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SECTOR COMPETITIVENESS FRAMEWORKS

ENVIRONMENT INDUSTRY

PART 1 – OVERVIEW AND PROSPECTS



Industry **Secteur**
Sector **de l'industrie**
Environmental *Affaires*
Affairs *environnementales*

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ENVIRONMENT INDUSTRY

PART 1 — OVERVIEW AND PROSPECTS

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PREPARED BY:

**ENVIRONMENTAL AFFAIRS
BRANCH**

This *Overview and Prospects* is the first of two companion documents on the Canadian environment industry in the **Sector Competitiveness Frameworks** series, which is being produced by Industry Canada in collaboration with Canada's key stakeholders in the industry. *Part 2 — Framework for Action* will be prepared in coming months, based on discussions with major industry stakeholders, following study and review of the *Overview and Prospects*.

The **Sector Competitiveness Frameworks** series focusses on opportunities, both domestic and international, as well as on challenges facing each sector. The objective is to seek ways in which government and private industry together can strengthen Canada's competitiveness and, in doing so, generate jobs and growth.

Part 1 — Overview and Prospects is being made available for distribution in printed as well as electronic forms. In all, some 30 industrial sectors are being analyzed.

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FOREWORD

The new Canadian marketplace is expanding from national to global horizons and its economic base is shifting increasingly from resources to knowledge. These trends are causing Canadian industries to readjust their business approaches, and government must respond with new tools to help them adapt and innovate. Industry Canada is moving forward with strategic information products and services in support of this industry reorientation. The goal is to aid the private sector in what it is best qualified to do — create jobs and growth.

Sector Competitiveness Frameworks are a series of studies published by Industry Canada to provide more focussed, timely and relevant expertise about businesses and industries. They identify sectors or subsectors having potential for increased exports and other opportunities leading to jobs and growth. They cover 30 of Canada's key manufacturing and service sectors.

While they deal with "nuts and bolts" issues affecting individual sectors, the Sector Competitiveness Frameworks also provide comprehensive analyses of policy issues cutting across all sectors. These issues include investment and financing, trade and export strategies, technological innovation and adaption, human resources, the environment and sustainable development. A thorough understanding of how to capitalize on these issues is essential for a dynamic, job-creating economy.

Both government and the private sector must develop and perfect the ability to address competitive challenges and respond to opportunities. The Sector Competitiveness Frameworks illustrate how government and industry can commit to mutually beneficial goals and actions.

The Sector Competitiveness Frameworks are being published sequentially in two parts. An initial *Overview and Prospects* document profiles each sector in turn, examining trends and prospects. The follow-up *Framework for Action* draws upon consultations and input arising from industry-government collaboration, and identifies immediate to medium-term steps that both can take to improve sectoral competitiveness.

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The Canadian environment industry is composed of firms involved in two broad types of activities: provision of environmental services and production of environmental products. Firms in this industry provide a wide range of pollution prevention and environmental conservation, remediation and enhancement technologies, processes, products and services.

The world environment industry is evolving. It has only recently come to be regarded as a distinct industry and is still actively engaged in developing new markets and searching for new ways to deliver its services.

The Canadian environment sector consists primarily of small enterprises . . .

Preliminary data from Statistics Canada indicate that 123 000 workers produced environmental goods and services valued at \$15.6 billion in 1995. The business sector accounted for just over half of the goods and services produced, with output of \$9.3 billion and employment of 58 250 workers. The remaining \$6.3 billion in services provided were attributable to business and government activities to supply their own needs.

The Canadian environment industry consists of some 4 000 firms ranging from one-person operations to large, multinational corporations. The majority of firms employ fewer than 50 people. Approximately two thirds of the firms provide environmental services, the remaining third are manufacturers of a broad range of products.

Important subsectors of the industry include waste management, water supply and purification and wastewater treatment.

Canadian firms have gained international recognition for their expertise in developing water and wastewater treatment technologies, handling liquid and solid wastes, manufacturing environmental equipment such as shredders, as well as for their environmental engineering and consulting expertise.

The Canadian environment industry is in transition . . .

Those segments of the industry that are becoming mature are undergoing a process of rationalization and consolidation. Many small firms are being taken over or merged to form larger entities better able to compete internationally.

The forces driving the demand for environmental products are also undergoing change . . .

Governments are shifting their focus from pollution management to pollution prevention. At the same time, governments are supplementing regulation with negotiations to secure voluntary agreements from industry to limit releases of toxics and eliminate polluting activities. There is an increasing emphasis on re-engineering industrial processes to reduce the amount of pollution produced at source, rather than at "the end of the pipe." These cleaner production technologies and services, which enable firms to improve their resource use efficiency while eliminating the production and release of toxics, are critical to sustainable development.

Increasing pressure on industry to demonstrate its commitment to sustainable development presents challenges for industry and growth opportunities for the evolving environment industry. On December 10, 1997, Industry Minister Hon. John Manley tabled Industry Canada's *Sustainable Development Strategy* (<http://strategis.ic.gc.ca/sd>) in the House of Commons. On this same date in Kyoto, Japan, the Kyoto Protocol (<http://www.unfccc.de>) was adopted by the Conference of Parties to the United Nations Framework Convention on Climate Change (1992). Under the Kyoto Protocol, Canada would be required to reduce green house gas emissions to 6 percent below its 1990 levels by the commitment period from 2008 to 2012.

With the increased global focus on climate change and the impacts of fossil fuel use, there is greater demand for technologies and services that reduce energy use and/or facilitate use of less carbon-intensive sources of energy.

There is increasing interest by municipalities in transferring environmental activities to the private sector. Public-private partnerships have already been used for the development and operation of some local environmental infrastructure. Canadian firms, however, have some challenges to overcome in competing for this business.

While there are areas of strong demand within the domestic markets, export markets hold the best opportunities for the long-term growth of the industry . . .

The United States is Canada's major export market. Since the implementation of the North American Free Trade Agreement (NAFTA) in 1994, Mexico has also become an important market for Canadian environmental products. Canadian firms, however, have moved slowly to take advantage of export opportunities. In developing regions such as Latin America and parts of Asia and Africa, where countries are striving to establish an infrastructure to address basic pollution and waste problems, demand for environmental equipment and services is growing rapidly.

Canadian firms are well positioned to satisfy many of the basic product and service delivery needs of developing economies. The Canadian industry may also be able to participate in major infrastructure developments, if firms can successfully partner with others, including foreign producers, and acquire the critical mass and resources necessary to compete effectively in these lucrative markets.

1.1 The Bottom Line

The following major challenges need to be addressed by industry and government working together:

Trade

Canadian environmental firms should explore the possibilities for using their competitive strengths to further develop specialty or niche products, services and technologies. They also need to examine partnering arrangements with other companies, including foreign firms, that may facilitate their penetration of new domestic and export markets.

Investment/Financing

The industry requires significant investment to develop and commercialize new technologies and thereby strengthen its competitiveness. Technology development and commercialization has been impeded by a shortage of seed money and venture capital.

Through alliances and partnerships, companies could share the risks and the costs of new technology development and acquisition.

Research and Development (R&D)

Industry-funded R&D is lower in Canada than in most member countries of the Organisation for Economic Co-operation and Development (OECD). While this can be partly attributed to the limited resources of the small and medium-sized enterprises (SMEs) that characterize the environment industry, Canadian firms may fall behind technologically if they do not improve on their R&D investment and performance. A related concern arises from evidence indicating a relatively slow adoption of new technologies by Canadian firms. There is a need to look at how Canada can close the R&D innovation/adoption gap with its key competitors.

Human Resources

The development of an adequate base of qualified workers is a key challenge. Available evidence points to a shortage of technicians qualified and certified to work in the environment industry. Industry must work with colleges and universities to address this problem, and also to ensure that continuing education courses provide existing workers with an adequate opportunity to upgrade their skills.

By addressing the above challenges, capitalizing on its competitive advantages and strategically responding to emerging opportunities, the Canadian environment industry can more effectively position itself to benefit from the strong growth in the global demand for environmental technologies, products and services.

2 KEY POINTS ABOUT THIS INDUSTRY

Public concern over the state of the environment and regulatory requirements seeking to respond to these concerns have led to the emergence of an important industry dedicated to satisfying global requirements for environmental technologies, products and services. While there is no universally accepted definition of the environment industry, the Organisation for Economic Co-operation and Development (OECD) Working Group on the Environment Industry has developed the following interim definition (*Interim Definition and Classification of the Environment Industry*, OECD/Eurostat Informal Working Group on the Environment Industry, OCDE/GD(96)117, Paris, 1996, p. 7):

The environment industry consists of activities which produce goods and services to measure, prevent, limit or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. Clean technologies, processes, products and services which reduce environmental risk and minimize pollution and material use are also considered part of the environmental industry, although there is currently no agreement upon a methodology to measure their contribution. . . .

The environment industry does not correspond with Statistics Canada's current *Standard Industrial Classification* (SIC) codes; instead, the components of this industry are spread among a number of existing SIC categories. As a result, comprehensive time-series data are not available from Statistics Canada. In addition, estimates of the global market vary, reflecting the lack of agreement on the defining characteristics and subsectors of the industry. For this Overview, a variety of information sources have been utilized. Industry Canada and Statistics Canada, however, have recognized the need to develop a reliable database for this industry.

The environment industry includes producers of goods and services in air production control, water supply and purification, wastewater treatment, solid waste and solid waste management, wholesale of scrap materials, engineering, potable water and recycling, and other goods and services (Statistics Canada, National Accounts and Environment Division, *Environment Industry, 1995, Preliminary Data*, Item 16F0007XPE, Ottawa, June 1997). Using the OECD definition as an international standard, and drawing on data collected for a number of existing SIC categories, Statistics Canada is in the process of developing a more complete picture of Canada's environment industry. The 1995 preliminary statistics compiled by Statistics Canada provide a benchmark and are used throughout this document.

Industry definition
stated . . .

. . . comprising parts of
many different sectors

Clearer view will
emerge from new data
collection procedure

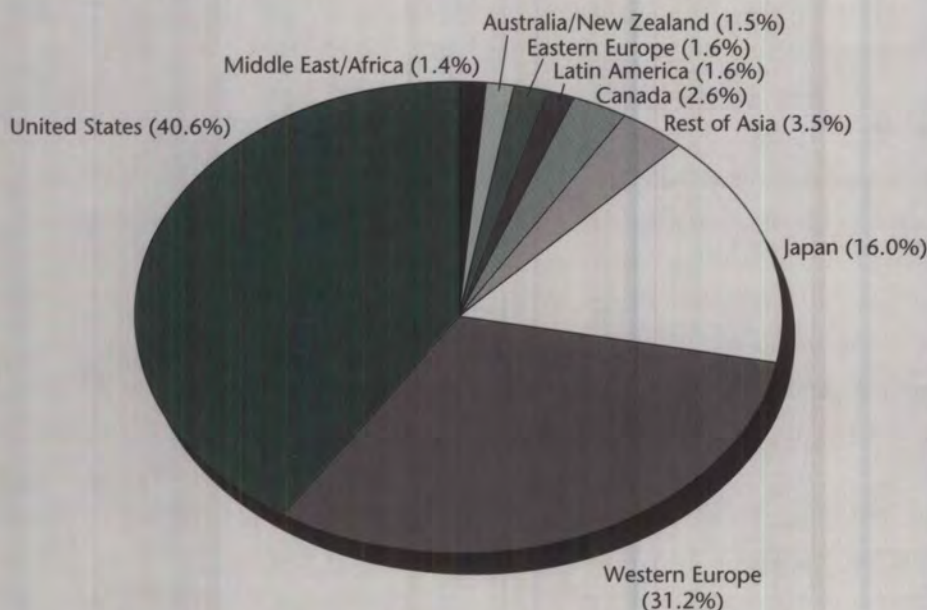
Global market:
\$1 trillion by 2000

2.1 Global Context

There is a large and evolving global market for environmental equipment and services. Although estimates vary, the global environmental market should approach \$1 trillion by the turn of the century, according to the Delphi Group ("A Market Analysis of National Funding of Environmental Technology Demonstration and Export Promotion," Ottawa, September 1997).

In 1994, Canada accounted for an estimated 2.6 percent of global spending on environmental goods and services (Figure 1). Member countries of the OECD represent approximately 80 percent of the world market. Developing countries, however, are becoming an increasingly important source of demand as their industrial sectors come under growing pressure to develop in a more sustainable fashion.

Figure 1. Global Environmental Market, 1994



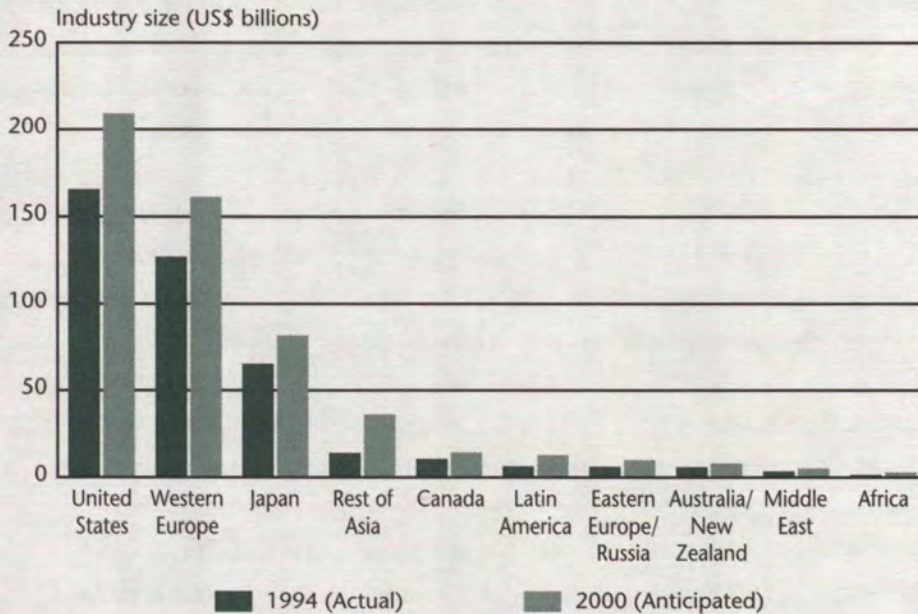
Source: "The Global Environmental Market," *Environmental Business Journal*, August 1995, p. 3.

3–5% annual growth
anticipated worldwide

The world market is forecast to grow at an average annual rate of 4–5 percent to the year 2000 by *Environmental Business Journal*, whereas the Delphi Group (*An Analysis of Markets for Canadian Environmental Technologies*, a report prepared for the Environmental Affairs Branch of Industry Canada and Technology Partnerships Canada, Ottawa, March 1998) forecasts Canadian annual growth in environmental markets at approximately 3 percent in the

period 1996–2000. Figure 2 shows that while markets in developed countries such as the United States, Canada and Japan are projected to grow at the average world rate of 4–5 percent, developing countries should see their markets expand at average rates ranging from 10 percent in Africa to 17 percent in Asia (except Japan) over the same period.

Figure 2. Actual and Anticipated Growth in the Global Environmental Market



Source: "The Global Environmental Market," *Environmental Business Journal*, August 1995, p. 5.

Competition is on the rise in global environmental markets, with firms aggressively positioning themselves to export their products and services to developing nations. At the same time, however, developing countries are acquiring increasing domestic expertise in the provision of environmental goods and services. To succeed in many of these markets, foreign firms may need to take advantage of this expertise through joint ventures and partnering with local firms.

The Canadian environment industry is some way from achieving its goal of becoming a major exporter. Exports currently account for only about 10–15 percent of the industry's shipments. The relatively small size of Canada's domestic market means that increased penetration of global markets is important to sustain the strong growth of the industry. This in turn requires Canadian firms to build upon their competitive advantages and aggressively pursue export opportunities in niche markets.

**Firms vie for markets
on global basis**

2.2 North American Context

The North American Free Trade Agreement (NAFTA) and the supplemental North American Agreement on Environmental Cooperation (NAAEC), which came into force in 1994, have led the Canadian industry to focus more on trade, investment and technology development opportunities south of the border. The purpose of the NAAEC, which created the Commission of Environmental Cooperation (Summary of Environmental Law in Canada, <http://www.cec.org/>), is to “enhance continental environmental cooperation in order to meet the challenges and take advantage of the opportunities created by the growing economic links between Canada, the United States and Mexico and by their shared reliance on a single ecosystem.”

Canadian firms
seek niche segments

The United States is the largest and most accessible market for Canadian firms and has been the destination for about 80 percent of the industry's exports. Canadian firms have mainly directed their attention to U.S. markets. Although it is highly competitive, the U.S. market is likely to remain important because of its sheer size. It appears that the best opportunities for Canadian firms will remain in niche segments and markets for specialized technologies. Partnering with the U.S. firms would give Canadian firms access to state and local government contracts, which are not covered by the World Trade Organization procurement code or the NAFTA.

At the same time, U.S. firms have become important competitors in Canada's domestic market. Imports supply over 35 percent of Canada's market for environmental equipment, with 80 percent of this coming from the United States.

... Mexican market is
becoming important

It is anticipated that Mexico will become an important export market as a result of the NAFTA. The vast majority of environmental goods in Mexico are imported, with 70 percent of current imports coming from the United States. New regulatory requirements may lead to major infrastructure projects, such as the construction of wastewater treatment facilities and municipal solid waste disposal systems. The Mexican environmental market is anticipated to reach US\$2.5 billion by the year 2000 (“Latin American Markets,” *Environmental Business Journal* 11, October/November 1996, p. 3).

The NAFTA eliminated tariffs on a number of types of environmental equipment such as drying machinery, distillation equipment, centrifuges and instrumentation. By January 1998, Mexico and the United States were to have eliminated tariffs on various other equipment of specific interest to Canadian firms, most notably incinerators and filtering and purifying machinery for water, other liquids and gases. The Canadian environment industry should also benefit from provisions in the NAFTA that encourage the three countries to effectively enforce their domestic environmental regulations.

2.3 Canadian Industry Snapshot

Canada's growing environment industry provides a wide range of technologies, products and services for pollution prevention as well as environmental conservation, control, protection, remediation and enhancement. With the emerging global focus on reducing greenhouse gases that contribute to climate change, renewable energy and energy efficiency are also emerging as key subsectors. The development of a dynamic world-class environment industry can make a significant contribution to Canada's economic prosperity and help in the country's efforts to move toward sustainable development.

Industry Size

The Canadian environment industry is estimated to comprise 4 000 small and medium-sized enterprises (SMEs) as well as a number of larger corporations. Preliminary data from Statistics Canada providing lower bound estimates of the sector are provided in Annex C. They indicate that total domestic production, including that undertaken by businesses and governments supplying their own needs, amounted to \$15.6 billion in 1995. This involved 123 000 workers, which amounted to just over 1 percent of total Canadian employment in 1995.

Total domestic production is composed of commercial sales of \$9.3 billion, business own account production of \$1.5 billion and government production of \$4.8 billion. The commercial sector, producing environmental goods and services to sell in domestic and export markets, employed 58 251 workers in 1995.

Statistics Canada data indicate that the market for commercial sales of environmental goods and services is about \$10 billion, which is roughly in line with the estimate shown in Figure 2. Other sources suggest, however, that the domestic market may be 20–30 percent larger than these estimates (Ontario Centre for Environment Technology Advancement, "Ontario Environment Industry, 1997 Economic Survey," OCETA, Toronto, November 1997).

Firms in the industry range from one-person operations to large, multinational corporations; however, most firms are SMEs, usually employing fewer than 50 people. A November 1997 OCETA study (<http://www.oceta.on.ca/>) indicates that SMEs, which comprise approximately 90 percent of the operating companies in Ontario, had 1995 average sales of \$421 000 for small companies (fewer than six employees) and \$3 million for medium-sized companies (between six and 50 employees), while large companies (more than 51 employees) had sales averaging \$19 million.

**Environment industry
could lead Canadian
move to sustainable
development**

**123 000 workers
produce output
worth \$15.6B**

**Most firms are small,
employ fewer than
50 people**

Services amount to
\$9B annually

Products amount to
\$4B annually

Construction accounts
for \$3B annually

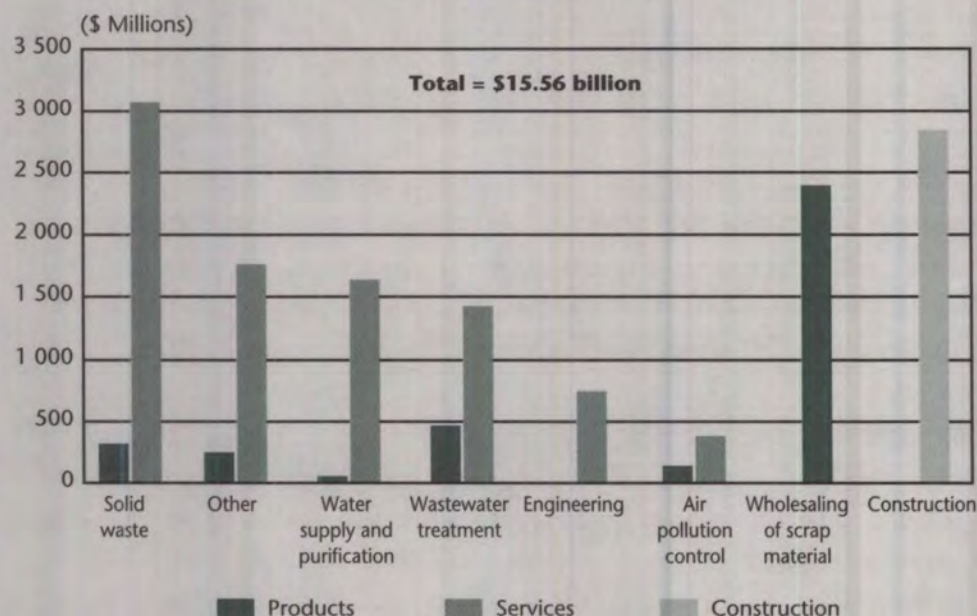
Approximately two thirds of the environment industry firms in Canada provide **services**, such as solid waste and wastewater management and treatment, water supply and purification, water, soil and air quality testing, and environmental engineering. According to Statistics Canada's preliminary estimates, service production amounted to over \$9 billion, or just under 60 percent of total 1995 domestic production.

The other one third of the firms are manufacturers, making a broad range of **products** including clean process technologies and portable site remediation equipment. Statistics Canada estimates that the manufacturing subsector contributed about \$4 billion to the industry's total 1995 production.

Construction activities associated with the provision of environmental goods and services amounted to almost \$3 billion, accounting for 18 percent of the value of domestic production.

Figure 3 shows the contribution of different good and service subcomponents of the industry. Output in the waste management subsector was \$3.4 billion or 22 percent of 1995 domestic production. Other major subsectors include water supply and purification, and wastewater treatment.

Figure 3. Total Domestic Production, 1995



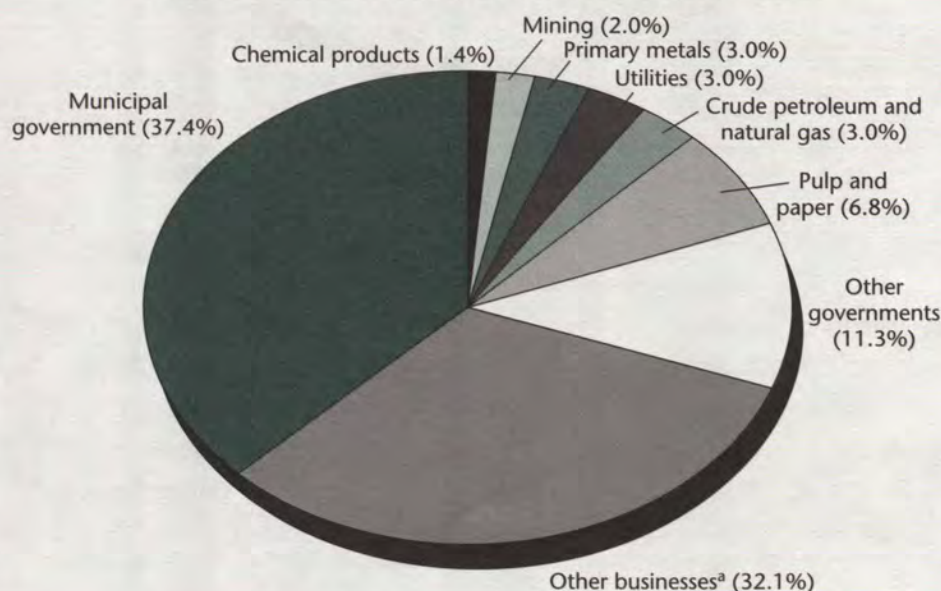
Source: Statistics Canada, National Accounts and Environment Division, *Environment Industry, 1995, Preliminary Data*, Item 16F0007XPE, Ottawa, June 1997. (Effective February 1998, the National Accounts and Environment Division has become the Environment Statistics Program.)

Canadian firms have established a good reputation for the establishment of water and wastewater treatment systems, the handling of liquid and solid wastes, the manufacture of equipment such as shredders and incinerators, and the provision of environmental engineering and consulting services. Consulting engineering services of \$747 million accounted for approximately 8.0 percent of environmental business sales in 1995. Environmental services have accounted for a growing share of consulting engineering services; in 1991, environmental specialists accounted for about 9.4 percent of consulting engineering revenues but, by 1995, this had grown to over 12 percent (Statistics Canada, National Accounts and Environment Division, "Environmental Aspects of Consulting Engineers in Canada, 1991 to 1995," Draft, Ottawa, October 1997).

Key Market Segments

Figure 4 shows the key customers or end users for Canadian environment industry products and services and also their relative shares of the Canadian environmental market. The industry relies on sales to both the public and private sectors, with the public sector being the largest market for domestic environmental services. Municipal governments are major purchasers of solid waste management and recycling services and environmental protection services.

Figure 4. Canadian Environmental Market, 1995



^a Includes other manufacturing industries, waste management industry, food industry, beverage industry and non-metallic mineral industry.

Source: Industry Canada based on data provided by Statistics Canada, National Accounts and Environment Division. (Effective February 1998, the National Accounts and Environment Division has become the Environment Statistics Program.)

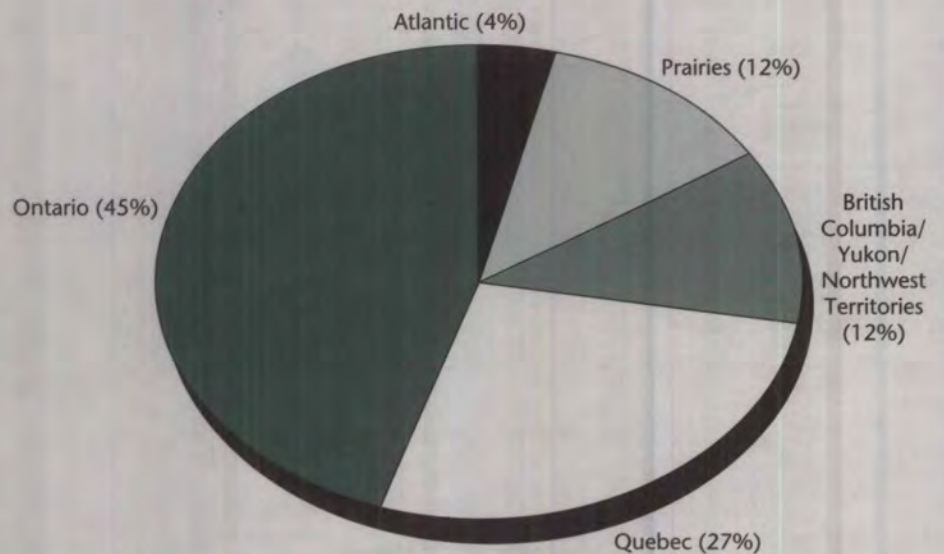
**Municipal governments
are major purchasers of
waste management
services**

Ontario has the majority of firms in the domestic market

Industry Distribution and Structure

The regional distribution of industry activity within Canada is illustrated in Figure 5. Ontario companies account for about 45 percent of industry revenues. This is somewhat higher (about 40 percent) than this province's contribution to Canada's overall gross domestic product (GDP). At 27 percent, Quebec's revenue share also exceeded its contribution to GDP.

Figure 5. Distribution of Environment Industry Revenues, by Region, 1995



Source: Industry Canada based on data provided by Statistics Canada, National Accounts and Environment Division. (Effective February 1998, the National Accounts and Environment Division has become the Environment Statistics Program.)

Firms are often located near to natural resource industries or industrial markets served by these industries. For example, the majority of Canada's firms dealing with the remediation of hydrocarbon-contaminated soils are located in western Canada, close to petroleum-producing facilities. Many wastewater treatment firms are located in Ontario and Quebec, and there is a concentration of firms providing geographic information systems (GIS) and remote sensing on both the Atlantic and Pacific coasts. Most of the firms manufacturing environmental products are located along the Montreal-Windsor corridor in Ontario and Quebec.

Globalization and rationalization mark industry transition

The Canadian environment industry is going through a transition period. As certain segments of the industry begin to mature, there is a trend toward industry rationalization and consolidation. Recent developments in the solid waste industry segment are a case in point. "Higher capital requirements, arising from increasing and more stringent environmental regulations,

are affecting the smaller private companies' . . . ability to operate" (Allied Waste Industries, Scottsdale, Arizona, First Quarter 1996 Corporate Profile). *Waste Age* magazine has observed that 41 companies on its 1995 "Waste Age 100" list were not on the 1996 list, 17 of these because of mergers or acquisitions.

Similarly, a number of Canadian companies are undergoing restructuring. Many small firms are being taken over or merged to form larger entities better able to compete internationally. Philip Services Corp. (<http://www.philipinc.com>), based in Hamilton, Ontario, ranked 41st on the list of the 200 fastest-growing companies in the world, according to a study by Deloitte & Touche (*The Globe and Mail*, May 15, 1997, p. B12). It has made a number of acquisitions over the past year in the resource and recovery and industrial by-products area emerging as one of the largest environmental companies in Canada, employing over 8 000 employees and generating revenues that are expected to be around \$2 billion (US\$1.6 billion) for 1997.

Although the industry contains a few larger conglomerates, companies in the Canadian environment sector tend to be small. Economies of scale and increased operating efficiencies can potentially be gained through partnerships, including joint ventures and strategic alliances. Canadian firms often partner on large projects to overcome the disadvantages associated with their relatively small size. Governments have recognized the potential benefits of such arrangements and support industry efforts to establish strategic alliances, particularly for export market development.

Human Resources

Of the 123 000 jobs that Statistics Canada estimates (see Annex C) to have been attributable to environmental activities in 1995, just over 72 000 or almost 60 percent were in the private sector. In the public sector, some 51 000 workers were involved in environmental activities in 1995.

The environment industry is dependent on a skilled and knowledgeable work force. In environmental consulting firms, for example, almost 70 percent of positions require professional or technical skills in the sciences. Training requirements in the industry and related human resources issues are addressed by the Canadian Council for Human Resources in the Environment Industry (CCHREI), a not-for-profit Canadian corporation, established by the industry (<http://www.chatsubo.com/cchrei/>). CCHREI's primary goals include facilitating the development of national occupational standards for environmental employment, developing a certification process for individuals involved in environmental activities, and establishing an accreditation process for environmental courses and programs.

**Firms restructure
for strength in
world markets**

**Jobs require high
skill levels**

The environment industry sector employs a broad range of individuals with a wide variety of skills and occupations. Although many of those employed are specialists with specific environmental training, others are generalists whose skills could be applied to, or adapted from, other industrial sectors. Statistics indicate that workers in the Canadian environment industry are relatively young, with a higher than average proportion in the 20–34 age group. The employees are more productive than average; the industry produced an estimated \$130 000 of output per worker, 25 percent above the average for manufacturing sectors and double the average for the overall economy.

Professional and Trade Associations

CEIA promotes
environmental firms
across Canada

The Canadian Environment Industry Association (CEIA) (<http://www.ceia-acie.ca>) is the umbrella organization for Canada's 10 provincial environmental industry associations and networks. CEIA's mission is to promote the interests and support the development of Canadian companies whose business is supplying environmental technologies, products or services. To this end, the association provides various services, including trade promotion, networking, skills development and information dissemination. The CEIA also conveys members' views and policy concerns to federal and provincial governments. CEIA membership currently stands at approximately 1 500 firms nation-wide.

The industry is represented as well by several subsector trade associations. These include the Canadian Water and Wastewater Association (<http://www.cwwa.ca/>), the Canadian Association for Environmental Analytical Laboratories (<http://www.caeal.ca/>), the Geomatics Industry Association of Canada, the Canadian Solar Industry Association (<http://www.newenergy.org/newenergy/cansia.html>) and the Natural Gas Vehicle Association.

Government Policy

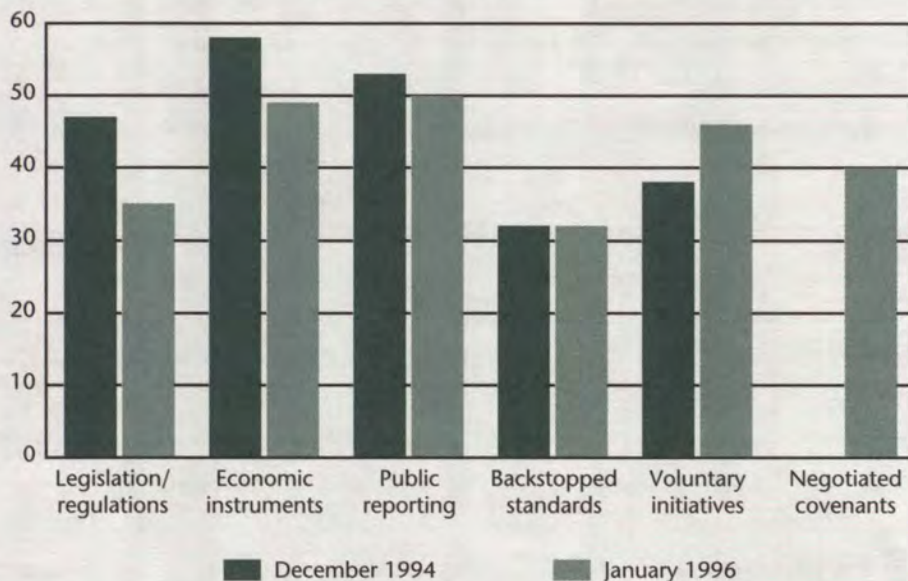
Government policies and especially environmental regulations have played a key role in the growth of the environment industry. In the United States, the air pollution control industry expanded rapidly after the 1970 *Clean Air Act* and its 1977 amendments, and subsequently declined during the 1980s when the focus of U.S. regulations shifted toward hazardous waste management. In Ontario, during the late 1980s, the control of toxic substances became the major water quality management issue as a result of the implementation of the Municipal Industrial Strategy for Abatement (MISA). MISA has had a significant impact on the development of the wastewater industry in Ontario.

More recently, governments have attempted to respond to the high costs of enforcing regulations by shifting more responsibility for environmental control to the private sector. The development of a pollution prevention strategy in 1995 signalled a shift in emphasis by the federal government from attempting to manage pollution to pollution prevention. The new focus is on promoting efficient conservation strategies through which private firms will contribute to the broader objective of sustainable development.

As governments at all levels decrease their reliance on strict regulation, voluntary agreements by industry to limit toxics or prevent pollution are becoming more common. Examples include the Canadian Chemical Producers' Association (CCPA) Responsible Care® Program, Major Industrial Accidents Council of Canada (MIACC), and the Accelerated Reduction/Elimination of Toxics (ARET) program. A 1996 GlobeScan survey of 100 sustainable development experts from primarily OECD countries showed that, between 1994 and 1996, the importance of legislation and regulations to motivate action on pollution prevention significantly decreased while the importance of voluntary approaches increased (Figure 6).

Private sector is
assuming a larger
share of pollution
prevention strategy

Figure 6. Number of Pollution-control Instruments in Canada



Source: Synergistics Consulting, 1996-1 GlobeScan Survey, Toronto, May 1996.

The mandate of the *Canadian Environmental Protection Act* (CEPA) (<http://www.ec.gc.ca/cepa/>) is to identify and control toxic substances on land, air and water. CEPA's focus is proactive, using regulations and enforcement together with a package of non-regulatory approaches such as guidelines, codes of practices, incentives, and the development and transfer of pollution measurement and control technologies.

CEPA takes
proactive role

**Public sector is
major market
of industry**

The influence of governments on the Canadian industry extends beyond their role as regulator; the public sector is an important market for environmental goods and services. Municipalities in fact account for over 50 percent of the total domestic market. The federal government's procurement policy commits the Government of Canada to conduct all its operations in an environmentally responsible manner. Several provinces have also implemented "green" procurement policies.

Under the Canadian Environmental Industry Strategy (CEIS), which sunset on March 31, 1998, the federal government established a policy framework aimed at promoting the growth and development of the environment industry in Canada. The CEIS, announced in September 1994, was composed of 22 initiatives (see Annex A), giving expression to three central themes:

- delivering federal government support to the industry in a direct, easily accessible, service-oriented and cost-effective way
- supporting the development and commercialization of innovative environmental technologies
- improving access to domestic and global market opportunities for environmental companies.

**Sustainable
Development Strategy
has four objectives**

Looking to the future, governments will continue to build on the successes of CEIS in working with industry to determine how best to reduce greenhouse gas emissions and to demonstrate commitment to sustainable development. This is exemplified in Industry Canada's Sustainable Development Strategy (<http://strategis.ic.gc.ca/sd>), which has identified four strategic objectives:

- foster a marketplace climate in Canada that promotes sustainable development
- enhance the ability of Canadian firms to develop and use innovative technologies and tools that contribute to sustainable development
- encourage trade and investment flows that contribute to sustainable development in Canada and abroad
- continue to improve the capacity of Industry Canada to manage and deliver departmental policies, programs and operations that contribute to sustainable development.

2.4 Performance and Competitiveness

Industry Performance

While there are insufficient data to document the historic performance of the environment industry, what information is available suggests that this is a rapidly growing sector, benefiting from the growing emphasis on controlling pollution and implementing more sustainable production systems. The industry has been cyclical, however, dependent on the economy and the level of investment available at any given time.

The OCETA's 1997 Economic Survey of the Ontario Environment Industry looked at private sector for-profit companies in the province. Its findings suggest that the environment sector in Ontario is growing significantly faster than the overall Ontario economy.

Environmental specialists, a subgroup of consulting engineers, are firms whose environmental revenues account for at least 33 percent of their total revenues. It is significant that the foreign earnings of this subgroup of consulting engineers more than doubled between 1991 and 1995, while those of non-specialists remained relatively flat. While most foreign revenue was from work performed in the United States, an increasing proportion of income came from other areas, including South America, Asia and Africa.

Some understanding of recent market conditions can be obtained from the financial results published by publicly traded environmental firms. *The Globe and Mail Report on Business* in July 1997 included 14 publicly traded environmental firms among the top 1000 Canadian firms, ranked by profits. Most of the firms exhibited better performance — measured in terms of earnings per share, return on equity and percentage change in profits — in the past year than in the previous two-to-five-year period. Top performers included Philip Services Corp., SNC-Lavalin Group Inc., Trojan Technologies Inc., Bovar Inc., Zenon Environmental Inc., Groupe Sani Gestion Inc. and Conor Pacific Environmental Technologies Inc.

Since the factors driving demand and the challenges facing firms (i.e. trade barriers, human resources, regulation and technological change) are broadly similar in Canada and the United States, it is also instructive to look at the financial results reported by U.S. environment firms. The *Environmental Business Journal* monitors the performance of publicly traded U.S. companies with its EBJ Stock Index. In 1995, firms involved in solid waste management, process and prevention technology and instrument manufacturing posted gains over 1994 of more than 40 percent. This followed three years of softer industry performance.

The weak market conditions in the early 1990s help explain the large number of mergers and acquisitions that have been occurring on a North American basis in various segments of the industry. These have affected such service segments as environmental laboratories, remediation (particularly in the U.S.) and waste management. Such rationalization and restructuring may also partly signify the evolution, maturation and globalization of the industry.

**Environment sector
growth outpaces
overall economy
performance in Ontario**

**North American
rationalization follows
period of weak growth**

According to OECD's *The Global Environmental Goods and Services Industry* (Paris: 1996), competitive advantages in the environment industry are largely a function of:

- technological innovation
- quality and service performance
- marketing and export strategies
- flexibility in production.

Canadian firms must work on these factors to build their ability to compete in the global marketplace.

Trade Performance

**Exports are
mainly to U.S.**

While Statistics Canada's trade estimates are recognized to be incomplete, other sources suggest that approximately \$1.7 billion worth of environmental goods and services are exported from Canada. This represents about 10 percent of the environment sector's total commercial production. The U.S. market was the destination for about 80 percent of Canada's environmental exports.

**Imports account for
35% of domestic needs**

In terms of environmental equipment, Canada imports over 35 percent of its overall requirements, according to OECD statistics, and has a net trade deficit of approximately \$620 million. Canada imports 82 percent of its air pollution control equipment, most of this coming from the United States.

Canada provides environmental protection services to the United States, Europe and developing countries and is thought to run a trade surplus in this area. However, with incomplete trade statistics, it is not possible to assess Canada's trade balance in environmental goods and services.

**Canadian firms need
to become more
export-oriented**

Compared with Canada, countries such as Japan and Germany are much more export-oriented, exporting well over 20 percent of their production. Canada has the potential to participate more fully in the global environment market. Approximately 600 Canadian environmental companies are currently exporting, and this number is expected to double early in the next century.

Opportunities in export markets offer some of the best prospects for the future growth of the environment industry and the creation of high-paying jobs for Canadian workers. The benefits of pursuing an export strategy can be seen from the experience of Canadian companies that have been highly successful in developing foreign markets for their products and services. For example, Trojan Technologies Inc. of London, Ontario (<http://www.trojanuv.com>), and winner of the Financial Post Environment Award gold medal in 1997 is the world's leading

supplier of ultraviolet systems to disinfect effluents from wastewater treatment plants. Gross sales for 1997 totalled \$51.1 million. Exports accounted for \$43.5 million or 84 percent of sales. Approximately 85 percent of sales were to the North American market, primarily the United States. The remaining 15 percent of sales were to Europe, South America and the Pacific Rim. Trojan also has offices in The Hague and California.

Technology Performance

Technological capability is a fundamental determinant of the growth, profitability, efficiency and competitiveness of a firm. This applies particularly in the rapidly evolving environment sector. Firms in this industry must develop and/or adapt new technologies and successfully integrate them into their products and services to be competitive. The following government programs can assist companies in this area:

- The Industrial Research Assistance Program (IRAP) (<http://pub.irap.nrc.ca/irap/web/irapcomm.nsf>), a long-standing program of the National Research Council of Canada (NRC), helps SMEs undertake research, development and technology adaptation projects. It provides funding and technical information, industrial engineering and expertise to reduce the financial risk of developing new environmental technologies.
- Technology Partnerships Canada (TPC) (<http://tpc-ptc.ic.gc.ca>), an Industry Canada-led investment program designed to "close the gap" between the development and the commercialization of innovative technologies, focusses on the near-market end of the R&D cycle and on proven companies with high-risk projects.
- The Environmental Technology Verification Program (ETV) (http://www.ec.gc.ca/etad/etv_e.html), launched in the spring of 1997, is a joint initiative by Environment Canada and Industry Canada, developed in partnership with private industry. It provides credible and independent verification of a supplier's technology performance claims and provides a valuable marketing asset in domestic and foreign markets where it is often difficult to gain acceptance for new and innovative technologies.

A CETAC-WEST study of *Innovative Environmental Technologies in Alberta* (Calgary, 1997) found that technology development and commercialization activities were evident in all segments of the environment industry. The industry segments cited in this study include monitoring and instrumentation, pollution prevention, water purification, consulting, recycling, special waste management, soil remediation and air purification. The study found that half the companies were exporting their products and services, but that there was a high degree of specialization among firms. As a result of the diverse technology requirements in different subsectors, almost 80 percent of the companies focussed on only one segment of the industry.

Key programs

encourage innovation,
adaptation

Technology reliance
induces firms to
specialize

In the environmental monitoring and instrumentation segment, for example, almost half the survey participants were involved in international markets, suggesting that, in niche activities where Canadian companies have developed technological expertise, even small companies are actively pursuing export markets.

While general evidence on the technological capability of environmental firms is not available, a recent Statistics Canada study ("Technology and Competitiveness in Canadian Manufacturing Establishments," *Canadian Economic Observer*, Catalogue No. 11-010-XPB, Ottawa, May 1996) on the incidence of technology use in Canadian and American manufacturing firms is of interest. The study found that there is still a technology gap between Canada and the United States, although it is closing. Part of the remaining gap is believed to be due to the higher proportion of small establishments in Canada than the U.S. These results are relevant to manufacturers within the environment industry, who tend to operate at a much smaller scale than their U.S. competitors.

**Growing need for
eco-efficient and
energy technologies**

With the increasing pressure to move on to a path of sustainable development, there is a growing need for eco-efficient technologies, along with renewable and alternative energy technologies that respond to concerns over the impact of greenhouse gas emissions. Technologies that could be critical to the future success of the environment industry include closed-loop process technologies, biotechnologies such as biogas filters, membrane technologies for cleaning wastewater, ultraviolet radiation treatment of wastewater, bio-remediation, fuel cell technologies, photovoltaic modules, and advanced gas and wind turbines. According to some estimates, about half the environmental products that will be in use 15 years from now do not yet exist.

Research and Development

**R&D encourages
high-tech growth
of industry**

R&D is an important determinant of future productivity and growth, and central to sustaining high-knowledge endeavours. In the environment industry, the development of innovative technologies to provide new products and services is essential to meet changing environmental needs. The research-commercialization spectrum consists of five distinct stages:

- pure research
- pre-competitive R&D
- applied R&D
- product development
- product commercialization.

In Canada, most pure research is undertaken by universities. Pre-competitive and applied R&D is usually undertaken and/or supported by government organizations such as the NRC, Environment Canada and Natural Resources Canada (NRCan). Most specific product development and commercialization is handled by Canada's small, medium-sized and large corporations, largely through retained earnings and, to a lesser degree, supported by venture capital, government tax credits, contributions and repayable loans.

Canada lags behind most other OECD countries in terms of industry-funded R&D. While as much as 80 percent of all environmental R&D in OECD countries is industry-funded, Canada's environment industry funds just over half of this country's environmental R&D. The Delphi Group (*An Analysis of Markets*, p. 30) estimates private sector investment in environmental technology development at \$355.1 million for 1996.

Canada's environmental R&D initiatives have, however, resulted in the development of a number of notable innovations. Examples of developments under Industry Canada's TPC program include:

- Lex Technologies Inc.'s high-intensity mixer and extrusion system
- Pulp and Paper Research Institute of Canada's (PAPRICAN) project to redesign pulp and paper manufacturing processes, allowing more raw materials to be directed into the product with less lost to liquid waste
- Maratek Environmental Inc.'s project to reduce water-borne emissions and increase recycling from printing and graphics plants
- DynaMotive Technologies Corporation's project to commercialize fuel-oil refining from organic waste, using bio-oil with ethanol to produce an "eco-crude" to make high-value, eco-friendly products
- Ballard Power Systems Inc.'s PEM (proton exchange membrane) fuel cell (Ballard ranked 33rd in *The Globe and Mail Report on Business* in terms of top R&D companies, having spent 92.5 percent of 1996 revenues on R&D expenditures)
- Environmental Acoustics Systems Limited's project to use radio frequencies and acoustic energy to control the spread of polluting zebra mussels.

Given the link between innovation and competitiveness, it is important that the Canadian environment industry attempt to build on these successes by increasing its commitment to R&D.

**Industry accounts
for only half of
environmental R&D**

**Larger commitment
to R&D is required**

3 CHANGING CONDITIONS AND INDUSTRY RESPONSE

The environment industry is subject to ongoing and rapid change in its technology and markets. Environment firms that wish to be competitive in both the domestic and international marketplaces must be aware of changing conditions and respond accordingly.

All sectors are under
pressure to achieve
higher environmental
standards

The environment industry is the beneficiary of one important aspect of change, which is the increasing pressure on firms in all sectors to achieve higher standards of environmental performance. Firms are feeling pressure, not only from concerned citizens and governments, but also from lenders and investors who are worried about possible liability actions. As a result, there is a growing demand for pollution control technologies and processes that will help firms efficiently improve their environmental performance.

The increasing pressure on industry to demonstrate its commitment to sustainable development — development that meets the needs of the present without compromising the ability of future generations to meet their own needs — presents growth opportunities for the evolving environment industry. On December 10, 1997, Industry Minister Hon. John Manley tabled Industry Canada's *Sustainable Development Strategy* in the House of Commons. On this same date in Kyoto, Japan, the Kyoto Protocol (<http://www.unfccc.de>) was adopted by the Conference of Parties to the United Nations Framework Convention on Climate Change (1992). Under the Kyoto Protocol, Canada would be required to reduce greenhouse gas emissions to 6 percent below its 1990 levels by the commitment period from 2008 to 2012.

3.1 Technological Change

Environmental
technologies support
growth in other sectors

The environment industry has been characterized as an enabling sector; that is, a sector helping make other industries more efficient and productive while also helping them meet environmental standards and regulations. By developing efficient solutions to environmental problems, the industry can make an important contribution to improving the performance of many industrial sectors of the Canadian economy.

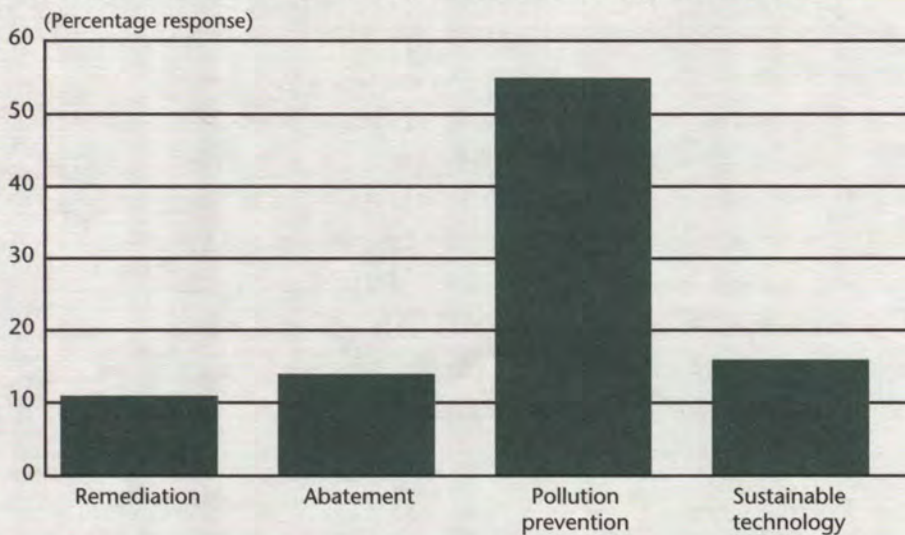
Pollution prevention — that is, reducing the amount of pollution produced at the source rather than controlling it after it has been created — is increasingly being incorporated into industrial processes. Industry is moving away from the end-of-pipe pollution abatement solutions, which have been the favoured form of compliance with environmental regulations. In its 1995 preliminary estimates for environmental protection spending by industry, Statistics

Canada noted an important increase in investment in integrated processes. Firms have come to appreciate that it is important for them to be seen as “environmentally responsible.” There is also an understanding that the implementation of modern production processes and technologies that reduce pollution at the source rather than the end-of-pipe may yield important savings in operating costs. Moreover, it is increasingly important for Canadian companies who want to do business internationally to be able to establish that they are environmentally responsible.

As a result, innovation is shifting increasingly from the discovery of end-of-pipe pollution control technologies to the development of cleaner technologies and workplace practices that can be incorporated in all stages of the production process. The United Nations Environment Programme (UNEP) defines cleaner production as the continuous application of an integrated preventive strategy that reduces the environmental risks of products and production processes. For production processes, this involves eliminating toxic raw materials, conserving water and energy, and reducing the quantity and toxicity of wastes at the source. The growing commitment to sustainable development and environmental protection will drive many decisions in the economy, and also create new investment opportunities in products and technologies outside the environment sector.

A 1996 survey by GlobeScan of sustainable development experts in primarily OECD countries including Canada indicates that pollution prevention technologies have become by far the most important and fastest-growing “green technology market” (Figure 7).

Figure 7. Fastest-growing Green Technology Markets, 1996



Source: Syneristics Consulting, 1996-1 GlobeScan Survey, Toronto, May 1996.

Firms recognize the need to become more environmentally responsible

Prevention technologies are growing rapidly

This trend to re-engineering the manufacturing process will have a significant impact on the environment industry. It creates strong incentives for environmental firms to develop new, more efficient pollution prevention and conservation technologies.

3.2 Trade

Twenty-six of Canada's embassies abroad have identified the environment sector as a priority in terms of pursuing export opportunities.

Trade liberalization supports environmental goals by improving access to technologies, goods and services that advance the objectives of sustainable development. Today, there are few tariff barriers in global markets for the environment industry. Some significant non-tariff barriers still exist. In particular, the U.S. *Buy American Act* remains a serious barrier to trade with the United States, impairing the access of Canadian firms to U.S. federal contracts for the construction or repair of public utilities such as water and waste treatment plants.

NAFTA opens
trade opportunities
for environmental
products and services

The NAFTA has, however, expanded trade, investment and technology development opportunities in the U.S. market and, in recent years, Canadian shipments of environmental products to the U.S. have increased. Mexico remains a challenge, although a number of Canadian companies are making inroads into this market. Promising opportunities exist in South America, especially Chile, Argentina and Brazil, where a number of large projects financed by international financial institutions (IFI) are being initiated. Canadian firms are also aggressively exploring business opportunities in South America, particularly those arising from the needs of the mining, oil and gas, and resource processing sectors.

A number of Canadian firms have been attracted by growing demands of Asian countries, including China, Republic of Korea, Taiwan and the Association of Southeast Asian Nations (ASEAN). A core of Canadian firms is now active in Indonesia, Malaysia, Singapore and Thailand, where Canadian consortia and individual companies have won a number of contracts. While most major projects in China are financed by IFIs such as the World Bank and the Asian Development Bank, there appear to be opportunities in the Chinese provinces for firms that can forge successful alliances with local governments and agencies. India is another country that is seen to offer promising opportunities for Canadian suppliers of environmental technologies and services.

European environmental regulations and standards have become an important trade policy issue. Canadian manufacturing firms interested in doing business in Europe are becoming increasingly aware of the advantages of ISO 14000 certification. This environmental management

quality standard developed through the International Organization for Standardization (ISO) (<http://www.iso.ch/>) is aimed at ensuring that, among other things, firms meet regulatory and other mandatory requirements and act in an environmentally responsible manner. Canadian exporters have reacted well to the ISO 14000 challenge. An increasing number of firms have adopted, or are preparing to adopt the standards, and many consulting firms now offer both registration and training services to assist firms to become certified for ISO 14000. Canadian environmental firms play an important role in helping Canadian exporters satisfy ISO 14000 standards.

IFIs are a significant factor in the market because of their increasing commitment to environmental projects, and their requirement that IFI-financed projects be assessed in terms of their environmental implications. In 1997, the World Bank (<http://www.worldbank.org/>) loaned in excess of US\$11.6 billion to projects targeted at protecting and improving the environment and supporting environmentally sustainable development. While Canada continues to be successful in winning front-end consulting contracts, major capital project contracts remain a major challenge for Canadian firms.

Many Canadian environmental firms have established local partnerships and alliances in order to more effectively pursue business opportunities and bid on major capital project contracts in foreign markets.

3.3 Investment and Financing

The Delphi Group (*An Analysis of Markets*, p. 30) estimates total private R&D investment in Canadian environmental technologies at \$355.1 million for 1996. Environmental technology companies raised equity and new capital in the amount of \$204 million, private corporations (non-environmental) invested \$139 million, while venture capital accounted for the remaining \$12.1 million.

Investment by Canada's environmental companies in the development of new products and technologies has been hampered by a lack of venture or risk capital (James Higgins, "The Environment Industry — The Washington Meeting," *Canadian Perspective on the World Environmental Industry*, Paris: OECD, 1996). This problem is partly due to the structure of the Canadian industry, which is relatively young, and characterized by small companies. Further, uncertainties about the regulatory environment tend to increase the perceived risk to investors. As a result, many environmental companies have difficulty moving their products

**Canadian firms strive
to meet ISO 14000
standards**

**Total private R&D
reached \$355M in 1996**

**Investment shortfall
hampers growth
of firms**

or technologies along the research to commercialization continuum. Small companies must rely largely on their scarce internal resources to bring new products to the point where they can be demonstrated to be effective and are of potential interest to venture capitalists.

As a result, there is concern that lack of financing will lead to the abandonment of useful innovations or their sale to foreign companies. In a survey of environmental companies (The Impact Group, "Challenges for Change," Toronto, April 1996), 41 percent indicated that access to investment capital (or the lack thereof) was an "important" or "very important" barrier to company growth. Only 17 percent of respondents indicated that access to investment capital would not be an important barrier to growth in the future.

The federal government and the environment industry have recognized the need to address problems arising from the lack of venture capital and the limited financial resources of the small firms that predominate in Canada's environment industry. A number of government programs have been established to help fund new technologies (see Annex B). Some of these programs were part of the Canadian Environmental Industry Strategy, which included support for the development and commercialization of promising environmental technologies as one of its three major objectives.

3.4 Human Resources

Ernst & Young (*Human Resources in the Environment Industry*, a detailed report prepared for the Steering Committee of the Environment Industry, Employment and Immigration Canada, Ottawa, March 1993) predicted that the industry would experience shortages of key technical specialists in future years because of the failure to adequately prepare for industry growth and technological change. The Impact Group ("Challenges for Change," Toronto, April 1996) reported that 32 percent of the Canadian environmental companies responded that the availability of technologist/technician skills had indeed acted as an "important" or "very important" barrier to the growth of their company in the past. This figure climbs to 53 percent when "somewhat important" responses are included.

**CCHREI assists
development of human
resources strategies**

In response to the concerns raised by the Ernst & Young report, the Canadian Council for Human Resources in the Environment Industry (CCHREI) was established in 1993. CCHREI is an industry-initiated, industry-led organization whose mission is to ensure an adequate supply of people with the appropriate skills and knowledge to meet the environmental needs of the public and private sectors. CCHREI is developing national occupational standards for

employment in the industry that can serve as the basis for the certification and accreditation of environmental courses and programs. It manages national employment programs designed to encourage young Canadians to enter the environment industry and publishes an annual directory of the environmental courses and programs offered by Canadian post-secondary institutions. CCHREI is currently carrying out a study of human resources in the environment industry sector, to assist industry in developing effective human resources strategies in the future. This study, "Environmental Sectors Data Development Project," will update the 1993 report, "Human Resources in the Environment Industry" of Ernst & Young, and is expected to be published in the fall of 1998.

Michael Porter (Industry, Science and Technology Canada, *Canada at the Crossroads*, Business Council on National Issues, Catalogue No. C2-186/1991-1E, Ottawa, October 1991) has argued that human resources development in Canada suffers from "low levels of industry involvement and cooperation with education institutions; a lack of flexibility among post-secondary institutions; and government policies for post-secondary education that discourage specialization, and the development of relatively costly programs in science, engineering and technology fields." In the environment industry, efforts are being made to address these problems by establishing partnerships between industry, government and academia. Examples include the Waterloo Centre for Groundwater Research, the University of Waterloo Earth Science program and the co-op programs of several other institutions. In keeping with the federal government's focus on youth, a number of opportunities are now available for university and college graduates to obtain skills and hands-on work experience in the environment sector. CCHREI in conjunction with Human Resources Development Canada has developed Environment Youth Internship Canada, Enviroentrepreneurs, and the National Environmental Youth Corps. In conjunction with Environment Canada, CCHREI has created the International Environmental Youth Corps.

**More environment
courses are needed to
train staff and recruits**

4 GROWTH PROSPECTS FOR THE INDUSTRY

4.1 Demand Outlook

Global concern
forces firms to use
environmentally
responsive practices

Growing concerns about resource scarcity, damage to the ecosystem and human health risks are driving the demand for environmental technologies in Canada and abroad. These concerns have given rise to new regulatory requirements and international environmental agreements, but they have also led to direct pressure on firms to implement more environmentally responsive practices.

Increasingly, industrialized economies are shifting toward “eco-efficient” technologies. This trend is likely to be reinforced by the growing public demand for economies to give concrete expression to the concept of sustainable development. The World Business Council for Sustainable Development has identified seven key elements of eco-efficiency: reduce the material intensity of goods and services, reduce the energy intensity of goods and services, reduce toxic dispersion, enhance material recyclability, maximize the sustainable use of renewable resources, extend product durability, and increase the service intensity of goods and services.

Eco-efficiency improves
productivity

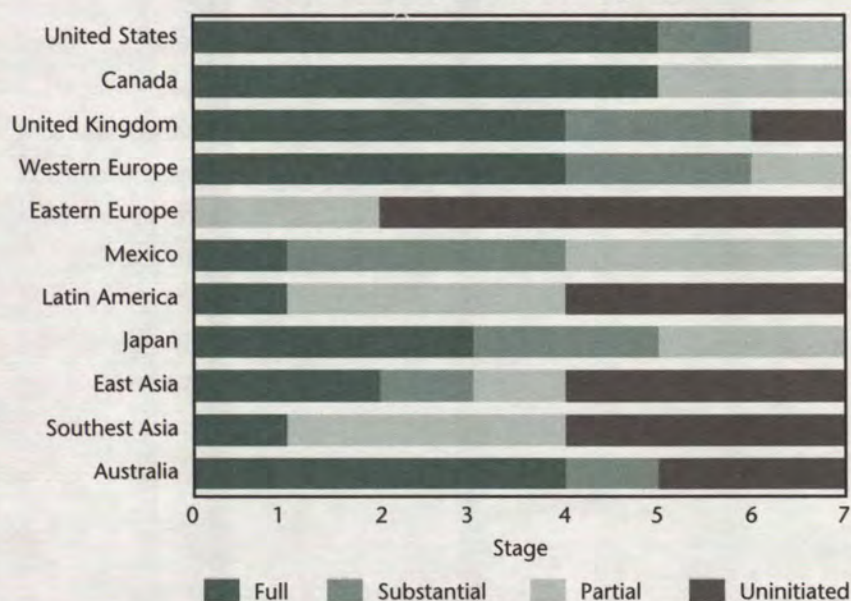
By “producing more from less,” not only do companies minimize environment-related costs but also they may improve overall productivity. Eco-efficiency may assist companies gain market share by compelling them to become more innovative in their business practices and in the goods and services they produce. As businesses strive to become more eco-efficient, the demand for eco-efficient technologies will increase. There will be growing opportunities for innovative Canadian SMEs that can provide environmental technologies and services to satisfy niche market requirements.

According to Environmental Business International (*EBI Report 2000: The Environmental Industry*, San Diego, August 1995, p. 40), nations typically go through seven stages in their evolution toward sustainable development:

- stage 1: public awareness and pressure
- stage 2: government policy stated
- stage 3: legislation enacted
- stage 4: regulations promulgated and agency empowered
- stage 5: enforcement creates market for environmental firms (pollution control, clean-up and waste management)
- stage 6: proactive effort to circumvent regulation and liability (pollution prevention)
- stage 7: internalization and integration of environmental efforts (sustainable development).

Canada is approaching stage 7, characterized by the internalization and integration of environmental efforts (Figure 8); that is, developing a sense of environmental responsibility and putting it into practice through the creation of integrated environmental management systems.

Figure 8. Phases of Environment Industry Evolution toward Sustainable Development



Source: Environmental Business International, *EBI Report 2000: The Environmental Industry* (San Diego: August 1995).

This suggests that Canadian providers specializing in abatement or end-of-pipe technologies will need to increasingly look toward markets outside Canada. It also means that there is likely to be increased demand in Canada for products and services that enable firms to address environmental problems at earlier stages of production and to make environmental management part of the overall production process. Nations at pre-stage 5 levels who have not yet integrated pollution prevention into industrial processes (i.e. countries in eastern Europe, East and Southeast Asia) still have a strong demand for pollution abatement technologies and services. Canadian firms specializing in pollution abatement technologies should give greater attention to the market opportunities in these countries.

The recent agreement among industrialized nations in Kyoto, Japan, to reduce emissions of carbon dioxide and other greenhouse gases by 5.2 percent overall from 1990 levels by 2010 (averaged over the period 2008–2012) means there is likely to be increased demand for technologies and services that reduce energy use and/or facilitate increased use of less carbon-intensive sources of energy such as natural gas, solar and wind power, and biomass.

Canadian firms are poised to meet strong demand abroad for pollution prevention products and services

Kyoto Protocol spreads
awareness of dangers
of greenhouse
gas emissions

Market growth potential is likely to be highest in the energy production and buildings sectors. High-efficiency industrial boilers and motive systems are likely to be another important growth area as manufacturers seek to reduce energy use and related costs.

Under the Kyoto Protocol on Climate Change, developing countries are not required to limit the growth in their greenhouse gas emissions. However, many countries in Latin America and Southeast Asia are beginning to recognize the dangers of becoming too reliant on fossil fuels to meet their future energy needs, which are expected to grow considerably over the next few decades. The energy production and buildings sectors are likely to be the primary sources of demand for new materials and technologies in these countries as well. The Kyoto Protocol includes a new Clean Development Mechanism, which enables companies to obtain "credits" for projects in developing countries that reduce greenhouse gas emissions. Canadian firms may become more active in sponsoring such projects, which ideally would allow them to offset their domestic greenhouse gas emissions and also obtain a favourable return on investment. Emission reduction credits can also be obtained for climate-friendly business ventures in eastern European and the former Soviet Union countries under the Kyoto Protocol's joint implementation provisions.

Market Growth

4–5% market growth
is predicted for
environmental products

The *Environmental Business Journal* has forecasted that the market for environmental products will grow in real terms at an average rate of 4–5 percent in developed countries such as Canada, and at over 10 percent in developing countries. The former is generally consistent with Informetrica's Economic Outlook for Durable and Investment Goods ("National Outlook and Uncertainties," Ottawa, Spring 1996), which includes environmental equipment. Informetrica forecasts growth of 4.8 percent until 2000, followed by growth of only 2.3 percent from 2001 to 2010. Given the limited size and moderate growth prospects of the domestic market for environmental goods and services, the more significant opportunities for Canadian environmental firms are likely to lie in export markets.

Most developing countries are in need of major capital investments to expand and upgrade their infrastructure. These developing nations offer an enormous market opportunity for Canadian expertise. Many of these countries will depend on IFI funding and need to adhere to the strict environmental standards established by the IFI and its funding partners, which include Canada.

4.2 Current Industry Strengths

Market Access

With the implementation of the NAFTA agreement in 1994, Canada has preferential access not only to the large and important U.S. market, but also to the Mexican market, where firms are in the process of adjusting to new, more stringent environmental regulations. The NAFTA also provides a stepping stone for entry into the South American market. Canada signed the Canada-Chile Free Trade Agreement (CCFTA) in February 1997 and currently has Memoranda of Understanding with Chile, Argentina, Brazil and Uruguay. Canadian environmental firms are gradually increasing their activities in South America.

Canada's environmental expertise is recognized internationally, and this can be of significant help to Canadian firms in their competition for export sales. For example, James Higgins ("Global Environmental Industry," *Ecodecision*, January 1994) states that Canada has always enjoyed a reputation as a leader in the fields of environment and sustainable development. Initiatives under the CEIS, such as the International Environmental Management Initiative (IEMI) as well as the Canada Centre for Mineral and Energy Technology (CANMET) and various bilateral and multilateral environmental agreements concluded by the government, all play a role in opening doors to new markets and building on the Canadian industry's international reputation.

Niche Markets

Canadian firms have recognized strengths in such traditional subsectors as water and wastewater treatment systems, handling of liquids and solid wastes, oil spill management and emergency response, instrumentation, and environmental equipment such as incinerators, shredders, compactors and refuse recycling equipment. Many of the products of these subsectors are in heavy demand in emerging markets where there is a need for basic infrastructure such as water treatment and waste disposal plants and systems.

The international market for water treatment, monitoring and consulting services, for example, is growing at almost 8 percent annually and is expected to reach US\$78 billion by the year 2000. Double-digit growth is expected in Southeast Asia, Latin America and Africa.

Recognition of
Canadian expertise
gives firms competitive
edge

Niche market products
are in increasing
demand

A niche marketing approach is also being effectively adopted by a number of Canadian environmental firms offering unique and individualized solutions to problems in a number of industrial sectors, including mining, pulp and paper, resource processing, land and resource planning, and renewable energy generation. Often solutions designed to respond to a very specific Canadian municipal, residential or industrial problem can become commercially viable only through export market penetration. Increasingly, these niche-oriented firms, largely SMEs, are doing the bulk of their business in export markets.

Access to Technology

**Access to public
and private R&D
benefits firms**

The Canadian environment industry benefits from ready access to a number of Centres of Excellence, which link academic and industry researchers. National examples include the NRC and Environment Canada. Additionally, private and public research capabilities and expertise are resident in institutions and academic facilities in almost every province. These resources are extremely important to the many small Canadian environment firms that can undertake only a very limited amount of internal research, but who recognize the importance of innovation to their efforts to remain competitive.

Government Support

**Federal departments
offer strong support**

Government departments such as Industry Canada, Environment Canada, NRCan (<http://www.NRCan.gc.ca>) and the Department of Foreign Affairs and International Trade (DFAIT) (<http://www.dfait-maeci.gc.ca/>) lend strong support to the environment industry. Industry Canada, for example, promotes companies and their capabilities through such multimedia tools as Canadian Environmental Solutions (CES), a CD-ROM/Internet infobase (<http://strategis.ic.gc.ca/ces>); *Strategis*, Industry Canada's comprehensive World Wide Web site (<http://strategis.ic.gc.ca>); the Environment Industry Virtual Office (<http://virtualoffice.ic.gc.ca>); and the Business Environmental Performance Office (BEPO) (<http://virtualoffice.ic.gc.ca/BEPO>). DFAIT provides international market intelligence, while Environment Canada's (<http://www.doe.ca/envhome.html>) labs play a vital role in advancing environmental technology development. Environment Canada established three Canadian Environmental Technology Advancement Centres (CETACs). These centres work with the environmental industry associations, the private sector, and federal and provincial governments and provide technical and business services to small and medium-sized environmental industry firms.

4.3 Competitiveness Challenges

Research and Development

R&D has a critical role in ensuring the future competitiveness of this knowledge-based industry. Canada lags behind other OECD countries in terms of industry-funded R&D partly because of the limited resources of Canada's SMEs. This low level of industry-funded R&D may have a serious impact on the sector's long-term competitiveness. Canadian firms may fall behind technologically if they do not improve on their R&D performance.

**More industry-funded
R&D is required to keep
firms competitive**

Investment/Financing

One of the most serious constraints identified by the Canadian environment industry is the lack of seed money for new product research as well as of venture capital for product development and commercialization. Problems in accessing capital can reduce innovation and impair the industry's ability to take advantage of rapidly growing markets for clean technologies and for new processes that contribute to the achievement of sustainable development objectives. Both the National Research Council's Industrial Research Assistance Program (IRAP) and Industry Canada's Technology Partnerships Canada (TPC) program are initiatives intended to help remedy these problems.

International Experience

Although the Canadian environment industry is highly regarded, Canadian companies are relatively inexperienced in marketing their products and services abroad. The Canadian industry has concentrated on the domestic market and neglected rapidly growing international markets. As a consequence, most Canadian firms are at the bottom of the learning curve in terms of international experience. Canadian firms need to explore the possibilities for using joint ventures, strategic alliances, networks and partnerships to build on their strengths and overcome the limitations of their relatively small size. Through alliances with foreign firms, Canadian companies may gain easier entry into new export markets and also acquire access to foreign technologies and capabilities that they can also apply in the Canadian market.

**Many Canadian firms
lack international
experience**

Human Resources

Despite the efforts of CCHREI, Canada still faces a shortage of workers with the skills required in the environment sector. Canada's situation is similar to that of the U.S. where, according to the *Environmental Business Journal* (June 1995), project managers and sales and marketing managers are the most difficult to recruit, followed by upper management, engineers, compliance specialists, hydrologists and geologists.

Source: CCHREI, 1994.

Further issues identified in Ernst & Young's 1993 study on "Human Resources in the Environment Industry" include:

- the need to develop business management courses that address the specific needs of the environment industry
- the need to work more closely with the academic community to develop programs that will prepare students for working in the environment industry
- the need to develop more comprehensive industry data.

Working closely with Human Resources Development Canada (HRDC), CEIA, Industry Canada and academia, CCHREI is attempting to fill these informational and institutional gaps by developing new training, staffing and certification arrangements.

Offering Full Service

**Bidding on turnkey
packages presents
challenges for most
small firms**

Canadian firms do well at winning contracts when there is a demand for basic environmental planning, institution building, regulatory infrastructure, and monitoring and evaluation. However, the industry has not been as successful in developing the delivery and financing packages for build-operate-transfer (BOT) and build-own-operate-transfer (BOOT) projects. These turnkey packages are often problematic for the Canadian industry because of the prevalence of small firms with limited human and financial resources. Although a few large firms such as Philip Utilities Management are able to provide this type of package, the challenge for most Canadian firms is to build the critical mass through partnering arrangements that will allow them to effectively compete in these markets. In some cases, it will be foreign partners who offer skills, contacts and/or resources that complement the particular strengths Canadian firms bring to the project.

Regulatory Uncertainty

Many venture capitalists have shied away from the environment industry because of the real or perceived uncertainty relating to environmental regulation. As reported in a study by Doyletech Corporation ("The Identification of Concerns of Suppliers of Capital to Environmental Companies," Toronto, 1994), one Ontario investor noted: "I'm not an investor in the environmental market because I'm afraid that a bureaucratic decision could wipe out the investment." This study notes that there is a perception that regulations are proliferating at too rapid a pace and that they are not properly prioritized. Uncertainty translates into increased risk or liability for potential investors, and discourages investment in environmental firms and technologies.

The harmonization of federal and provincial environmental regulations could help reduce this uncertainty. A decrease in federal-provincial duplication and a more simplified overall regulatory approach could also benefit other sectors of the economy. The Ontario Ministry of Environment and Energy, in a review of its own laws and regulations ("Responsive Environmental Protection," Toronto, August 1996) stated that "every dollar industry and municipalities save on the elimination of red tape and obsolete regulations is a dollar to invest in job creation and economic development."

Public-Private Partnerships

Public-private partnerships (PPPs) are beginning to emerge in Canada. The cities of Moncton, New Brunswick, Halifax-Dartmouth, Nova Scotia, and the regions of Peel and York in Ontario have entered into partnerships in which private firms participate in the financing and management of major infrastructure projects. Dartmouth has entered into a public-private partnership for the development of a water treatment plant, and the municipality of Hamilton-Wentworth has teamed with private industry to develop a water and wastewater treatment facility. However, a recent study for the Federation of Canadian Municipalities questions the ability of the Canadian environment industry to respond to the desire of municipalities to contract out activities such as waste disposal and infrastructure maintenance, traditionally performed in-house. The study contends that the Canadian environment industry is structurally underdeveloped compared with foreign rivals and may not be able to respond to the upcoming demand for PPPs. A study by the National Round Table on the Environment and the Economy ("State of the Debate on the Environment and the Economy," Ottawa, 1996) estimates that between \$79 billion and \$90 billion in water infrastructure capital will be required by the year 2015.

If Canadian firms do not address their structural problems, they are likely to miss out on some growing opportunities in the domestic market.

4.4 Future Opportunities

The environment industry is an evolving and dynamic sector. In Canada and other industrialized economies, increasingly stringent government regulations and the pressures on corporations to become environmentally responsible are driving the demand for the equipment and services provided by this industry.

Harmonization of regulations is needed to improve investor confidence

Firms need to increase awareness of industry trends

As noted above, Canadian municipalities are expected to be an important source of market growth in the near future. An instructive example in this area is Agra Inc., a Canadian company that has recently entered into an alliance called Allied Water, with American Anglian Environmental Technologies, an affiliate of American Water Works Co. of the United States. They are seeking contracts with municipalities to finance, develop and operate municipal water and wastewater treatment infrastructure and utility management projects. If Canadian firms acquire the necessary organizational capabilities and financial resources or establish partnerships with other firms that have the needed resources, PPPs could help set the Canadian industry on a strong growth path.

**Domestic privatization
could give firms
experiences they can
later export**

Growth prospects in the water treatment technologies market are particularly promising. The domestic "water" subsector is estimated at \$6 billion in 1995, taking account of private sales, government own-account transactions and relevant engineering and construction activities. While more than half of this is currently undertaken within the public sector and is not part of the industry's existing market, governments are showing increased interest in the possibilities for privatizing infrastructure development and contracting out related environmental activities. Domestic demand in this subsector could expand rapidly in coming years. Success in the domestic market will help Canadian firms win acceptance for their products and services in foreign markets.

The most promising opportunities for Canadian firms, however, are likely to be found in international markets. Global demand in the water treatment subsector, where Canadians have particular expertise, is growing at almost 8 percent per year and is expected to reach US\$78 billion by 2000. There is a rapidly growing demand for a wide range of environmental goods and services in developing countries, many of whom have no domestic environment firms to help local industry comply with newly implemented environmental regulations or to comply with the requirements attached to IFI-financed projects. As a result of assistance provided by CIDA and other Canadian agencies, many developing countries are favourably disposed to Canada and doing business with Canadians.

**Effect of Kyoto Protocol
is uncertain as yet**

The market demand effects of the Kyoto Protocol on Climate Change are uncertain at this time, since most governments are still evaluating policy options, but the climate change issue itself has renewed interest among industrialized economies in developing alternative sources of energy and finding new, more innovative ways to improve energy efficiency. Developing countries have more basic needs and generally will be seeking technologies that have proven track records and can be installed with minimal training and infrastructure requirements.

Many Canadian firms are constrained by their limited size and resources. Joint ventures with foreign firms could help Canadian companies overcome these disadvantages and thereby help reduce the barriers to entry into foreign markets. Joint ventures and strategic alliances with foreign partners allow Canadian firms to capitalize on infrastructure, networks and relationships already in place. Partnerships would also allow smaller Canadian firms to be more competitive in the BOT and BOOT markets, which require substantial financial and organizational resources. As well, partnerships with foreign firms would allow Canadian companies to focus strategically on their key competencies and competitive advantages.

A quality work force is key to creating competitive edges in a knowledge-based economy. There is a need to attract and retain skilled workers and to provide continuing education that offers adequate opportunities for skills upgrading. Skill shortages within the environmental sector work force must be addressed quickly.

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Canadian Environmental Solutions:
<http://strategis.ic.gc.ca/ces>



Business Environmental Performance Office:
<http://virtualoffice.ic.gc.ca/BEPO>

Quality work force is
key to expansion

Annex A

CANADIAN ENVIRONMENTAL INDUSTRY STRATEGY (CEIS)

The Canadian Environmental Industry Strategy (CEIS) (<http://strategis.ic.gc.ca/SSG/ea01121e.html>) announced in September 1994 sunset on March 31, 1998. This package of 22 initiatives was developed following many months of dialogue and consultations with industry representatives, associations, provincial governments and numerous other stakeholders across Canada. The strategy emphasized the need for a strong cooperative effort between the many individuals and organisations in both industry and government to build a major Canadian global presence from the early successes of this important sector. Some of the many activities developed under these initiatives are highlighted below:

The 22 initiatives were organized around three main themes.

I. Delivering federal government support to the industry in a direct, easily accessible, service-oriented and cost-effective way

- Initiative 1: Simplified access to government services
Development of information products, the Environmental Industry Virtual Office (Internet site) and Canadian Environmental Solutions (CES), a CD-ROM
- Initiative 2: Forum of government and provincial ministers of industry and environment
Cancelled

II. Supporting the promising development and commercialization of innovative environmental technologies

- Initiative 3: Environmental technology development and demonstration initiative
Activity undertaken by TPC and CETACs
- Initiative 4: Demonstrating Canadian technology for the international market
Activity undertaken by TPC and CETACs
- Initiative 5: Examination of the certification of products, processes and services
Environmental Technology Verification (ETV) program launched in 1997, MOU signed with California EPA and a cooperative agreement established with USEPA

- Initiative 6: Domestic market development through assistance for SMEs to improve environmental performance

Information product, Business Environmental Performance Office (BEPO), launched September 1997; workshops held included workshops on environmental performance in partnership with Great Lakes Pollution and Prevention Centre, and consulting services offered to SMEs by Niagara College and Orser Environmental Safety

III. Improving access to domestic and global environmental markets for Canadian companies

- Initiative 7: Improved access to business opportunities through international agreements and institutions

Projects were implemented within the framework of various MOUs, including projects in Poland, Romania, Mexico, Brazil, Chile, Argentina, Uruguay, Taiwan, Republic of Korea and China

- Initiative 8: Establishing a national statistical database

Statistics Canada released Environment Industry, 1995, Preliminary Data, June 1997; a second survey covering the years 1996–97 is under way

- Initiative 9: Supporting strategic alliances for export markets

Formation of export consortiums: CanEquip Environmental Services, Ecolombia, North American Environmental Services, CANORA and CENSOL

- Initiative 10: Enhancing environmental market intelligence

Environment sector market report commissioned by DFAIT, support for environmental conferences such as GLOBE, Americana

- Initiative 11: Promoting exports through the international transfer of environmental expertise

International Environmental Management Initiative (IEMI) launched in March 1995; implementation of some 33 projects included energy workshops in Poland, emissions testing in Mexico, water technologies in Turkey, geomatics in Chile

- Initiative 12: Environmental industry expertise in embassies and international organizations

Training, Canadian company site visits for trade commissioners, development of handbooks for trade officers on assistance to environment industry exporters and on environmental technologies.

- Initiative 13: Federal government commitment to green procurement
Development of a computer-based training program "Environment Procurement"; development of the "Green Procurement Reporting Framework"
- Initiative 14: Government practices review
Baseline reviews of existing policies and practices by all departments
- Initiative 15: Enhancing the "Going Green" building program
Over 100 active projects are under way, covering water, energy and "green" renovations
- Initiative 16: Strengthening participation in development assistance programs
Environment and environmental infrastructure are two of the six priorities in the Canadian assistance programs
- Initiative 17: Increasing awareness of federal export support
Canadian Commercial Corporation provides assistance in all phases of international procurement; established better linkages with provincial trade and environment ministries; conducted workshops with CEIA informing members about CCC and EDC
- Initiative 18: Enhancing the involvement of Members of Parliament; partnership with the Canadian environment industry
Forum for "Jobs, the Environment and Sustainable Development," May 1996
- Initiative 19: Establishing an implementation steering committee
Fourteen-member committee established
- Initiative 20: Establishing a sector advisory group for international trade
Cancelled
- Initiative 21: Representation on environmental advisory committees
Cancelled
- Initiative 22: Strengthening chapters of environmental industry associations
Support provided in the development of the Environmental Business Network (EBNET) to link CEIA national and provincial chapters with members and stakeholders

Annex B

GOVERNMENT PROGRAMS

The Environmental Industry Virtual Office is a partnership between all levels of government, academia and the environment industry. It was designed to provide direct client service and interactivity between the client and the partners, and most importantly the programs and services that the partners provide. There are over 100 partners listed in the 10 provincial offices comprising the Environmental Industry Virtual Office. Additionally, there are numerous other departments, organizations and agencies that support and participate in the Virtual Office but are not listed below. Access to the key federal, provincial and industry stakeholders, listed below, and the programs they have available to Canadian industry can be accessed at:

<http://VirtualOffice.ic.gc.ca>

- Alberta Economic Development and Tourism
- Alberta Research Council
- Atlantic Canada Opportunities Agency (ACOA) and its provincial offices
- Canada Economic Development for Quebec Regions (CED)
- Canadian Commercial Corporation (CCC)
- Canadian Council for Human Resources in the Environment Industry (CCHREI)
- Canadian Environment Industry Association (CEIA)
- Canadian Environment Industry Association, British Columbia chapter
- Canadian Environment Industry Association, Ontario chapter
- Canadian Environmental Technology Advancement Corporation-West (CETAC-West) and provincial offices
- Canadian International Development Agency (CIDA)
- City of Montreal
- Crocus Investment Fund
- Department of Economic Development and Tourism (Prince Edward Island)
- Department of Fisheries and Environment (Prince Edward Island)
- Department of Foreign Affairs and International Trade (DFAIT)
- Department of Industry, Commerce, Science and Technology (DICST) (Quebec)
- Department of Industry, Trade and Technology (Newfoundland)
- Department of Industry, Trade and Tourism (Manitoba)
- Economic Development Board (Manitoba)
- Economic Development Edmonton
- Enviro-Accès and provincial offices
- Environment Canada and regional offices
- Environmental Services Association of Alberta (ESAA)
- Grappe de Développement des industries de l'environnement inc.

- Greater Quebec Economic Development Corporation (SPEQM)
- Industry Canada — EAB and its regional staff and International Trade Centres in each province
- InNOVAcorp (Nova Scotia Innovation Corporation)
- Le Centre de recherches industrielles du Québec (CRIQ)
- Le Centre québécois de valorisation de la biomasse (CQVB)
- Manitoba Capital Fund
- Manitoba Environment
- Manitoba Environmental Industries Association (MEIA)
- Ministry of Employment and Investment (British Columbia)
- Ministry of Environment and Energy (Ontario)
- Ministry of Environment Lands and Parks (British Columbia)
- National Research Council (NRC) — Industrial Research Assistance Program (IRAP) and provincial offices
- New Brunswick Department of Environment
- New Brunswick Economic Development and Tourism
- New Brunswick Environment Industry Association (NBEIA)
- Newfoundland Department of Environment and Labour
- Newfoundland Environmental Industry Association (NEIA)
- Nova Scotia Department of the Environment
- Nova Scotia Economic Development and Tourism Department
- Nova Scotia Environmental Industry Association (NSEIA)
- Ontario Centre for Environmental Technology Advancement (OCETA)
- ORTECH Corporation
- Prince Edward Island Environmental Industry Network (PEINET)
- Recycling Council of Ontario
- Réseau environnement
- Saskatchewan Economic and Cooperative Development
- Saskatchewan Environment and Resource Management
- Saskatchewan Research Council
- Saskatchewan Trade and Export Partnership
- Science Council of British Columbia
- Sustainable Development Coordination Unit (Manitoba)
- Union québécoise pour la conservation de la nature (UQCN)
- University of Manitoba
- University of Saskatchewan
- Western Economic Diversification Canada provincial offices

Annex C

ENVIRONMENT INDUSTRY, 1995, PRELIMINARY DATA, TABLES

The lack of a formal industrial classification makes it difficult to identify members of the Canadian environment industry and to ensure that appropriate subsectors are included. Environmental activities are undertaken by firms currently located within a number of existing Statistics Canada *Standard Industrial Classification* (SIC) categories. Under initiative eight of the CEIS, Industry Canada and Statistics Canada undertook to develop needed data through a joint project titled "A National Statistical Database" on the environment industry. The following tables contain preliminary data from a 1995 benchmarking survey (June 1997).

Table C-1. Supply by Industry and Sector, 1995

	Business sales	Business own account	Government	Total domestic production	Imports	Total supply
(\$ millions)						
Producers of equipment and materials:	3 653	—	—	3 653	1 188	4 841
Air pollution control	145	—	—	145	914	1 059
Water supply and purification	59	—	—	59	10	70
Wastewater treatment	473	—	—	473	83	556
Solid waste	323	—	—	323	25	348
Other goods	253	—	—	253	156	408
Wholesaling of scrap materials	2 400	—	—	2 400	—	2 400
Services:	3 780	1 252	4 025	9 057	—	9 057
Air pollution control	39	349	—	388	—	388
Water supply and purification	82	—	1 559	1 641	—	1 641
Wastewater treatment	228	324	878	1 430	—	1 430
Solid waste management	2 125	330	623	3 077	—	3 077
Engineering	747	8	—	756	—	756
Other services	560	240	966	1 765	—	1 765
Construction	1 793	244	811	2 849	—	2 849
Total	9 227	1 496	4 837	15 560	1 188	16 748 ^a

^a This is a minimum estimate of the size of the environment industry.

Source: Statistics Canada, National Accounts and Environment Division, *Environment Industry, 1995, Preliminary Data*, Item 16F0007XPE, Ottawa, June 1997. (Effective February 1998, the National Accounts and Environment Division has become the Environment Statistics Program.)

Table C-2. Employment by Industry and Sector, 1995

	Business sales	Business own account	Government	Total employment
(Number of employees)				
Producers of equipment and materials:	13 322	—	—	13 322
Air pollution control	657	—	—	657
Water supply and purification	269	—	—	269
Wastewater treatment	2 142	—	—	2 142
Solid waste	1 464	—	—	1 464
Other goods	1 145	—	—	1 145
Wholesaling of scrap materials	7 644	—	—	7 644
Services:	31 891	12 230	44 861	88 982
Air pollution control	425	3 823	—	4 248
Water supply and purification	898	—	18 221	19 119
Wastewater treatment	2 494	3 551	10 259	16 304
Solid waste management	13 768	2 138	5 095	21 000
Engineering	8 182	89	—	8 271
Other services	6 124	2 630	11 286	20 040
Construction:	13 038	1 776	5 898	20 711
Total	58 251	14 006	50 758	123 015 ^a
a This is a minium estimate of the size of the environment industry.				
Source: Statistics Canada, National Accounts and Environment Division, Environment Industry, 1995, Preliminary Data, Item 16F0007XPE, Ottawa, June 1997.				

Annex D

INDUSTRY ACRONYMS

ACOA	Atlantic Canada Opportunities Agency
ARET	Accelerated Reduction/Elimination of Toxics
ASEAN	Association of Southeast Asian Nations
BAA	<i>Buy American Act</i>
BEPO	The Canadian Business Environmental Performance Office
BOOT	build-own-operate-transfer
BOT	build-operate-transfer
CANMET	Canada Centre for Mineral and Energy Technology
CCC	Canadian Commercial Corporation
CCFTA	Canada-Chile Free Trade Agreement
CCHREI	Canadian Council for Human Resources in the Environment Industry
CCPA	Canadian Chemical Producers' Association
CEC	Commission of Environmental Cooperation
CED	Canada Economic Development for Quebec Regions
CEIA	Canadian Environment Industry Association
CEIS	Canadian Environmental Industry Strategy
CEPA	<i>Canadian Environmental Protection Act</i>
CES	Canadian Environmental Solutions
CETAC	Canadian Environmental Technology Advancement Centre
CIBS	Canada's International Business Strategy
CIDA	Canadian International Development Agency
CQVB	Le Centre québécois de valorisation de la biomasse
CRIQ	Le Centre de recherche industrielles du Québec
CWWA	Canadian Water and Wastewater Association
DFAIT	Department of Foreign Affairs and International Trade
EAB	Environmental Affairs Branch
EBI	Environmental Business International
EC	Environment Canada
EIS	Environmental Industry Sector
ESAA	Environmental Services Association of Alberta
ESDD	Environmental Sectors Data Development Project
ETV	Environmental Technology Verification Program
GIS	Geographic Information System
IEMI	International Environmental Management Initiative
IFI	international financial institution

IRAP	Industrial Research Assistance Program
ISO	International Organization for Standardization
MEIA	Manitoba Environmental Industries Association
MIACC	Major Industrial Accidents Council of Canada
MISA	Municipal Industrial Strategy for Abatement
NAAEC	North American Agreement on Environmental Cooperation
NAFTA	North American Free Trade Agreement
NBEIA	New Brunswick Environment Industry Association
NEIA	Newfoundland Environmental Industry Association
NRC	National Research Council
NRCAN	Natural Resources Canada
NRTEE	National Round Table on the Environment and the Economy
NSEIA	Nova Scotia Environmental Industry Association
OCETA	Ontario Centre for Environmental Technology Advancement
OECD	Organisation for Economic Co-operation and Development
PEINET	Prince Edward Island Environmental Industry Network
PPP	public-private partnerships
SIC	Standard Industrial Classification
SMEs	small and medium-sized enterprises
SPEQM	Greater Quebec Economic Development Corporation
TPC	Technology Partnerships Canada
UNEP	United Nations Environment Programme
UQCN	Union québécoise pour la conservation de la nature
VO	Virtual Office
WCGR	Waterloo Centre for Groundwater Research
WED	Western Economic Diversification
WTO	World Trade Organization