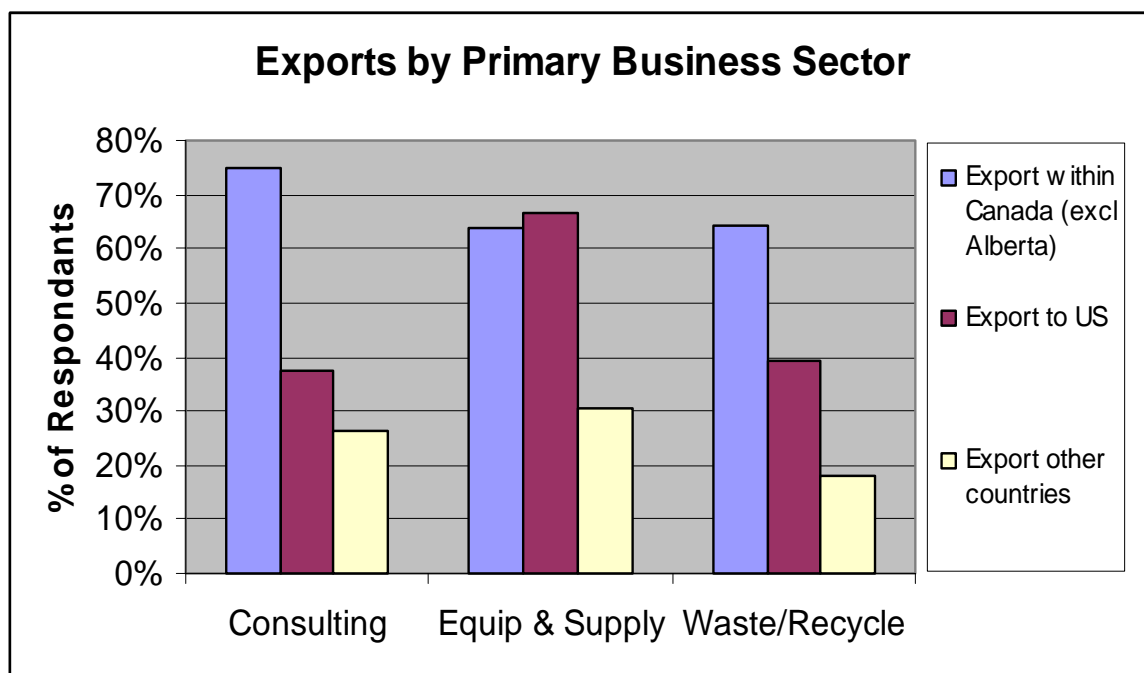
The dominant portion of the sales was in the domestic market, with close to 85% of the revenues being earned within Canada, mostly within Alberta. This is consistent with the WEIS 1993 Study¹⁰ and the Statistics Canada year 2000¹¹ data with respect to dominance of the SME's and attractiveness of the local energy markets in Alberta.

¹⁰ Sentar Consultants Ltd., *Western Provinces Environmental Industries Business Development Study, Man Report*, op.cit.

¹¹ Environmental Accounts and Statistics Division, Statistics Canada, "Environment Industry Survey, Business Sector, 2000", op.cit.

The ESAA survey data suggests a key difference in market orientation – companies providing services were domestic market focused and those providing technology-based products were export market focused. According to the survey, companies that were involved in the development of technology and provision of products such as instrumentation (i.e. in the “Equipment and Supply” sector) were more than twice as likely to export their products outside of Canada (mainly to the US) than the companies in the “consulting services” sector.

This export orientation can be seen in the following chart, where the “services” companies tended to focus on the local markets while close to 70% of the companies in the “Equipment and Supply” sector were in the export markets. The US was the primary export market, with other markets noted as Mexico, Venezuela, China and the UK.



This export market orientation of technology based companies suggests that technology provides Alberta companies with a competitive edge in global markets. This suggests that Alberta “equipment and supply” companies are successfully penetrating niche markets with products originally developed for applications in Alberta or originally tested in Alberta.

7. Alberta’s Environmental Industry Within the Framework of an Innovation and Technology Commercialization System

7.1 Framework of Alberta’s Innovation and Technology Commercialization System

In the development of strategies to grow the Alberta environmental industry, it is instructive to view the industry within the broader Innovation and Commercialization framework. The environmental industry in Alberta operates, as do other knowledge-based industries (e.g. energy, agriculture, information etc.) within an Innovation and Technology Commercialization System. This system includes three interrelated elements of:

- Research
- Development and
- Commercialization

The weakest elements in the system are in the Development and Commercialization stages – where technology is converted to Demonstration products (e.g. prototypes), tested and then commercially marketed. It is critical that the “technology push” from research be replaced with the “market pull” of customers in order to provide products and services that meet market needs. In Alberta, there have been heavy public investments in research but considerably smaller public investments to support the commercialization of technologies into marketable products and services.

More importantly, few incentives have been provided to encourage the private sector to commercialize products and services in Alberta. Numerous studies over the past seven years (starting with the Davitech Report¹²) have pointed out this weakness in Alberta’s technology commercialization system and that the province is not capturing the benefits of its significant investments in research through the creation of new products, jobs and new companies.

The following Figure 1 provides a useful “Innovation and Technology Commercialization” framework that will be used within this report to position the issues and challenges facing the Alberta environmental industry.

¹² Davitech Consultants, “Barriers to Technology Commercialization in Alberta”, August 1997.

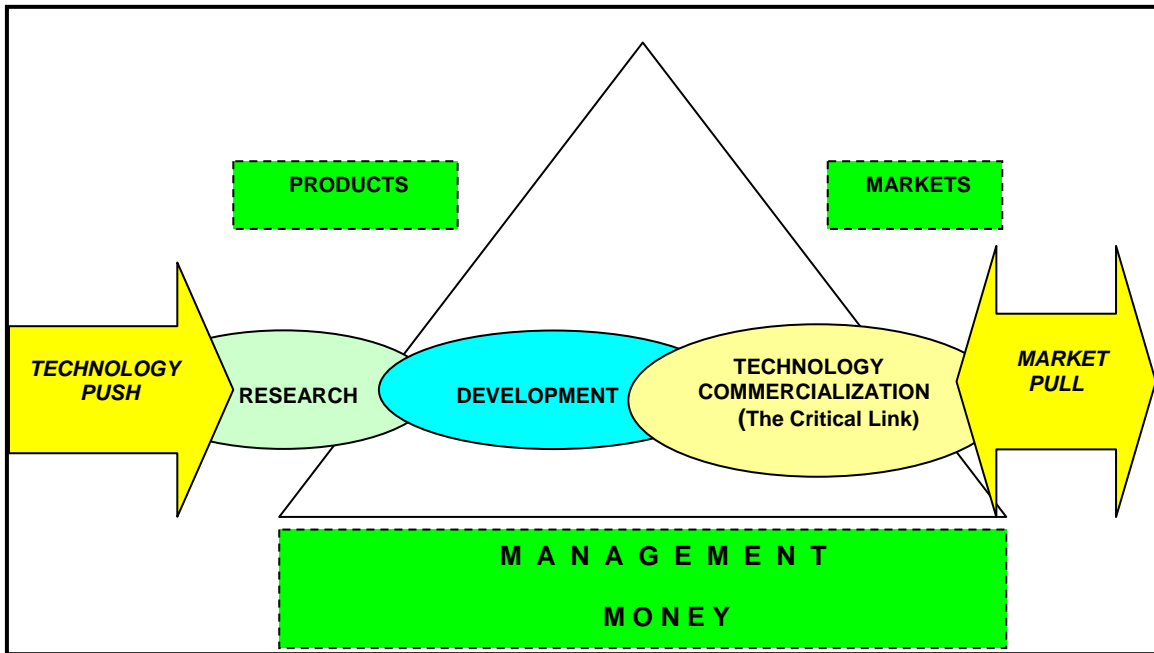


Fig.1 Framework of the Innovation and Technology Commercialization System

This Figure illustrates the key linkages that are necessary within the innovation system to ensure that market-based products and services are successfully developed. Product/service development and commercialization are the critical links (and the weakest links in Alberta) between the technology push of research and the market pull of customer needs. **Innovations create wealth only when sufficient customers are willing to buy a product or service.**

This Figure also identifies the Key Success Factors for the successful “Development and Commercialization” of technology. These factors have been identified in previous studies of the environmental industry (and summarized in Appendix 1) including the recent October 2003 Doyletech Corporation Report.

The Key Success Factors for technology commercialization are:

- **Markets** (Strong Market Pull)
- **Products** (and Technology)
- **Management** (Business Skills)
- **Money** (Financing)

7.2 Factors Shaping the Successful Development of Alberta's Environmental Industry

The following factors will shape the success of Alberta's technology commercialization system including the continued growth of its environmental industry:

Innovation: The foundation for the province's economic and social development is the innovative applications, in both domestic and global markets, of knowledge and technology to various industry sectors. The roots of the environmental industry have been in providing solutions for the energy sector.

Knowledge Transfer and Commercialization: Based on the strengths, global linkages, and technical expertise historically related to its resource-based economy, Alberta is in an excellent position to capture the significant economic potential from the convergence of previously separate industry sectors, such as alternative energy, environment, information, agriculture, biotechnology, and advanced materials etc.

Appropriate Roles of the Private Sector and Governments: Alberta has the necessary building blocks and therefore the potential to develop a world-class environmental industry, with applications tested and commercialized in Alberta and marketed globally. The private sector is the driver for the commercialization of technologies that meet the needs of the markets. However, governments shape the success of the private sector by establishing globally competitive business conditions including the regulatory framework.

Balance Between Technology Push and Market Pull: A balance is needed between investments in research (technology push) and investments to develop products and services to meet market needs (market pull). With this balance, the province and the nation will maximize the returns from their significant investments in research to create value-added products and services that meet the needs of the markets. Without this balance, the province will not be able to capture the benefits of research through new company creation, jobs and innovative products

Opportunity: The opportunity and the challenge facing Alberta's SME's in the environmental sector is to convert research and innovative ideas into demonstration

products/services and then to commercialize these products to meet market needs. The significant growth opportunities are in the creation of new products/services and the penetration of new markets (See Product/Market matrix in Fig. 2 below), within the constraints of the business environment and regulatory framework.

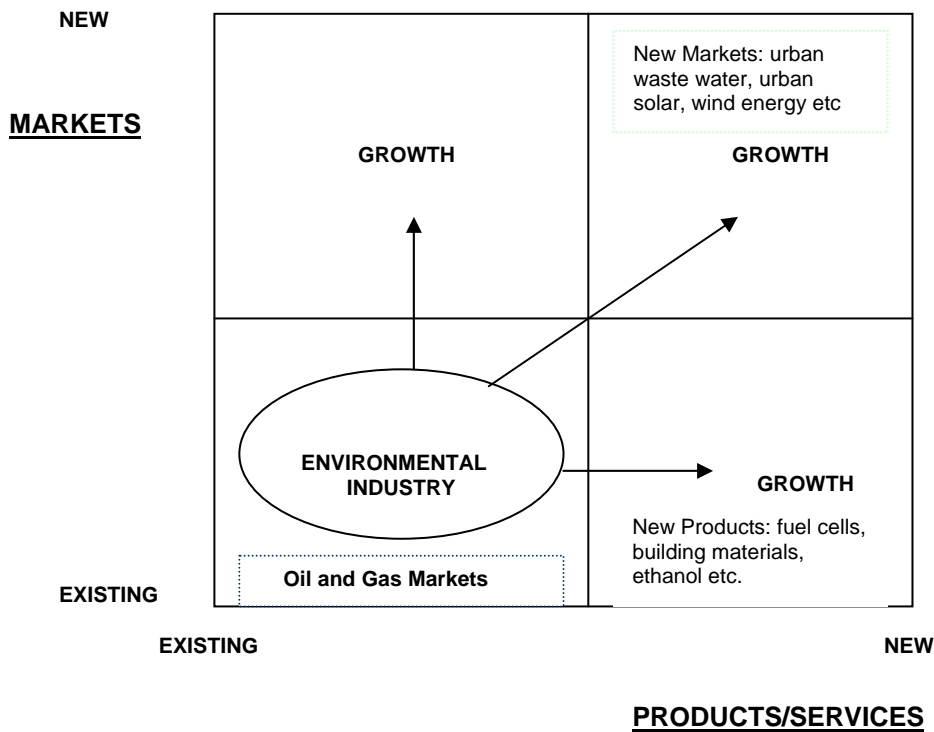


Fig. 2 Product/Market Matrix - Growth Opportunities in New Markets and Products

8. Summary of Strengths, Weaknesses, Opportunities and Threats Relative to the Commercialization Framework

A summary of the SWOT analysis of Alberta's environmental industry, relative to the Research, Development and Commercialization framework is shown below.

		RESEARCH	DEVELOPMENT	COMMERCIALIZATION
S			<ul style="list-style-type: none"> - Ready Access to strong energy market - High concentration of technical expertise - Entrepreneurial culture to branch out of oil/gas sector - Abilities to test/build applications locally and export 	<ul style="list-style-type: none"> - Ready Access to energy market - High concentration of technical expertise - Entrepreneurial culture - Access to global network of Albertans - Products companies already oriented to global markets
W	<ul style="list-style-type: none"> - Low levels of private sector R&D investment 	<ul style="list-style-type: none"> - Poor access to capital at development stage - Inadequate knowledge of market needs - Few early adopters for risky developments - SME's with limited access to networks of relationships 	<ul style="list-style-type: none"> - Limited availability of venture capital funds - Inadequate marketing skills - Inadequate business skills to direct company growth - Historical dependence on oil/gas applications 	
O		<ul style="list-style-type: none"> - New energy and non-energy sectors create new demands (e.g. urban developments) - New primary resources (oilsands) create new demands - Healthy energy sector is potential source of risk capital 	<ul style="list-style-type: none"> - New energy and non-energy industries create new demands - New primary resources (oilsands) create new demands - Healthy energy sector is potential source of commercialization capital - Applications developed locally can be exported to niche markets 	
T	<ul style="list-style-type: none"> - Low levels of innovative technologies created from low research investments 	<ul style="list-style-type: none"> - Weak legislation and regulatory enforcement - Inadequate business support system (skills, money) - Lack of urgency of commercialization challenge - Limited use of current govt. programs - No incentives for early adopters - Canada at competitive disadvantage to US and Europe re alternative energy and renewables 	<ul style="list-style-type: none"> - Lack of urgency of commercialization challenge - Saturation of local market opportunities for SME's - Acquisition of innovative SME's by larger firms with little interest in Alberta's growth - Loss of jobs and companies to jurisdictions with more competitive business environment - Costs, risks to enter intl.mkts. - Loss of export opportunities 	

9. Discussion of SWOT Analysis of Alberta's Environmental Industry

This analysis is based on the results of past studies (summarized in Appendix 1), the results of the ESAA Year 2002 survey of the Alberta environmental industry and on CETAC-WEST's interviews and focus groups in October 2003.

Because of the interrelationship of the strengths and opportunities, these will be discussed together.

9.1 Strengths and Opportunities

- ***Access to Market***

Strengths: Ready access to a globally competitive oil/gas sector and the enforcement of regulations has been the basis of the growth of Alberta's environmental industry. **Knowledge and technologies can be transferred from the oil/gas sector to other sectors such as the urban sector (e.g. waste water management systems, utility power systems) or the rural sector (e.g. wind energy) or the transportation sector (e.g. fuel cells).**

Opportunities in New Markets and New Products/Services: The local oil/gas sector competes in a global market and has complex and varied needs. These needs provide opportunities for the environmental companies to develop innovative solutions that can later be exported to energy and non-energy sectors in global markets. As identified in Section 6.2, Alberta's "Equipment and Supply" companies (i.e. technology based) have been taking greater advantage of these global opportunities than its services companies.

There are potentially significant growth opportunities since:

- The oil/gas sector in Alberta is globally competitive and includes an extensive value chain of industries from resource extraction to high value-added industries e.g. exploration, production, refining, marketing, petrochemicals.

- These industries in the natural resources value chain all have needs for solutions that directly or indirectly impact the environment (e.g. the need to reduce “end of pipe emissions” as well as the need to improve industrial process efficiency for energy conservation). These needs, such as for eco-efficiency, will create demands for creative solutions from environmental companies.
- Progressive oil/gas companies are taking defensive measures in anticipation of air emission controls and these will also create demands for industrial process efficiencies.
- The scope of the environmental industry in Alberta can therefore expand beyond end of pipe emission reductions to include broader competencies such as industrial production process efficiencies. These competencies can be applied to a range of industry sectors in local and export markets such as in the manufacturing, chemicals, urban and transportation sectors.
- Increased oilsands resources in Alberta are now replacing declining conventional energy resources. Although there are alternative scenarios for the longer-term actions of the oil/gas companies facing declining conventional oil and gas reserves, or government actions regarding energy conservation, Alberta’s oilsands will be developed as will likely be its vast coal reserves, under certain regulatory guidelines. These developments will create new and increased demands for innovative environmental solutions (e.g. related to greenhouse gases, water consumption, pipeline transportation etc.) that can be applied to other sectors in both domestic and global markets.

- ***Financial Strength of the Economy***

Strengths: The oil/gas sector, which is the primary market for Alberta's environmental industry, is financially strong. This sector contributes close to a third of Alberta's wealth and this can provide opportunities for the environmental industry.

- The sector has healthy cash flows, has been downsized and has its cost structure and balance sheet under control. Companies have realized large profits and the demands for oil and gas are increasing.
- Although the Western Canada sedimentary basin is maturing, the slack in conventional oil supply is being taken up by the increasing supplies from the vast oilsands deposits that have hardly been tapped.
- The energy sector is under steady pressure to improve its environmental performance in a number of areas including air emissions (including Greenhouse Gases and pollutants) and water usage.

Opportunities: The combination of the strong financial position of the energy industry and the environmental concerns related to its operations has created opportunities for Alberta's environmental industry:

- Opportunities to both reduce "end of pipe" emissions as well as to transform production processes to reduce environmental impacts.
- The financial health of the energy companies also suggests that there could be potential opportunities, with suitable incentives, for these companies to act as sources of capital for those SME's that have technical strengths but are undercapitalized.

- ***Concentrated Technical Expertise***

Strengths: **Alberta has the highest concentration of technical skills in Canada, largely related to the sciences and engineering. This reservoir of superior technical skills has been a key success factor in the abilities of the Alberta product-based SME's to penetrate global markets.** The strength of these companies has been related to their innovative design capabilities, their abilities to spot niche opportunities in other sectors (apart from oil and gas), the reliability of their products, the superior product quality and value provided to customers, and their entrepreneurial skills.

The reservoir of technical skills combined with the knowledge of local market opportunities has also been the basis of the formation of the large number of small Alberta companies that are providing environmental services in several sectors such as the urban sector (e.g. energy efficiency consulting services) and the transportation sector (e.g. air quality monitoring services).

Opportunities: Alberta's globally recognized technical strengths and innovation in the energy sector are being transferred to technology developments in the environmental sector. Even within the usual SME constraints of money, marketing and people, a relatively large proportion of the Alberta environmental industry (roughly 60%) is working on the development of technology, with the main focus on water and wastewater technology and soil remediation technology.

If these constraints of marketing, business skills and money were reduced, there would be significantly greater opportunities to leverage the province's technical expertise. As it is, this expertise is being applied to several sectors in addition to the energy sector, such as the rural sector (e.g. fertilizers from wastes), the urban sector (e.g. development of non-PVC water pipes for residential and industrial buildings) and the transportation sector (e.g. fuel emissions technologies).

A major opportunity with global applications is the implementation of the Kyoto Accord, which could provide potential opportunities for the Alberta environmental industry.

However in view of the regulatory uncertainties, the industry has not yet become engaged.

- ***Entrepreneurial Culture***

Strengths: **Alberta has a globally recognized entrepreneurial risk-taking culture which, together with the high level of technical skills, is the basis of innovation in several sectors in Alberta.** In the environmental sector, this combination is the basis of the formation of the over 800 companies in the sector with over 17,000 employees.

The combination of the entrepreneurial culture, risk-taking and strong technical skills is also the foundation of the export orientation of the environmental firms that are in the “Equipment and Supply” sector. These equipment based firms are twice as likely to export their products outside of Canada (mainly to the US) than the companies in the services sector. For such firms, their entrepreneurial and technology innovation capabilities have provided a strong competitive edge (e.g. higher product reliability, improved performance etc.) in global markets.

Opportunities: The major opportunities are to build on the combination of technical skills and risk-taking culture in order to faster develop applications locally, since time to market is a major competitive edge for the SME’s. This would be a strong advantage for Alberta firms competing against larger companies in international niche markets.

- ***Global Credibility of Albertans***

Strengths: **Alberta has a recognized global credibility for its energy industry, its energy companies and the skills of its energy personnel.** This has provided an extensive and influential network of potential contacts and relationships for the solutions provided by local Alberta environmental firms.

Opportunities: These potential contacts could be of significantly greater value to companies pursuing global niche opportunities in export markets if it were easier for the companies to access market research and development information.

9.2 Weaknesses and Threats

The weaknesses or needs in Alberta's environmental industry together with the threats represent the gaps between reality and potential. They will be outlined in some detail since the recommendations are directly aimed at filling these gaps.

(a) Weaknesses or Needs

Although Alberta SME's are at different stages of development (e.g. roughly three quarters of the firms surveyed by ESAA in 2002 had less than 50 employees), they had similar needs.

The weaknesses or needs of Alberta SME's can be summarized along four dimensions:

- **Market penetration**
- **Access to capital**
- **Networking and alliances**
- **Human resources** (notably Business and Marketing skills)

These needs are similar to those identified in the past studies summarized in Appendix 1, and have been re-emphasized in the recent Doyletech Corporation October 2003 Report.¹³

¹³ Doyletech Corporation, "An Assessment of CETAC-West's Relevance Ten Years After Inception", Report, October 2003.

- ***Market Penetration***

Notwithstanding the strong technical capabilities of the SME's, they all face challenges with respect to the penetration of new markets, particularly global markets. Existing Government programs are viewed as helpful at the initial high level stage of understanding the “forest” of global opportunities but are not useful at the next level of the “trees”. Real opportunities are at the level of individual firms and it is costly and difficult for Alberta SME's to get market intelligence on opportunities and to build foreign relationships to facilitate procurement and sales. The often undercapitalized SME's therefore focus on the local domestic (Alberta and Canadian) markets for sound economic reasons related to costs of doing business.

- ***Capital***

For all the SME's, the availability of capital on reasonable terms, that reflects the size and financial capacity of the companies, is a critical weakness. Whether the companies were providing services (e.g. consulting) or products (e.g. instrumentation), capital was necessary for growth but very difficult to obtain.

The SME's in the services sector required capital to both strengthen their skills and to explore new markets. The strength of these companies and their ability to compete were largely related to the knowledge and experience of their staff, the breadth of their contacts for new market opportunities and their abilities to respond to market needs. However, the costs of acquiring experienced people and exploring new markets were often exorbitant relative to the companies' internally generated cash flow. The traditional financial institutions were viewed as of no value to companies providing services; and the government financing agencies were viewed as not much better in understanding the environmental industry or the financial situation facing the SME's.

The SME's producing products (e.g. in the equipment and supply sector) faced more urgent and larger financial needs. The strength of these companies was related more to their innovative design capabilities, their abilities to spot niche opportunities in other

sectors (apart from oil and gas), the reliability of their products, the superior product quality and value provided to customers, and their entrepreneurial skills.

Again, it is costly to pursue global market opportunities and to get the marketing skills to penetrate foreign markets. However, these products companies need to finance these activities in order to survive, since the local domestic markets are often too small (e.g. for instrumentation products). In addition, these firms need substantial funds for product development and to finance working capital. Product development activities on innovative products are often high-risk and the proponent SME's have obtained little support from private or public sector funding agencies.

- ***Networking and Alliances***

Particularly for the smaller SME's at relatively early stages of development (less than 15 employees), the abilities to network and to develop contacts were viewed as key areas of need with respect to the development of technologies and markets. Networking was also instrumental in identifying opportunities for forming partnerships with other SME's or with larger companies, such as for the purposes of trial demonstrations and beta testing of products. Unfortunately, the business environment for the larger energy companies is now different than a decade ago and these companies are no longer willing to work with SME's to trial risky products or services (see also the next Section on "Threats").

- ***Human Resources***

For all the SME's with less than 50 employees, the availability of adequate numbers of people and the people mix have been major drawbacks to their pursuit of growth opportunities. In particular these companies tend to be dominated by people with strong technical skills that can produce solutions. They are much less populated with people with strong marketing and business skills - these skills enable sound business planning and, together with the availability of capital, are essential

prerequisites to the companies' abilities to manage growth, as re-emphasized in the Doyletech Corporation recent October 2003 report.¹⁴

(b) Threats to the Industry

The key threats facing Alberta's environmental industry can be summarized along the following dimensions:

- **Absence of a strong regulatory framework.**
- **The lack of an effective business support system to encourage private sector SME's to take high risks and to pursue innovation and technology development.**
- **Absence of "early adopters" of innovative environmental technologies.**
- **The lack of urgency to deal with the challenge of commercializing environmental technologies.**
- **Limited use of existing government programs.**
- **Costs and risks of entering into international markets**

These threats can be outlined as follows:

- ***Absence of a Strong Regulatory Framework***

In terms of its growth potential, the environmental industry relies heavily on the presence of a strong regulatory framework which would influence the operations of the resources sectors in Alberta. The oil/gas sector generally views environmental measures as costly in the short term but will implement these measures when forced to do so by legislation. It is the enforcement of regulations rather than environmental legislation alone that is the key driver of the demand for environmental products and services.

Innovation in the environmental and other economic sectors has been sharply stimulated whenever there has been a major regulatory initiative, such as the reductions in sulphur

¹⁴ Doyletech Corporation, *op.cit.*

dioxide emissions, or the phase out of phosphates, dioxins or PCB's. Where government has taken firm regulatory action, industry has responded with creative solutions. Strong regulatory pressure is therefore essential to stimulating innovation and the development of the environmental sector. Conversely, lack of enforcement is therefore a major threat to growth of the industry.

- ***Insufficient Business Support For New Environmental Technologies***

Despite the opportunities and strengths in Alberta's environmental industry, business support for the development and commercialization of new environmental technologies is lacking. There is an imbalance between the public funds committed to research and the funds required for capital and skills to stimulate the development and commercialization of environmental technologies.

Critical financial needs within the innovation system are for:

- pre-commercial financial assistance to support environmental product developments and
- seed capital to provide "patient" money for early stage commercialization activities that are targeted at global markets.

Equally critical needs are for the skilled business and marketing skills to manage the growth of the environmental SME's. According to "Angel Investors", a significant majority of projects are rejected because of the entrepreneurs' inability to demonstrate adequate business skills.

- ***Absence of Early Adopters of Innovative Technologies***

Alberta SME's that are providing innovative environmental services or products need to test market their products at the pre-commercialization stage. In the past, the larger energy companies were willing to form relationships with the smaller environmental firms to do joint research or to act as beta sites. The business environment is now different and the "host" companies are operating under much

leaner cost structures and with reduced management or management that is much more risk averse. The result is that the SME's now have significantly fewer opportunities to find early adopters of innovative technologies.

- ***Lack of Urgency***

Although there is enormous economic potential in Alberta from the commercialization opportunities associated with environmental technologies (e.g. related to greenhouse gases, or water management processes or wastes recycling etc.), **there is a lack of urgency with respect to the need to encourage the involvement of a strong private sector in commercializing technologies in the environmental industry.** This situation is likely the result of the province having a healthy economy based on a strong oil and gas sector that masks the need to act now on strengthening the emerging environmental industry.

This situation is compounded by the fact **that the environmental industry in Alberta does not have a lobby group to represent its interests and therefore has no political influence.**

- ***Limited Use of Existing Government Programs***

Alberta SME's that provide products have made greater use of government programs than those SME's that provide services (e.g. consulting). The product-based SME's have used government programs that support technology development, such as IRAP and the SRED Tax Credit Program. They have also tended to make greater use of government resources and programs that facilitate access to export markets such as trade commissioners and PEMD. **Although the product-based SME's view these and other programs as of value, they believe the programs are often bureaucratic, provide high level information, and are not as extensive in scope or competitive with the support programs provided by other global jurisdictions, notably in the US and Western Europe.**

- ***Costs and Risks of Competing in International Markets***

For both services and products companies, growth opportunities are seen as being primarily in international markets. However, small companies have difficulties moving into international marketplaces because of difficulties and costs of penetrating distant markets and competition from large companies with more resources and staying power. This is a greater concern for service companies, which see international markets as their greatest opportunity for growth. However these companies often do not have the competitive edge provided by an innovative technology and have greater difficulties becoming competitive in foreign markets.

For Alberta environmental firms, whether providing services or products in global markets, the enormous head start of the European countries in encouraging sustainable development and environmentally appropriate technologies, is viewed as a significant competitive disadvantage for Canada. For firms competing in the US, the enormous funding provided by the US government to SME's at the pre-commercialization stage of environmental technologies, is viewed as a significant handicap.

10. Conclusions

This review of the Alberta environmental industry indicates a vibrant industry of over 800 SME's with considerable technical skills and a strong entrepreneurial culture. The industry has grown from around \$650 Million in revenues a decade ago to roughly \$3.2 Billion. Historically, it has depended on a strong regulatory framework applied to the development of the province's enormous endowment of energy resources. According to a recent survey by the Environmental Services Association of Alberta (ESSA), the industry is dominated by services oriented companies, while roughly 15 per cent of the companies produce technology-based products in the "equipment and supply" business.

The environmental firms have been the drivers of innovation in products and services in local and export markets. The industry's market access to a thriving energy sector has provided the opportunity to develop innovative solutions to local environmental problems. The combination of market access, skills and entrepreneurship has enabled the environmental industry to strengthen its competitive capabilities and to transfer this expertise to international markets and to other sectors such as in the petrochemical sector, the urban sector (e.g. building materials), the rural sector (e.g. fertilizers from wastes) and the transportation sector (e.g. ethanol).

There are therefore significant strengths in the industry and a strong foundation for continued growth. This is based on the considerable technical expertise in the province, its entrepreneurial culture, the strength of the economy and the continued development of its energy resources, both non-renewable (e.g. oilsands, coal) and renewable (e.g. wind). Alberta's products-based SME's have taken greater advantage of these strengths and have been much more oriented to the export markets than the services-based companies.

Nevertheless, the future growth and success of the environmental industry are not assured, despite its healthy growth over the last two decades. Major growth opportunities are much riskier and competition is fiercer against better capitalized and larger firms with sophisticated marketing and business capabilities. There are potentially major local opportunities, such as in the energy sector (e.g. oilsands developments, coal bed methane, northern pipelines, the Kyoto accord) or in the renewable energy sector

(e.g. wind, hydro) or in the agriculture sector (e.g. energy from biomass). However, the actual realization of business opportunities for the environmental industry will continue to be driven by the regulatory framework. Equally importantly, the substantial growth opportunities are in export markets, where a large portion of Alberta's environmental equipment supply companies already compete in specialized niches.

When Alberta firms enter international markets, they are competing against large corporations with much stronger market capabilities and support from their governments. The international marketplace is not an even playing field for the mostly smaller Alberta firms. The smaller SME's in the services sector are particularly challenged in capturing market share since they are limited in terms of resources for acquiring market intelligence, executing marketing activities, managing growth and finding the capital to support marketing and growth initiatives.

Products-based SME's that are engaged in the supply of equipment and technology are faced with additional challenges of finding the resources to develop and commercialize technologies. The product development process, which is already risky, has become much more difficult since the large energy firms now invest little in R&D and show little interest in being the "early adopters" of risky environmental technology.

In addition, the October 2003 Doyletech Corporation Report found that SME's in the equipment supply sector require focused assistance in technology commercialization, suggesting the need for a much stronger technology commercialization infrastructure. This includes specific support services, such as access to market research, business strategy development, management, access to capital, and networking with peers and experienced business professionals.

The Innovation and Commercialization process is not well defined and is not given sufficient priority when allocating resources to stimulating economic growth. Alberta has made significant progress over the past decade in investing in university research but much less in the product development and commercialization process. It is the latter process that will bring the benefits of research and innovation to the marketplace in terms of new jobs and economic growth.

Although there are helpful government programs for launching new technologies, they are not viewed by the SME's as competitive with programs available in other countries to competitors. In some cases, the programs are viewed as cumbersome, bureaucratic and not designed with an understanding of the limited resources of the smaller SME's. These SME's also do not have the option of tapping private capital. While Alberta is a relatively rich province with significant private capital, it is only in exceptional cases that this capital is accessible to fledgling companies in the environmental sector.

If substantial growth is to occur in the environmental industry, Alberta's overall business environment to encourage the private sector SME's to commercialize technologies must be significantly improved. There is no magic bullet to solve all the industry's challenges but, in the spirit of continuous improvement, the time for decisive and visionary action is now, when the national and provincial economies are robust.

The opportunity is to create a world-class environmental technology industry in Alberta. The province's resource endowments, entrepreneurial culture and technical skills provide a necessary but not sufficient foundation for growth in a highly competitive global environment. Alberta's strong technical expertise and entrepreneurial culture are increasingly being applied to other sectors than the energy sector, both locally and globally. However, substantial growth in the environmental technology industry will only be achieved with stronger and more effective government programs and incentives for business skills development and for private capital investment than are currently available to the small companies in the environmental sector.

11. Recommendations

1. **Review and strengthen existing successful government funding programs that provide support to the SME's in the continuum of activities from research through development and to commercialization.** Examples of federal programs are IRAP, IRAP's Precommercialization Assistance (PA) program and the Program for Export Market Development (PEMD).

A review should be conducted to ascertain what degree of funding is directed to environmental projects, and to gather data to be analyzed. Informed conclusions can then be made as to how to make the programs more effective, to build on their strengths, remove barriers and make practical improvements so the programs will be more user-friendly to the small companies that dominate the environmental sector.

Some suggested areas of improvement are:

- Designing the programs to be less bureaucratic and time consuming for SME's that have limited people and financial resources and time.
- Providing greater depth of information about global markets and sectors beyond the high level assessment that is currently available. The high level assessment is useful to know the "forest" but the opportunities are in the "trees" at the company level and it is costly for the SME's to get information at this level.
- Having the programs managed by business people and supported by technical people that understand the environmental industry. The SME's compete in the global market against firms from other nations that provide much greater in-depth advisory and financial support to their local companies.

2. **Significantly increase and sustain support for proven and existing programs** delivered by not-for-profit organizations **aimed at increasing the ability of SME's to commercialize technologies, particularly aimed at the export markets. As a priority, support to programs that help SME's to develop their business and marketing skills should be increased**, along the lines of the October 2003 Doyletech Report.

Suggested actions are:

- Implement recommendations to increase the following assistance to SME's:
 - Networking with peers and experienced business people
 - Market identification, intelligence and development
 - Managing growth
 - Business strategy development.

These recommended areas of assistance are fully consistent with those in the October 2003 Doyletech Report.

- Increase business skills training for SME's. The training should be comprehensive, should afford learning from the experiences of seasoned business people and should provide networking and learning from others – these are the characteristics viewed as most valuable by SME's. For example, the “Entrepreneur to CEO Workshop”, now offered in Alberta once each year to 30 to 35 environmental SME's is viewed by SME's as effectively meeting these requirements.
- Consider requiring that SME's, in order to qualify for government program funds, should participate in such a business skills training program, with the possibility of allocating a small portion of program funds (no more than 5%) towards covering the cost of the training.

- 3. Create instruments and incentives to encourage private capital injection into projects that support both the development of technologies and the commercialization of those technologies into marketable products and services.**

Other studies have reviewed financial incentives used in Alberta to encourage private sector participation in other sectors (e.g. fiscal regimes for oilsands developments) and recommended financial incentives such as a provincial R&D tax credit, renewable energy incentives etc. These and other recommendations from past studies should be revisited with respect to their overall economic impacts and the most feasible ones implemented.

- 4. Facilitate the development of an “early adopter” program that reduces the risks for the larger companies to partner with smaller SME’s in the development of new environmental technologies.**

- 5. Create a stronger environmental technology commercialization infrastructure and culture based on a compelling vision – a world class environmental technology industry in Alberta.**

The action steps could include – increasing the awareness of the potential regional and national economic contributions of a world-class environmental industry; exploring the development of an association that represents the interests of the environmental SME’s and lobbies on their behalf; developing a system for recognizing the needs and risks faced by SME’s engaged in technology commercialization; and recognizing the achievements of SME’s that have successfully overcome the risks involved in developing and commercializing new technologies into export markets.

APPENDIX 1

Review of Past Environmental Sector Studies

Review of Past Environmental Sector Studies

In addition to the recent ESAA 2002 survey, four major studies of the environmental sector in Western Canada have been conducted during the past ten years:

- “Building a Stronger Environmental Technology Exploitation Capability in Canada”¹⁵, conducted in 1992 by Doyletech Corporation on behalf of Environment Canada and Industry, Science and Technology Canada”.
- “The Western Provinces Environmental Industries Business Development Study” (WEIS)¹⁶, conducted in 1993 by Sentar Consultants Ltd. on behalf of the governments of Alberta, British Columbia, Saskatchewan and Manitoba and for Industry, Science and Technology Canada and Western Economic Diversification Canada; and
- “A Survey of Innovative Environmental Technologies in Alberta,”¹⁷ conducted in 1997 by CETAC-WEST, sponsored by Alberta Economic Development and Tourism, the Alberta Research Council and the Calgary Economic Development Authority.
- “An Assessment of CETAC-WEST’s Relevance Nine Years After Inception”, Daft Report October 2003, conducted by Doyletech Corporation.

(1) “Building a Stronger Environmental Technology Exploitation Capability in Canada”, by Doyletech Corporation, 1992

The primary objective of this study was to recommend an appropriate infrastructure for providing technology exploitation services to Canadian developers of environmental technologies. Such services would accelerate the application of technology for solving environmental problems and the creation of wealth for Canadians. The study also provided an overview of Canada’s environmental technology industry and the markets available to it, both domestically and overseas.

¹⁵ Doyletech Corporation, “Building a Stronger Environmental Technology Exploitation Capability in Canada”, performed for Environment Canada and Industry, Science and Technology Canada, July& 92.

¹⁶ Sentar Consultants Ltd., *Western Provinces Environmental Industries Business Development Study, Man Report*, performed for Alberta Economic Development and Tourism; British Columbia Economic Development, Small Business and Trade; Manitoba Industry, Trade and Tourism; Saskatchewan Economic Development; Industry, Science and Technology Canada; Western Economic Diversification Canada, January 1993

¹⁷ CETAC-West, *A Survey of Innovative Environmental Technologies in Alberta*, performed for Alberta Economic Development and Tourism, the Alberta Research Council, and the Calgary Economic Development Authority, 1997.

The Doyletech study was based on a survey of Canadian companies engaged in the supply of products and services for environmental applications, as well as other constituencies such as the investment industry and regulatory authorities.

The study found that the major barriers to a stronger supply capability were regulatory and financial in nature. Other barriers that were identified were referred to as “technical” and “market” barriers. The study recommended the establishment of a facility or network of facilities that would assist firms in overcoming such barriers and that would meet the following criteria:

- to have linkages to the R&D community, the investment community and to regulatory authorities;
- to have the ability to assist firms in technology assessment, scale-up and commercialization;
- to have the ability to function on a national basis;
- to be partially funded by the private sector and by other levels of government and operating at arms length from government.

In 1993, the Canadian Environmental Technology Advancement Centres were formed, resulting in the establishment of three centres with the mandate to provide technology commercialization assistance to firms across Canada. One of these centres was based in Calgary (CETAC-WEST) and the other two were in Ontario and Quebec.

(2) “The Western Provinces Environmental Industries Business Development (WEIS) Study”, by Sentar Consultants, 1993

The overall objective of the WEIS Study was to “,, identify specific projects and business development opportunities and recommend approaches for Western cooperation and collaboration to facilitate and promote the development of the environmental industries in the four Western Provinces.”

The central findings of the 1993 WEIS study were as follows:

- Environmental businesses represented a growing sector of the economy of Western Canada with annual growth rates expected in the range of 5-15% during the next five years.
- More than 2000 firms were in the industry, employing more than 20,000 people and generating annual sales between \$1.4 and \$1.8 billion.
- The breakdown of revenues and employment by province were estimated at:
 - Alberta \$650 Million revenues, 8,000 workers
 - British Columbia \$650 Million revenues, 8,000 workers
 - Saskatchewan \$175 Million revenues, 2,000 workers
 - Manitoba \$200 Million revenues, 2,000 workers

- There was a strong service orientation, notably in the provision of consulting services; only 15% of respondents had revenues from environmental products that they manufactured themselves.
- The industry was somewhat parochial, with one third of those surveyed reporting no sales outside their own province, although the greatest growth opportunities were expressed in terms of international business.
- Most Western Canadian firms were small, undercapitalized and unable to conduct mid to longer-term research and technology developments – over one quarter of the industry was in business for less than five years; the median employment level was six employees; the average service firm had sales just under \$1 Million and the average manufacturer had sales over \$2 Million.
- The major issues were common to firms across the provinces and related to: the legislative and regulatory environment, liability, market development, R&D, access to capital and the appropriate role of government.
- In terms of its growth potential, the environmental industry relied heavily on the health of the primary resource industries. The main driver of growth was related to government legislation and actions, though differing legislation had produced an uneven playing field for the industry.
- The greatest hindrance to growth was the state of the economy. The threat of environmental liability was a major concern and liability was viewed as a brake on access to capital. Inadequate marketing skills were a significant constraint to growth.
- There were significant challenges to the introduction and commercialization of new technologies (and the WEIS Study made several specific recommendations to deal with this issue and others that were identified).

(3) “A Survey of Innovative Environmental Technologies in Alberta”, by CETAC-West, 1997

The key objectives of this survey were to determine what technology development and commercialization capabilities existed within the Alberta environmental industry and what were the critical needs or challenges with respect to the commercialization of technology. In view of these objectives, although roughly 1100 firms characterized their businesses as environmental in 1996, the focus of this survey was only on those firms that were involved in technology development and commercialization (roughly 15% of the total firms).

The primary findings of this survey were:

- Alberta had a dynamic and growing environmental industry that, however, was fragmented into several segments and largely composed of SME's. Almost 80%

of the firms had less than 50 employees and two-thirds had less than 25 employees. There was a heavy service orientation.

- Technology development and commercialization activities were being conducted across all segments (eight were identified – “monitoring instrumentation, special wastes management, pollution prevention, consulting, recycling, water purification, soil remediation and air purification”). The environmental monitoring instrumentation segment was particularly strong in Alberta, accounting for 20% of respondent firms, while consulting, wastes management and pollution prevention each accounted for roughly 15% of the firms.
- No single firm dealt with all the segments of the industry. Eighty per cent of the firms focused on one segment only and 15% focused on two segments. This fragmentation was viewed as detrimental to building critical mass in the industry.
- Around 50% of the companies surveyed served only the Canadian markets and another 22% served the US market in addition to the Canadian market. By segment, firms in soil remediation, air purification and environmental monitoring instrumentation leaned to the export markets while firms in wastes management, recycling and water purification tended to the domestic market.
- The most significant issue with respect to technology development and commercialization was identified as access to funds; marketing was identified as the next major issue. For firms in the waste management sector, regulation was seen as the most critical issue.
- In addition to their internally generated funds for technology development and commercialization, the sources of funding most cited by the technology development firms were IRAP, ARC, private capital and the SRED Tax Credit program. Companies generally indicated a reluctance to use government programs because of the heavy information requirements and long response times.
- Finally, the CETAC-WEST study included a directory of detailed corporate profiles of the firms engaged in technology development in Alberta. These profiles highlighted the technology development and commercialization capabilities of each participating company, with cross references to the eight environmental sectors or activities. This data was aimed at providing the study sponsors with relevant information that could be used to identify clusters of comparable capabilities and mutual challenges in the environmental industry and to help promote the global market development of the industry.

(4) “An Assessment of CETAC-West’s Relevance Ten Years After Inception”, October, 2003, by Doyletech Corporation

As CETAC-WEST neared the end of its first year of operation, it engaged the services of Doyletech Corporation in the Fall of 2003 to do an assessment of its relevance to Canadian environmental firms and to certain national initiatives such as the Innovation Agenda and the Kyoto Accord. Doyletech Corporation had performed the initial study in 1992, on behalf of Environment Canada and Industry, Science and Technology Canada (“Building a Stronger Environmental Exploitation Capability in Canada”) that was the basis for the creation in 1993 of three Canadian Environmental Technology Advancement Centres.

The preliminary conclusions of the Doyletech Corporation 2003 assessment are as follows:

- CETAC-WEST is filling a gap that is not well served by other technology commercialization organizations in Western Canada. The reasons for this gap are numerous but they range from a lack of knowledge of the environmental industry to a lack of interest in small to medium sized enterprises (SME's) because they are unlikely to provide financial returns for such services in the short term.
- There is a strong endorsement for CETAC-WEST's services (e.g. market niche identification) and the conduits it uses for delivering such services (e.g. workshops and roundtables).
- CETAC-WEST is making significant contributions to Canada's national environmental and innovation strategies; its leadership of a program known as the Energy and Environmental Efficiency Program is an example of such contributions.
- There is a concern among both clients and interested parties that CETAC-WEST is too dependent on the skills of a small number of key people, particularly its President. This would suggest that it is resource limited.
- CETAC-WEST is recognized as an authority on both the innovation process and on the Canadian environmental industry and is therefore well equipped to contribute to national initiatives. (One interested party stated that the model should be applied to other industrial sectors).
- It is recommended that CETAC-WEST be provided with stable financing so that it can engage in meaningful strategic planning and execution of its original mandate.
- Such financing is likely only available from public sources; a model should be implemented to measure its economic payback to Canadian taxpayers over an extended period of time. Such a model would be based on incremental taxation revenues received from companies that receive assistance from CETAC-WEST.

APPENDIX 2

SUMMARIES OF CETAC-WEST'S SURVEY AND FOCUS GROUPS

(1) Summary Observations From CETAC-WEST's October 2003 Telephone Survey

Approximately 30 environmental companies were interviewed by telephone to assess the opportunities, the strengths and weaknesses of the environmental industry in Alberta. These companies were selected from CETAC-WEST's client data base. Of the total companies, 21 or 66 % were SME's with less than 25 employees; 10 or 33% were engaged in exporting their products or services to international markets. The companies were segmented into two categories:

- companies providing environmental services and
- companies in the equipment supply/technology sectors.

1. The Services Sector

Of the total companies interviewed, 18 or 60% were in this sector. The services sector included:

- Consulting
- Air emission compliance monitoring
- Laboratory services and
- Liquid and solid waste management services including recycling.

Markets and Growth

The primary market for this sector is the oil and gas industry in Western Canada. The Consulting, Compliance Monitoring, and Laboratory Services companies indicated that their markets were mature. The Waste Management and Recycling services sub-sector indicated a moderate growth potential.

New projects such as construction of new oil-sands plants, new Northern pipelines and the Kyoto accord were identified as opportunities that could stimulate this sector. However, the companies are dependent on the economic condition of the oil and gas industry and the willingness of the industry to implement environmental programs. The impact of the Kyoto accord is dependent on Federal and Alberta government intentions in terms of compliance requirements and these intentions have not yet been clarified.

The larger consulting and service companies that have established offices in international markets do participate in the global markets and see opportunities to grow. The smaller firms find that access to the global markets is expensive; in addition, they neither have the necessary financial resources nor human resource skills to enter and develop these markets. These SME's generally lack access to and an understanding of these global markets.

The SME's indicated that participating in trade missions was expensive for them. There were exceptions and some SME's have developed relationships with global clients by indirect means such as participation in technical forums. Some companies suggested that an accelerated tax credit (such as \$1.50 tax credit for every \$1 spent) could provide an incentive to enter and develop the global markets. One advantage in the global market that was quoted was the favourable Canadian exchange rate.

Drivers and Barriers

The key drivers of demand for the service sector are environmental regulations and regulatory enforcement. Corporate due diligence, in response to public pressure, also drives this market. Changes to the regulations and or more stringent enforcement would stimulate this sector.

The barriers to growth in this market are:

- lack of or decline in regulatory enforcement
- weak economic conditions in the user industry
- difficulty in accessing international markets
- lack of financial resources and
- lack of specialized skills and enough experienced people.

Strengths

The key strengths of the consulting and services sector include:

- being staffed with highly educated people
- located close to the energy industry and having easy access to the market
- being very responsive to the user industries needs
- being able to work closely with the governments and the industry
- having specialized expertise and
- being capable of providing creative, unique and cost effective solutions.

Needs

The consulting and service sector does limited amount of R&D. It relies heavily on knowledge and experience. It does not face the same issues that are encountered in technology development and commercialization, as is the case of the equipment supplier sector. Consequently, this sector does not seek the extent of funding from government programs such as IRAP or WD, but is primarily dependent on internal resources.

2. The Equipment Supply/Technology Sector

Of the total companies interviewed 12 or 40% were in the equipment supply/technology category. Eleven of the 12 had less than 25 people, but 7 of the 12 participated in international markets.

Markets and Growth

The companies in this sector included those with a variety of equipment used to prevent, reduce, measure and control emissions of pollutants and wastes to the environment. The equipment/technology companies produced devices such as: filtration to extend the usable life of synthetic lubricants and to reduce waste generation; meters to measure low flow and flares; devices to eliminate natural gas venting at well sites; humidifiers for fuel cells; spill collection plates on drilling rigs; alternate power sources generated from wastes; water clarification and treatment equipment devices; bio-treatment of drilling fluid wastes, and others.

This sector generally targets its products to niche domestic and international markets. Their markets are not limited to oil and gas but include a variety of industries, including the electric power, agriculture, fuel cells and others. The sector projects relatively strong growth into the future. A majority of SME's in this sector participate in the global market.

Drivers and Barriers

The drivers of demand for these product are user economics, product performance and reliability, pricing, and, in some cases, regulation.

The common barriers to market growth in this sector are:

- resistance of customers to change
- overcoming scepticism and demonstrating the benefits of new technologies
- financing working capital
- competition within the sector particularly from larger firms and
- in some cases, the size of the market.

Strengths

The strengths of this sector include:

- high levels of technical expertise
- high levels of entrepreneurship
- innovative design concepts
- patent protection
- quality of products
- operating reliability and technical support expertise and
- the favourable exchange rate.

Needs

In the equipment supply and technology sector, the development of products requires investments in R&D, technology commercialization and aggressive marketing programs. Most importantly, capable management to oversee the continuum from ideas to market was viewed as critical. The SME's were the source of innovation in this sector. They

identified the need for encouragement, sustained funding and sustained mentoring in order to successfully commercialize their ideas.

The firms that have successfully brought their products to the market have utilized some or all of the government programs available to them. These include IRAP, SR&ED tax credit, assistance from CETAC-WEST, PMED and WD. The most frequently used programs were IRAP and the SR&D tax credit. Providing enabling tools to these SME's has been critical to their success. In some cases the SME's elected not to apply for these programs because the application and approval process was viewed as too long, too burdensome in paper work and too bureaucratic.

IRAP provides funding for up to half the dollars and requires that the other half be raised from private sources. It was suggested that by increasing the IRAP contribution to three quarters for example would significantly relieve the burden in raising capital for SME's. It was also noted that government programs should be designed to reward success in addition to assisting in covering the costs of failure.

APPENDIX 2

SUMMARIES OF CETAC-WEST'S SURVEY AND FOCUS GROUPS

(2) SUMMARY OF CETAC-WEST'S OCTOBER 8, 2003 FOCUS GROUP ON THE ASSESSMENT OF ALBERTA'S ENVIRONMENTAL INDUSTRY

Drivers and Markets

- The most important market driver is regulatory enforcement. Examples include innovation driven by firm regulatory action, such as phase out of dioxins, PCB's'. Companies do not buy "green" unless it makes good business sense.
- Size of the market is difficult to estimate since market boundaries are unclear. Applications or technologies used by environmental companies have value in other industries but these applications are not usually counted as part of the environmental industry.
- It is unclear whether Alberta is competitive globally in services. Some firms in the products sector have established international reputations for their products.
- There is strong market potential in export markets. Alberta companies have a good image and have respected technical skills. Firms see opportunities in niche markets.
- Strong protectionist measures in global markets need to be overcome.

Strengths

- Excellent technical skills.
- SME's are drivers of innovation in Alberta (large companies acquire technology).
- Entrepreneurial and risk taking culture.
- Good, clean image in the marketplace.
- Access to the oil and gas sector in Alberta and existence of opportunities here.
- Links with respected Alberta expatriates in other countries.

Weaknesses

- Small size of firms and inadequate access to funds make it difficult to grow other than organically.

- Lack of capital for product development is a major challenge.
- Funds and resources for penetrating export markets are not available.
- The local market is relatively small; the next level of growth is global markets but it is expensive to penetrate.
- Weak marketing knowledge of global opportunities.
- Inadequate marketing skills in firms.
- Time to market is critical for SME's since it is often the basis of competition against larger firms. However, capital and management skills needed to achieve faster timelines are both in short supply.
- Large energy companies are not investing in R&D or taking risks with testing or partnering on new technologies.
- Government support programs for export markets are not competitive with those in other jurisdictions.

Opportunities for Improvements

- Opportunities for government support, particularly in the development of technology in environmental products sector. Development of wind energy via use of incentives is seen as an example of positive government action.
- Link the capital available in the healthy energy sector with the needs of the SME's with incentives by governments (for example, 50/50 initial stage co funding). In particular, capital needed for product development.
- Governments provide market intelligence data on export markets and on opportunities in other industries. Market data now is useful but is at too high a level (the "forest"), and needs to be at the level of "trees" to be of value to SME's.
- Incentives to promote an early adopter program would be of significant value at the product development stage.
- Support is needed from governments to provide higher profiles to local firms (e.g. web site development); to help find partners for SME's in export markets; and to provide early stage funding on reasonable terms.
- Programs are needed at early stages financing, not handouts, but aimed at sharing upfront risks and benefiting from the returns.
- Current government programs should be less bureaucratic and more effective. For example, IRAP programs would benefit from a team approach whereby technical, business and marketing people are focused on providing assistance to SME's.

- In Alberta, government might consider providing infrastructure space that is vacant in “Research Centres” on reasonable terms to SME’s, for example for product testing on lab equipment.

APPENDIX 2

SUMMARIES OF CETAC-WEST'S SURVEY AND FOCUS GROUPS

(3) SUMMARY OF CETAC-WEST' OCT. 22, 2003 FOCUS GROUP ON ASSESSMENT OF ALBERTA'S ENVIRONMENTAL INDUSTRY

Drivers and Definitions

- No commonly accepted definition of environmental industry. For example, company in the fuel cell business that self-identifies as being in the energy sector would not be captured in industry survey. Similarly companies that improve production processes that also reduce environmental emissions would not be captured in the definition of the industry.
- Legislation and regulatory enforcement are critical drivers for growth of environmental industry. Regulatory pressures essential to overcome "false economics" in Alberta, where environment is viewed as a cheap or almost free good. Example of waste water management company unable to compete against deep well disposal in Alberta priced at \$1.00 per cu. metre
- Environmental protection as provincial responsibility.
- Federal perspective on environment more representative of public interest. Feds do try to account of externalities, unlike the provincial government. Example of federal incentive for wind energy that has been instrumental in the development of wind energy in Alberta.

Strengths in Alberta

- Endowment of natural resources – oil, gas, coal, wind. Energy sector critical to provincial economy; also provides foundation for growth of several sectors such as linkages to environmental and ICT sectors.
- Large resources of skilled, motivated, innovative people – strong intellectual assets.
- Entrepreneurial, risk taking culture; attracts creative people.
- Significant receptor industries that can use environmental services and products.
- Favourable tax structure for profitable companies.
- Profitable energy sector with capital that can be directed to SME's given the right incentives.

Weaknesses

- Low levels of private sector investment in R&D; attributable to uncompetitive business environment in Alberta to encourage private sector investment in commercializing technologies.
- Alberta tax structure not supportive of start-up companies or deployment of technologies.
- Government assistance programs for SME's not competitive with other jurisdictions, particularly the US and Europe. Big handicap for Alberta companies trying to penetrate global markets.
- Little perceived urgency of commercialization challenge for SME's in environmental sector. Economy driven by large, profitable oil and gas firms that are "fat and happy" and are reluctant to change the status quo.
- Alberta has major reservoir of technical skills in oil and gas but not necessarily in energy, where energy includes non-fossil based sources.

Opportunities

- More efficient utilization of energy in residential and industrial applications – particularly the utilization of natural gas. Example of potential major problem of natural gas requirements for oilsands that might require imports of gas.
- Water conservation and water treatment as key priority areas in Alberta.
- Development of alternative forms of energy, such as renewables.
- Kyoto potentially major opportunity to reduce GHG and export technologies. Problem is regulatory uncertainty.
- Alberta's deregulated energy environment also provides opportunity to engage in emissions trading. Example of Alberta being offset partner with major GHG emitters.
- Remediation of oilsands lands as major opportunity.

Threats

- Lack of regulations and uncertain regulatory enforcement.
- Perceived lack of urgency re commercialization challenge.
- Alberta will not capture the benefits of its significant investments in research if the private sector has few incentives to deploy technologies. Loss of people and jobs to jurisdictions with more progressive approaches.

- Policy makers tend to look for silver bullet that solves a myriad of problems – need to take many steps to improve commercialization.

Suggested Actions

- Develop provincial strategy on technology commercialization that includes consideration of support for both the front end investments in research and in the back end deployment of technologies. Technology commercialization strategy to focus on both the people skills problem and the money problem – both needs to be addressed.
- Need an awareness and communications program and a champion to pinpoint the potential in the environmental industry, to raise the level of understanding in the government and to rally a critical mass of people encouraging steps to commercialize technologies. Environmental industry needs an industry association to represent them, to lobby and to leverage federal and provincial funds.
- Need both carrot and stick approach – greater certainty in regulatory framework together with incentives to encourage industry to spend money on environmental improvements. U.S. and Ontario viewed as much more advanced than Alberta in encouraging industry. Examples of incentives are precedents in oil and gas sector such as royalty relief for oilsands; and incentives to permit recycled products to compete against virgin material.
- Level the playing field for SME's competing nationally and globally by providing support programs (such as in marketing) that are competitive with those of other jurisdictions. Canada is significantly behind the US in terms of support programs to the SME's.

APPENDIX 3

Global and National Environmental Industry Trends

Global and National Environmental Industry Trends

Structure and Trends in the Global Industry

Global market estimates for the size and forecasts of the environmental industry are varied due to the difficulties in defining and measuring the industry and the lack of universally accepted criteria for defining the boundaries of the industry. This leads to considerable difficulty in making reliable comparisons of studies performed by different organizations, even within the same country. Consequently, estimates for the current size of the global industry range from over US\$ 500 billion¹⁸ to US\$ 800 billion¹⁹. The largest established markets are the US, Western Europe and Japan, that account for roughly 80% of global expenditures. These markets are expected to grow at rates consistent with their economic performance, in the range of 3-5%.

The global markets for environmental technologies are driven by several important policy and market drivers, such as: growing industrialization, environmental awareness and legislation in emerging markets; liberalization of environmental technologies trade via bilateral and multilateral efforts; greater global interest in sustainable development; and broader application of environmental “best practices” by multinationals. Although greater demand for environmental products and services is expected from emerging nations in Asia and Latin America, significant tariff and non-tariff barriers could restrict this environmental trade.

The greatest global environmental demands are in the Water/Waste Water Management and in the Waste Management sectors, which account for almost 80% of global expenditures.²⁰ These sectors are expected to continue to provide solid opportunities for exports, both in environmental goods and in services. In the developed nations, rising demands are forecast for clean technologies and for green energy (e.g. biomass, wind, solar etc.), while the water market in emerging nations continues to be a significant opportunity for exporting firms.

The global environment industry is characterized by a large number of small to medium enterprises (SME's) and a small number of large companies that dominate a few market segments. The supply side is very diverse (from divisions of large chemical firms to individual consultants) and has a different structure of activities and size distribution in different countries. Large firms are more common in the German industry while small firms are more important in Canada, the US, Italy and Switzerland.²¹

¹⁸ Office of Environmental Technologies Industry, Trade Development, US Commerce Department, “Global Environmental Technologies, Trends, Markets and Prospects”, *Export America*, November 2002.

¹⁹ Environmental Affairs Branch, Industry Canada, “Canada’s Environmental Industry – At a Glance”, February 2003.

²⁰ Environmental Affairs Branch, Industry Canada, *op cit.*

²¹ OECD, “The Global Environmental Goods and Services Industry”, 1996.

The degree of diversification, defined as the range of environmental products and services produced, is highest in the more mature environmental segments (e.g. water and waste water) and in the larger companies that produce a wide range of products and services. The trend is towards providing products that are more complete – from design and equipment production, to providing services related to the installation and application of the equipment. This trend follows the shift in public policy towards pollution prevention and voluntarism rather than command and control measures aimed at clean up of pollutants.

The structure of the global environment industry is changing, with a shift from “end of pipe” equipment and clean-up services to integrated and “clean” environmental technologies. In the long term, this substitution may radically affect the structure of much of the industry by increasing the importance of research, design, consulting and other services, compared with clean-up and remediation-based goods and services. This structural change is being driven by the increasing policy focus on the diffusion of clean environmental technologies that are being integrated into industry production processes.²² This policy focus reflects societal concerns in the developed nations about clean water, clean air and climate change.

Structure of the Canadian Industry (as per Statistics Canada)

With respect to the global market, Canada has a relatively low profile, supplying roughly 3% of the global market. By comparison, the U.S., the world’s largest producer and user of environmental technologies, accounts for about 28% of the global market. According to Statistics Canada and based on their year 2000 survey, there are roughly 7500 firms in the Canadian “environmental sector”. Their definition of the sector includes firms that do not directly perform environmental activities, such as chemical manufacturing and legal services.²⁴ In total, these firms generated CAD \$26 Billion in revenues in 2000.

Of this total, revenues from only environment-related activities in 2000 were estimated by Statistics Canada at \$14 Billion. Export markets represented 9% of environmental revenues, at \$1.3 Billion, mostly in the form of environmental goods (\$0.9 Billion). There was a healthy annual export growth rate of 15% between 1996 and 2000. The US remained Canada’s largest export market, providing revenues of \$900 Million, followed by Europe (\$127 Million) and Asia (\$76 Million).

According to Statistics Canada data, four industry groups (as defined by that organization), led Canada’s environmental industry, accounting for almost three quarters of the total revenues – “Wholesale Trade” that accounted for 30% of revenues and was driven mainly by the sales of recyclable material; “Waste Management and Remediation Services”, that accounted for 21% of revenues; “Engineering Services” that accounted for 14% of revenues and “Construction Services” that accounted for 11% of revenues.²⁵

²² OECD, *op cit.*

²³ Expert Panel on Skills, Advisory Council on Science and Technology, Industry Canada, “Profile of the Environment Sector”, 1999.

²⁴ Environmental Accounts and Statistics Division, Statistics Canada, “Environment Industry Survey, Business Sector, 2000”, Catalogue No. 16F008XIE, August 2002.

²⁵ *Ibid.*

Small and medium sized firms (SME's) continued to dominate the Canadian environmental industry, making up 96% of all firms in 2000.

As in previous years, Ontario and Quebec generated the greatest environmental revenues in the year 2000, with Ontario accounting for \$6.2 Billion and Quebec accounting for \$3.2 Billion. Next in line were Alberta at \$1.9 Billion and British Columbia at \$1.7 Billion. Ontario and Quebec also generated the dominant export revenues, with Ontario generating \$708 Million and Quebec generating \$266 Million. Next in line with export revenues were British Columbia at \$187 Million and Alberta at \$119 Million.