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Final Draft

An Analysis of Markets for Canadian Environmental Technologies:

Asessing the Impact of Domestic, Global and Market Segment Forces on Investment Decisions

Presented to:

Technology Partnerships Canada

The Delphi Group
September 1997

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Preface

This report has been prepared for Technology Partnerships Canada, and special federal government operating agency which is part of Industry Canada. The report is designed both as an overall review of Canadian and global environmental markets, and, perhaps more importantly, segment by segment analysis for specific environmental markets.

The emphasis of the report is on environmental technology market analysis. The report analyzes demand, supply and financing analysis of environmental technology companie to assist Technology Partnerships Canada identify, source and conduct due diligence on prospective investments in the sector.

The report has been reseached and written by The Delphi Group, one of Canada's leading environmental market research firms with offices in Ottawa, Vancouver and the Greater Toronto Area. The data and information in the report has been obtained through a representative documents review, and interviews with environmental companies and buyers of environmental technologies, goods and services across Canada. Analysis was conducted by The Delphi Group. The findings of the report should not be considered as definitive, empircal conclusions, and should be utilized at the risk of the user.

The Delphi Group
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I. Executive Summary

1.0 Focus of this Report

Canada's global economic competitiveness is, in large measure, dependent on the strength of the country's technological resources. Research and development and commercialization of leading-edge technologies, in key industry sectors, creates the assets that generate new employment and economic growth.

Commodity scarcity, international environmental agreements, human and eco-system health risks, and regulatory regimes are among the factors which are driving demand for environmental technologies in Canada and abroad. The environmental technology industries are part of the group of high-technology sectors which form the foundation of a new Canadian economy.

Environmental technologies cross a number of market segments including: water and wastewater treatment, air emissions control, materials recovery, solid and hazardous waste management and recycling, measurement and instrumentation, remediation and alternative energy and fuels.

The focus of this report is to study the demand and supply dynamics affecting environmental technologies within Canada, and in international markets. The report has been prepared for Technology Partnerships Canada (TPC), a special operating agency of the federal government agency which is a part of Industry Canada. TPC has been designed to enhance wealth creation by investing in research, development, demonstration and market development of technologies in partnership with the private sector.

The report analyzes commercial activity in environmental technology markets, particularly for major market segments. Market growth and activity trends are also projected. The report highlights investment opportunities for TPC, and identifies factors which could be a part of the due diligence and investment decision-making process.

The report reflects a number of business conditions which are relevant to TPC execution of its mandate.

- ***Scope of the Report:*** Any comprehensive study of environmental technologies should be based on a broader market analysis. However, The Delphi Group has paid particular attention for the need to focus on factors which are specific to the supply and demand of environmental technologies.

- ***Diversified Nature of Environmental Technologies Markets:*** Markets for environmental technologies are quite diverse. Unlike many other industry sectors, environmental industry segments can be quite distinct from each other, and often intersect with other areas of commercial activity. For the purpose of this report, the following definition of environmental technologies has been employed.

> **Definition: Environmental Technologies**
>
> "Environmental technologies are industrial and infrastructure goods which are wholly or partially in demand as a consequence of regulatory and/ or market forces which enhance environmental protection. In many instances, environmental technologies will also produce various other benefits of an economic or social nature."
>
> *The Delphi Group, 1997*

- ***Investment-Driven:*** The report emphasizes information and analysis which is pertinent to investment decision-making in Canadian environmental technologies.

1.1 Research and Consultative Methodology

The report has been produced through the following methodology.

A. ***Review of Market Intelligence:*** A wide range of market intelligence documents and sources were reviewed in detail. These include: quantitative market surveys, market segment studies and industry reports produced in Canada, the US, Europe, Asia and Latin America.

B. ***Analysis of Delphi's Database and Proprietary Information:*** The Delphi Group possesses a substantial body of market information in its in-house database about environmental technology market forces and trends, and specific market transactions (i.e. financing, investment performance, market expansion strategies). Much of this market intelligence has been amassed for the production of *Environmental Business Canada*, a quarterly newsletter on the environmental sector which will start publication in the fall 1997.

C. ***Key Informant Interviews:*** The Delphi Group consulted with over 30 Key Informants including leaders in Canada's environmental industry and corporate buyers of environmental technologies. Key Informants were solicited for their views of market trends and associated implications for business prospects in the sector.

D. ***Analysis of Environmental Technology Performance:*** The Delphi Group studied how Canadian environmental technology companies have performed in terms of bottom line and share/investment performance, and globally against firms from other countries in export markets.

Market intelligence compiled by the research activities of the study, were analyzed internally by The Delphi Group, its staff and advisors.

1.2 Report Structure and Organization

The report is organized in the following fashion.

- The remainder of the first section is a summary of the major findings of the study including domestic and global market forces and trends, Canada's competitive position and comparative advantage in environmental technologies, and investment opportunities and strategy options available to TPC.
- Section II delves into specific domestic market forces and trends in Canada which are influencing demand and supply of environmental technologies.
- Section III explores the forces which are affecting global demand for environmental technologies.

- Section IV is an in-depth assessment of market activity, technology demand, competitiveness and issues which are pertinent to investment decisions

- Section V sets out investment opportunities available to TPC in the view of The Delphi Group

- Section V identifies factors that TPC may wish to incorporate into portfolio management of the environmental technology sector.

1.3 Major Domestic and Global Market Forces

The report has highlighted a number of Domestic Market Forces which are influence and shape environmental technology markets in Canada. These forces include the following.

- **Industrial Markets Drivers**
  - Compliance and Liability Provisions
  - Pollution Prevention
  - Eco-Efficiency and Commodity Demand
  - International Expansion of Resource Industry Companies
  - Ontario Hydro Developments
  - Toxics Release Inventory
  - ISO 14,000
  - Voluntary Initiatives, Agreements and Covenants

- **Infrastructure Developments and Trends**
  - The Infrastructure 'Gap"
  - Water and Sewage Markets
  - Other Infrastructure Markets

- **Regulatory and Policy Measures**
  - The Canadian Environmental Protection Act (CEPA)
  - Packaging Protocol
  - Air Quality regulations and Smog Plans
  - Site Remediation
  - Climate Change Convention

- **Human and Eco-System Health Drivers**

- Environment and Human Health Concerns
- Home Purchasing Decisions
- Workplace Health Issues
- The NIMBY Phenomenon

Global markets are influenced by many of the factors present in the Canadian economy. In addition, there are other market forces that are prominent in export markets.

- ❑ **Industrial Development and Technology Requirements**
  - US Market Growth and Trading Relationships
  - Industrial Growth of Emerging and Newly Industrialized Markets
  - Eco-Efficiency and Materials recovery
  - A Need to Know about Environmental Impacts
- ❑ **Regulatory Regimes and Compliance**
- ❑ **Infrastructure Expansion and Technology Requirements**
- ❑ **International Agreements, Conventions and Programs**
  - International Agreements
  - Trading Block Implications
- ❑ **The Role of International Financial Institutions**
- ❑ **Urban Environmental Markets**

1.4 Strategic Options for TPC

TPC has a number of Strategic Options available to strengthen its presence, deal flow and investments in environmental technology companies. Key Strategic Options covered include the following.

- ❑ Determining Environmental Technology "Families" to Monitor.
- ❑ Determining Specific Environmental Technology Solutions to Consider Investing in.
- ❑ Positioning TPC in the Environmental Technology Financing Market
- ❑ Proactively Sourcing Investment
- ❑ Additional Due Diligence Factors to Introduce

II. Domestic Market Forces and Trends

2.0 Overview

Domestic demand for environmental technologies is an outgrowth of several market drivers. The nature of these market forces affect demand for specific technologies, or groups of technologies, in dramatically different ways.

Domestic market demand for environmental technologies in the recent past has been very mixed. Some forces are pushing demand higher, and others are lessening pressures for expenditure, particularly on the part of industry, on environmental technologies. Market momentum for environmental action (driven largely by consumer attitudes and legislation) peaked in the late 1980s and early 1990s (around the time of the federal government's Green Plan).

For the past five years, traditional remediation and waste markets have been relatively static. Growth has been clearly towards technologies which: have a strong economic and environmental basis (i.e. eco-efficiency); help prevent pollution, particularly of toxic substances that are hard to manage and dispose of; and, have a strong cost competitive advantage in regulatory driven markets.

There is, though, clear evidence that environmental technology markets are becoming more bullish. A number of diverse market forces are at play which will drive an overall increase in demand for environmental technologies. Demand for technologies will increase significantly to the extent to which they respond to market forces.

2.1 Industrial Market Drivers

2.1.0 Compliance and Liability Provisions

Concerns over compliance and liability continue to be the major driver for environmental technology purchases and investments on the part of private corporations. The annual *Canadian Environmental Management Survey 1996*, administered by the consulting firm KPMG (*Source: KPMG*), shows that regulatory compliance and director/officer liability continue to maintain the first and second positions in terms of importance of environmental issues faced by Canadian corporations.

Corporate regulatory and liability concerns reflect certain interests. Firstly, ensuring the a corporation's image includes environmental responsibility. Secondly, compliance is seen as a non-revenue producing activity, and thus there is pressure to reduce related costs. Thirdly, potential culpability of directors and officers in cases of environmental negligence.

These factors can be expected to affect environmental technology demand in a two ways.

1. Continued demand for technologies which help corporations meet environmental standards, especially those which control the release of hazardous pollutants.

2. A greater corporate interest in front-of-the-pipe environmental technologies which are perceived to lower the cost of compliance.

2.1.1 Pollution Prevention

Canadian corporations, particularly in the resource extraction and processing, and manufacturing sectors, have moved to embrace pollution prevention as the preferred strategy to deal with environmental issues.

This development is attributable to the value of pollution prevention to re-orient business thinking away from strict compliance and towards more creative ways of meeting, and exceeding, regulatory standards. Companies have also found that pollution prevention tends to better integrate environmental factors into operations, rather than have them treated simply as an add-on. Finally, pollution prevention strategies have yielded enhanced outcomes in terms of environmental performance and community acceptance than traditional management approaches.

The *BC Pollution Prevention Project* (*Source: West Coast Energy*) is one example of newer corporate environmental management practices. Several dozen large and medium-sized BC companies have formed an alliance to cooperatively find ways of improving environmental performance through pollution prevention. The effort in BC is mirrored in most major resource and manufacturing industries including: the automotive manufacturing, chemicals production (i.e. the *Responsible Care* program), and metals processing industries.

The impact of pollution prevention strategies is beginning to have an impact on environmental technology demand.

1. Traditional remediation markets (e.g. soil) are in recession as more effective pollution prevention techniques reduce the amount of pollution generated.

2. Greater emphasis is being placed on process technologies which, in and of themselves, may not be considered as environmental technologies (since they also often have efficiency benefits), but do yield environmental gains. This has meant that information technologies (to manage and integrate process systems), measurement and monitoring technologies, and a diverse set of technologies relevant to closed-loop systems are in ascendance.

3. Pollution prevention is starting to do what economists have argued needs to be done - waste is being valued as a resource. Technologies which utilize waste products to create secondary products are being devised.

4. Technologies which promote the substitution of benign products for existing toxic or hazardous substances/waste in the production process are highly valued.

It should be noted that pollution prevention practices are relatively new - arising over the past five years. The full impact of the development has yet to be felt in environmental technology markets for a couple of reasons. Firstly, corporations must run through the cycle of capital stock replacement and will tend to upgrade major processes and technologies when existing stock is either fully amortized or is unproductive. Secondly, there is demand for a variety of environmental technologies which prevent pollution, but have either yet to be devised, or are currently uneconomic. This said, pollution prevention will have a powerful impact on environmental technology demand, but will do so over a long period (i.e. 10-15 years) of time.

2.1.2 Eco-Efficiency and Commodity Demand

The concept of eco-efficiency (actions that produce both economic and environment dividends) is closely related, to pollution prevention. Eco-efficiency is a much studied business phenomenon. The work of the United Nations Environment Programme (UNEP), Industry and Environment Activity Centre, has highlighted eco-efficiency initiatives (also known as cleaner production) around the world. UNEP has convincingly demonstrated that eco-efficiency is a major competitive advantage for business (*Source: Cleaner Production Worldwide*) through environmental technology innovations such as:

- Waste Reduction in Elecroplating,

- Water-Based (versus solvent) Adhesives,
- De-Inking Process for Waste Paper,
- Chrome Recovery and Recycling in the Leather Industry, and
- Recovery of Protein from Potato Starch Effluent.

Eco-efficiency is driving a vast array of innovation in the environmental technology sector. It is the most important industrial factor companies utilizing environmental technologies must consider in the R&D efforts.

Eco-efficiency features which are driving environmental technology demand include:

1. Eco-efficiency is a partially a response to rising commodity prices. Long term price trends for many commodities (especially non-renewable resources such as metals or fossil fuel-generated energy) are increasing. Rising commodity prices make certain technologies more attractive. This is also known as input or process eco-efficiency and makes more efficient use of raw materials in the production process.

2. Output or waste eco-efficiency utilizes technologies which re-use or recycle waste by-products, or recover waste and create secondary markets for these commodities.

An example of eco-efficiency efforts in Canada is the 3M plant in Perth, Ontario, which has led the corporation's commitment to developing new products from waste streams. Adhesive waste by-products are now being sold to a shoe manufacturers as a raw material (*Source: Drivers of Demand for Environmental Products and Services, Environment Canada*).

2.1.3 International Expansion of Resource Industry Companies

The resources sector (mining, forestry, fossil fuels, etc.) continues to drive much of Canada's economy. Companies in these sectors are, though, also aggressively expanding into foreign markets. Canada's mining industry is at the forefront of resources development in regions such as Latin America and the Pacific Rim. The country's natural gas industry has new ventures in the US and Asia.

Other jurisdictions, even developing countries, have demonstrated concern about the environmental impact of resource extraction on communities and eco-systems. In some instances (e.g. Placer Dome in the Philippines), Canadian resources companies have had major projects delayed, or canceled, due to local environmental concerns.

These forces are driving demand for environmental technologies in two ways.

1. Through the 1990s Canadian resource companies have made major improvements to their environmental management practices within the country. The rate of regulatory warnings and charges (*Source: Environment Canada, State of the Environment Report, 1995*) in the resources sector has dropped. All this has led to greater demand for environmental technologies which help resource companies reduce their environmental impact. Families of environmental technologies in demand include: measurement and monitoring devices, tailings control, industrial wastewater treatment, hazardous waste disposal and transport technologies, and eco-efficient processing technologies

2. As Canadian resource companies have expanded into foreign markets they have relied heavily on environmental technologies which have helped them meet regulatory standards and minimize eco-systems damage.

In effect, the resources sector is beginning to view environmental technologies as an aspect of competitive advantage. Demonstrated high environmental standards assists these enterprises to accelerate permitting requirements and gain local approval in new and existing markets. In developing countries this is doubly important since environmentally-responsible projects allow states to access International Financial Institutions (IFI) financing given that environmental impact assessments are required.

Perhaps the best illustration of this resources market development is the leadership role being played by the Canadian companies in the areas of Sustainable Mining and Forestry.

2.1.4 Ontario Hydro Developments

Recent developments in the generation and delivery of energy on the part of Ontario Hydro (Canada's largest utility and largest consumer of fossil fuels) will have a dramatic effect on the demand for environmental technologies in several respects. The issues confronting Ontario Hydro include:

- ***Generating Capacity:*** The closure of up to seven nuclear reactors over the next 2-4 years which will cause power shortfalls, and require that the utility build new generating capacity or purchase power from other Canadian and/or US utilities, or power producers. This situation, coupled with the utility's accumulated debt of over $35 bn, will lead to a sharp increase in

the price of electricity in Ontario, and will have a flowover impact on power prices in the northeast region of North America.

- ***Restructuring:*** The potential breaking up of the utility separating the generating and transmission arms of the company.

- ***Privatization:*** The potential privatization of the utility and opening up of power markets to private producers, foreign competitors and independent power producers. This will increase demand for cost effective emissions control (i.e. NOx, SOx, etc) technologies to reduce the cost of compliance and improve share performance.

The impact of these power market developments on demand for environmental technologies is significant.

1. Ontario Hydro expenditures on air pollution control devices will increase by 20-30% as it fires up dormant or underutilized fossil fuel generating capacity (e.g. Nanticoke). Ontario Hydro will also seek new technologies which are more cost efficient.

2. Demand side management efforts (i.e. energy efficiency) on the part of industrial and retail customers will increase because of price increases and utility promotion efforts. This will increase demand for a very wide range of energy efficiency equipment from industrial boilers and dryers to home energy consumption and conservation devices.

3. There will be a greater push to source competitively renewable energy technologies. These include: wind and solar energy and biomass and micro/mini hydro.

4. A greater reliance on fossil fuel generation (likely under any short to medium term scenario) will release greater amounts of NOx, SO2 and particulates into the atmosphere reducing air quality. General public and governmental concern over the situation, and its impact on human health, will increase demand for industrial air emissions controls, automotive emission controls and alternative fuels.

2.1.6 Toxics Release Inventory

Canada created a *National Pollutants Release Inventory* (NPRI) in 1996 following the National Toxics Inventory lead of the US. The NPRI records a

range of emissions by companies in the country. If the experience of the US is an indication, the NPRI will drive demand for environmental technologies in several ways.

1. The NPRI will facilitate benchmarking of emissions releases between and among companies, notably within an industry sector. This should create some movement towards higher emissions standards in various industrial sectors, and will put a premium on pollution prevention-oriented technologies.

2. The NPRI will focus attention on companies that are laggards in dealing with pollution. This should lead to additional demand for pollution prevention-oriented technologies from buyers which have not been that active in the past.

3. The Inventory, available as it is to the public at large, will bring attention to releases and concentration of very toxic and hazardous substances. Public demand will put pressure on companies to deal with these situations, and will create demand for industrial toxic and hazardous waste treatment and disposal technologies.

2.1.7 ISO 14,000

The International Standards Organization (ISO) has promulgated an environmental management quality standard the 14,000 series. ISO 14,000 is a complement to the ISO 9,000 quality management standard. Corporations have been warm to compliance with the 14,000 standard for a number of reasons. Firstly, it provides a standard benchmark for environmental management. Secondly, it acts as a demonstration of diligence, and thus a defence against liability claims. Thirdly, it provides clarity to organizational efforts. Fourthy, it can be used for marketing purposes to demonstrate environmental responsibility.

While the ISO 14,000 standard is not earth shattering in importance, especially because it continues to emphasize process rather than performance, it is a welcome innovation and promotes environmental management vigilance - thus enhancing demand for environmental technologies.

2.1.8 Voluntary Initiatives, Agreements and Covenants

Canadian corporations have begun actively exploring voluntary actions on pollution for a variety of reasons including corporate responsibility, reduction of compliance costs and industry standards. Dofasco has recently concluded the first voluntary agreement in Canada involving both provincial and federal levels of government. The *Responsible Care* program of the chemical

production industry is an excellent example of voluntary action that may have staved off certain regulatory measures. Certain industries are exploring the merits of binding covenants to reduce pollution.

Voluntary agreements tend to broaden the scope and change the emphasis of corporate environmental action. They give life to pollution prevention efforts that tend not to be found in legislation, and provide greater flexibility about how pollution is reduced. This leads to greater demand for pollution prevention, front-of-the-pipe environmental technologies. It also promotes action in such areas as product stewardship and supply chain management (to reduce environmental impact through the production process).

2.2 Infrastructure Developments and Trends

2.2.0 The Infrastructure "Gap"

The story is straightforward - Canada's infrastructure is aged, and in dire need of replacement. In addition, new infrastructure is required, particularly in growing urban regions such as the Greater Toronto Area, the North and South shore of Montreal and BC's Lower Mainland.

New and refurbished infrastructure is an important driver for environmental technologies for two reasons.

1. Water and sewage infrastructure corresponds to the largest single segment of Canada's environmental industry.

2. Between 6-10% of infrastructure capital requirements, and 3-7% of on-going infrastructure-related expenditures (*Source: Transportation Association of Canada*) are directly related to environmental regulations and environmental conservation. As illustration, airports must build infrastructure and install technologies which manage the disposal of ethylene glycol (used to de-ice planes prior to take-off) to ensure that this chemical does not contaminate ground water, or find its way into municipal sewage systems.

The infrastructure cost for replacement of new roads, bridges, and water and sewage systems renewal is conservatively projected at $240 bn over the next 15 years (*Sources: NRTEE, Transportation Association of Canada*). The lack of infrastructure activity in Canada, especially since the late 1980s, is a major reason for the stagnant, or recessionary, situation many environmental

engineering firms have faced. Demand for environmental engineering services, and the application of technologies in infrastructure, has been flat.

The primary reason for this weak market was that federal, provincial and municipal governments did not, through the 1970s and 1980s, make the fiscal transition from building new infrastructure to maintaining existing infrastructure. In the meantime, rising public debt has reduced the availability of funds for infrastructure renewal.

The market is beginning to undergo a profound change.

- ***Privatization:*** Some public infrastructure is being privatized (often under community ownership). For example, airports throughout the country which are now experiencing a construction boom financed primarily through user fees and permit revenue.

- ***Public-Private Partnership Models:*** Notably in the water and sewage sector, municipalities have begun to develop public-private partnerships with private financing and management firms. Cities such as Moncton, Halifax-Dartmouth and the Regions of Peel and York have struck partnerships which will have private partners finance new infrastructure, and refurbish existing, water and sewage systems.

- ***Appreciation of the Looming Crisis:*** The cost of replacing infrastructure increases the longer it is ignored. Repairing a 60 year old sewer can be 2-4 times as expensive as upgrading a 40 year old pipe (*Source: Canadian Water and Wastewater Association*). The same relationship holds for roads, and especially bridges. Due largely to the clamour from municipalities, governments will address the infrastructure challenge in the first decade of the 21st Century.

2.2.1 Water and Sewage Markets

It is estimated that $79-90 bn in water infrastructure capital will be required by the year 2015 (*Source: State of the Debate of Water and Wastewater Services in Canada, NRTEE*). This will largely be financed by private sector lending to municipal utilities, and repaid through user fees. Canada currently has the next to lowest price for water in the industrialized world (*Source: Urban Water: Environmental Indicator Bulletin, No 94-1, Environment Canada*) since capital costs are not fully assessed to consumers. Thus, Canadians will experience gradual water price increases over the next 15-20 years as the country moves to a full cost (capital and operational) price regime.

Water price rises will have an enormous impact on demand for environmental technologies.

1. Higher prices will drive demand for more water efficient technologies in both industrial and residential markets. For example, the food processing industry in Canada (which largely obtains water and sewage services from municipalities) currently consumes a large amount of water at low, subsidized prices. Anticipating price increase, this industry is beginning to source technologies which can reduce water demand and increases water re-use. This will place a higher premium on certain technologies (e.g. ultra-filtration membrane technologies and reverse osmosis) which have often found industrial markets hard to penetrate

2. Water infrastructure development and renewal financing will drive demand for a host of environmental technologies related to water purification and sewage treatment such as aerators, UV radiation, pumps, enzyme treatment, ozonation, among many others. Due to higher price, water utilities will also move towards purchasing newer, more innovative technologies which have a greater capital cost but also produce a higher life cycle efficiency.

2.2.2 Other Infrastructure Markets

Among other infrastructure markets the principal effect on environmental technologies will come from the modernization and upgrading of ports and airports. A range of technologies to control water, waste and air emissions is required in these facilities.

2.3 Regulatory and Policy Measures

2.2.0 The Canadian Environmental Protection Act (CEPA)

The anticipated promulgation of CEPA in the next year or two will have the effect of driving the private sector pollution prevention initiatives. While, as noted earlier, this trend is already unfolding, CEPA will tend to broaden pollution prevention across industry, and boost industry efforts given the mandatory reporting and public disclosure aspects of the proposed legislation.

2.2.1 Packaging Protocol

The Canadian Council of Ministers of the Environment (CCME) promoted a Packaging Protocol in 1992 requiring that packaging waste contribution to landfills in the year 2000 be 50% that of 1990 levels (*Source: CCME*). While the packaging protocol was initially pursued with some gusto, recent efforts have been half-hearted. Since there is no mandatory regulatory driver for the policy, and solid waste tipping fees have not risen dramatically in the past three years (prices were increased in the early 1990s in several major Canadian cities), the CCME target will not be achieved.

Initial gains came through diversion of packaging waste to recycling streams, and improvement in packaging technology. A range of technologies were introduced which re-used or recycled packaging waste. Canadian markets for these environmental technologies are plateauing and growth will be modest to the end of the decade. Only those technologies which have a demonstrated price advantage, or other eco-efficiency gains will find markets vibrant.

2.2.2 Air Quality Regulations and Smog Plans

Concern over air quality is prompting Canadian governments to take two types of actions. Firstly, BC, reflecting a general West Coast movement towards higher air quality standards, promulgated new legislation which is similar to the more restrictive air measures in California and Oregon. The new BC standards were largely a response to declining air quality in the Lower Mainland, which is projected to worsen as population density rises.

Secondly, the CCME has asked each province to develop plans to control smog. This policy initiative has become a major force for environmental technology markets, particularly in Ontario and BC. Examination of the preliminary Ontario Smog Plan suggests that over the medium to long term (i.e. 5-10 years) one can expect it to have a number of impacts on environmental technology markets.

1. Automotive emissions testing provisions will drive the installation of catalytic converters in clunkers. Tighter controls on diesel-consuming small engines may also be introduced.

2. Governmental and public pressure will prompt automotive manufacturers to re-double their efforts at fuel efficiency (which have been remarkably effective over the past two decades).

3. Alternative fuel and battery technologies will be given a boost through continued (in the case of ethanol) and new tax incentives to the extent that they reduce air pollution.

4. Industries which generate air emissions can expect to have various restrictions placed in them, for example, mandatory shut-downs days during period of smog crisis. This will increase demand for air pollution control technologies.

5. Companies which sell products which produce air emissions (e.g. paints and solvents) will seek out technologies which substitute alternative inputs which are more air-friendly.

2.2.4 Site Remediation

There continues to be a large number of contaminated sites in Canada, owned by both public and private concerns. Federal and provincial legislation in this area is, however, rather weak and major clean-up projects are only being started in response to the presence of specific human and eco-system health risks, and alongside construction development (as a consequence of environmental assessments). There is some light on the horizon if the brownfields (i.e. site remediation to produce a "clean" real estate asset) market grows in Canada, and the recent brownfields development in Cochrane, Alberta through a joint venture between Domtar and Conor Pacific is very interesting.

While some positive noises about site remediation were made in the 1995 CEPA review, there is no legislative driver for site clean-up similar to the Superfund exists in Canada. Soil remediation markets are, therefore, in recession.

2.2.5 Climate Change Convention

A more binding Climate Change agreement is expected at the December Conference of the Parties (COP) meeting in Kyoto, Japan. The new agreement could include mandatory measures to reduce greenhouse gas emissions on the part of countries. While it is difficult to anticipate the outcome of the "dance of climate change negotiations", some features of the potential agreement are emerging.

Firstly, while the agreement will likely be stronger than the current convention any mandatory provisions will not come into force until after 2005, and maybe even until 2010. Secondly, while developing countries will continue to resist making any firm commitments to reduce greenhouse gas emissions until the next COP, they will demand technology transfer inducements from industrialized countries to help them become more energy efficient. Thirdly, the agreement may introduce incentives for countries which develop major energy efficiency or alternative energy technologies. These could range from the creation of a formal global emissions trading market to credits for major innovations. Fourthly,

agreement on a global fossil fuel tax will not reached, however, a consensus may emerge about the conditions which will catalyze another look at a carbon tax mechanism.

The Climate Change agreement will have a major impact on environmental technology markets in several ways.

1. Industry will reinforce its effort at energy efficiency and aggressively explore cutting end use demand for energy.

2. There will likely be a gradual increase in the economic value placed on energy generated from renewable sources in anticipation of Climate Change price impacts on fossil fuels. This will create more active R&D in renewable energy.

3. Investment capital will seek out opportunities in "quantum leap" energy solutions such as battery technologies, high-efficiency Photo voltaics, fusion, ocean thermal and sound wave driven motors. The amount of new capital investing in such technology will be significant, and could exceed $5 bn over the next 5 years.

On the surface, the above trends appear promising for the environmental technology sector should they come to pass. A note of caution is, though, warranted. The impact of the Climate Change agreement will not be felt overnight. Market forces will unfold over a 5-15 year period and depend on the mandatory strength of agreement and new scientific evidence. Indeed, perhaps the largest driver for energy-related environmental technologies will the outstanding economic/share performance of an energy efficiency or alternative energy company that attracted large investments.

2.4 Human and Eco-System Health Drivers

2.4.0 Environment & Human Health Concerns

The *International Environmental Monitor* of Environics International (formerly Synergistics) has tracked public opinion on the environment and sustainable development for the past five years. A recent survey has shown a marked shift in worldwide concern about the environment. Respondents in 24 countries (including Canada, other industrialized and developing countries) ranked environmental risks to their health, and that of their children, as among the highest priority concerns. On average, 94% of respondents perceived that environmental degradation was already harming their health. This finding is not new, however, the high degree of pressing

concern about health risks arising from environmental factors is a recent development. These public concerns about human health risks will affect demand for environmental technologies.

1. Consumers will begin to questions producers about the health risks associated with their products (either through use or in the production process). They will also buy products that can demonstrate that they pose fewer health risks to them. For example, food products which contain pesticides and may disrupt human endocrine systems will be in less demand. This will prompt industry to seek out alternative technologies (including chemical technologies) which are benign to human health.

2. Consumers will want to know more about the environmental impact, and associated health risks, arising out of the production of goods they buy. This will prompt companies to improve their environmental performance through technology application and subscribe to eco-labeling programs. An example of this factor is the recent effort of Northern Telecom to study the life cycle impact of the regular run of the mill phone. This study highlighted that copper used in the telephone circuits sometimes resulted in arsenic poisoning of waterways through the course of the mining and processing system. Northern Telecom has since sought out technologies which allow it to use recycled copper in the phones and plans to position this innovation as a competitive advantage, particularly in European markets.

While the extent and nature of impact that consumer health concerns will have on technology demand is uncertain, the depth and breadth of emotion and public opinion on this matter suggests that it will be a major driver of environmental technology development. The health concerns of Canadian will only reinforce others demands for improved environmental technologies such as smog planning efforts.

2.4.1 Home Purchasing Decisions

Major mortgage companies, like chartered banks, regularly canvass consumer opinion about home purchasing issues. A 1996 survey of the Royal Bank showed that Canadians attached great importance to the environmental safety (or risk) of their home, and the installation of environmentally-friendly devices, only after crime-free neighbourhoods. While interesting, this finding appears to be of limited importance to Canada's environmental technology sector. This conclusion would be incorrect. The construction materials sector had devised a range of environmental beneficial technologies

which are either produced with less environmental impact or improve the environmental performance of the home. The Central Mortgage and Housing Corporation (CMHC) has highlighted many new and innovative construction technologies in its *Green Home.*

Household-oriented environmental technologies include:

- Low Emission Paints,
- Roof Shingles made from Recycled Materials,
- Electro-Static Air Filters, and
- Energy Monitoring Devices.

2.4.2 Workplace Health Issues

Employers are concerned about the environmental health risks encountered by the employees for three reasons. Firstly, the cost of illness and disability. Secondly, potential director and officer liability. Thirdly, employee productivity while on the job. This is a driver for environmental technologies.

There is increasing concern about poor air quality in office buildings, especially the closed seal buildings common to Canada. Newer air control technologies, including UV radiation and ozone purification seek to improve air quality. A recent study of the Environmental Protection Agency (EPA) has found a very strong correlation's between improved air quality and employee productivity.

2.4.3 The NIMBY Phenomenon

The Not in My Backyard (NIMBY) phenomenon continues to be a factor in communities throughout the country. Companies with significant pollution releases encounter significant opposition to proposed new operations, especially through the site approval and environmental assessment process.

Community concern is not misplaced. The recent Hamilton plastics fire released harmful toxics into the atmosphere, and the burnt site is now a dangerous toxic dump of dioxins and furans.

Corporations which embrace pollution prevention and utilize modern environmental technologies are finding NIMBY reactions easier to respond to, and tend to gain site approvals faster.

III. Global Market Forces and Trends

3.0 Overview

In large measure, many of the market forces at play in Canada are also present in global markets for environmental technology. It is important to appreciate the different market dynamics in industrialized in contrast to emerging (or developing) country economies. Most industrialized countries (i.e. G-7 and OECD) mirror the environmental technology supply and demand elements found in Canada.

Emerging countries have a different set of conditions. They tend to display the following market forces (identified in the previous section on Canada's domestic economy) in much the same, or in a more profound, manner as is encountered in Canada.

- Pollution Prevention
- Eco-Efficiency
- Infrastructure Development
- Regulatory Measures and Policies
- Air Quality Concerns
- Human Health Concerns

There are, however, a number of additional market forces that are unique to global markets, and which are influencing global demand for environmental technologies, including exports from Canada.

3.1 Industrial Development and Technology Requirements

3.1.0 US Market Growth and Trading Relationships

The US is Canada's largest export market for environmental technologies much as it is for the rest of the country's economy. The natural inclination of Canadian environmental technology companies to target the US, especially the North East and the North West, has paid handsome dividends.

The expansion of the US economy since the recession of the early 1990s, coupled with NAFTA-induced enhancement of trading relationships should

make the US the export destination of choice for Canada's environmental sector. Canadian technology companies are more often than not cost competitive against their US counterparts. In addition, Section IV cover specific areas of competitive advantage Canadian companies enjoy in export markets by industry segment.

The specific environmental technology markets which are affected by the US markets are very diversified.

3.1.1 Industrial Growth of Emerging & Newly Industrialized Markets

Industrial growth in Asia and Latin America is creating vast new markets for environmental technologies. New capital stock in primary and secondary industries are being built to global standards which require greater attention to environmental impacts than has historically been the case. Average annual growth in Asia ranged from a low of 2.6% in Vietnam to a high of 10.5% in Thailand over the 1980-1993 period (*Source: Environmental Markets Asia 1996-1997, SGS*)

The country of Korea is an illustration. In 1995, the activity of the ten largest purchasers of environmental protection equipment has the following profile.

Company	Expenditures
POSCO (steel)	$ 520 mn
Yukong (oil, petrochemical)	150 mn
Dong Bang Steel	28 mn
Hankyang Chemical	26 mn
Ssangyong Cement	25 mn
Lucky Goldstar (electronics)	24 mn
Incheon Steel	24 mn
Kangwon Industry	18 mn
Hanson Paper	12 mn
Keumyang Industry	11 mn
Total	$ 838 mn

Source: Market Report - Korea: Environmental Industry Team Canada Market Research Centre

The scale of purchases is large, and the industries are largely ones in which Canadian companies have experience in helping address environmental problems. Environmental markets are also growing rapidly year to year. For example: Indonesia (20-25%), Malaysia (12-22%), Taiwan (8-12% (*Source: Environmental Markets Asia 1996-1997, SGS*)

Canadian environmental technology companies have ready markets in newly industrialized and emerging economies. The challenge is to develop the business and financing strategy to seize these business opportunities.

3.1.2 Eco-Efficiency and Materials Recovery

While regulatory drivers are present in export markets (see 3.2), industrial demand is primarily being shaped by a need to promote eco-efficiency and effectively recycle and re-use commodity inputs and valued waste by-products. While this situation mirrors the Canadian domestic market it takes on an added dimension in emerging economies.

Firstly, due to subsidized prices and the lack of market pricing of commodities (notably energy), industries in newly industrialized and emerging economies have not paid particular attention to the efficient use of resources. This is changing rapidly as economies liberalize. Secondly, capital stock is these economies is aged. Therefore, as capital becomes more available substantial investment is being made in new capital stock. This provides industrial companies with inventive to modernize and employ more advanced eco-efficient technologies.

The net effect of this situation, as documented by the UNEP, is that after industrial eco-efficiency initiatives fall second only to major environmental infrastructure development as drivers of the market. There is, therefore, significant demand for eco-efficient environmental technology in sectors of Canadian comparative advantage (e.g. minerals processing, pulp and paper, chemicals and petrochemicals, fertilizer, cement etc.).

3.1.4 A Need to Know About Environment Impacts

A common element to most emerging and newly industrializing economies is that environmental impacts and pollution outputs are not measured or tracked on any regular basis. Mandatory reporting is uncommon, and either random and continuous emissions monitoring is rare.

As a consequence, these economies tend to lack the most basic information about environmental impacts and options. Technologies which provide these solutions is a major Canadian comparative advantage.

- Geomatic and GIS firms can provide leading edge environmental planning solutions. Canadian companies such as ESSA and Water and Earth Sciences are experiencing strong export demand for their software products.

- Laboratory testing and monitoring companies can supply the full gamut of measurement. Novamann International has penetrated the Mexican market effectively

- Instrumentation and control companies help industry monitor and regulate emissions to minimize environmental damage. Cadham Hayes is marketing real-time software to monitor wastewater emissions in countries such as Turkey and Argentina.

3.2 Regulatory Regimes and Compliance

For a number of reasons emerging countries are beginning to introduce and enforce regulatory regimes to protect the environment. This development is quite recent. Many developing states had environmental statutes, but failed to enforce them. International agencies, trading requirements and, above all, local citizens concerned about environmental risks to their health (especially poor air quality) are pressuring governments to create and enforce environmental regulations.

Taiwan has promulgated rigorous environment standards and established harsh penalties for non-compliance. India's central and state pollution control boards have been vigilant in monitoring emissions releases by companies. In the past three month alone, the pollution control boards, with the power of the courts, have literally closed over 4,500 businesses for non-compliance with air regulations.

This type of action is welcome news indeed. The lack of working regulatory regimes has meant demand for environmental technologies in emerging countries has been weak. However, since regulatory enforcement is not widespread in all developing countries (some states like China have weak environmental legislation) it will take some time for command and control driven demand to be a major force in new emerging markets.

3.3 Infrastructure Expansion & Technology Requirements

Newly industrializing and emerging economies have huge unmet infrastructure requirements. Even some industrialized countries (e.g. US, UK) have "gaps" in infrastructure supply. The World Bank projects that the current infrastructure requirements exceeds $3 trillion today.

The market forces at play in infrastructure markets are affecting demand for environmental technologies in much the same fashion as in Canada.

1. Price liberalization and private financing in the water and wastewater sector is driving demand for water infrastructure development. For example, Malaysia has decided to privatize its national waste water system. Malaysia estimated that a national waste water system would cost in excess of US 3.8 billion (M$10 billion) - capital also needed for other infrastructure requirements. In response to a private sector initiative from the Malaysian subsidiary of British utility North West Water, and Malaysia's Berjaya Group, the Malaysian government granted an exclusivity provision for the country. Early in 1993, the newly-formed Indah Water Konsortium was awarded a contract to design, build and operate the Malaysian waste water system.

2. Infrastructure development in roads, bridges, ports and airports increases demand for environmental technologies which reduce air, water and waste emissions from these facilities.

3.4 International Agreements, Conventions and Programs

3.4.0 International Agreements

There are a number of international environmental agreement and conventions. Several formal multi-lateral programs addressing specific ecological issues also exist.

Major International Environmental Agreements/Instruments

UN Convention on the Law of the Sea (UNCLOS)
Global Programme of Action to Protect the Marine Environment from Land-Based Sources of Pollution
Convention on Biological Diversity
Montreal Protocol on Substances that Deplete the Ozone Layer
Framework Convention on Climate Change
Global Environmental Facility

The actual market impact of these international agreement on demand for environmental technologies is mixed. The Montreal Protocol Fund has assisted developing countries acquire alternative-to-CFC technologies such as

solvent substitution. The lack of binding structure to these agreements, however, mean they lack teeth. The Climate Change Convention will, though, have a major impact on demand for environmental technologies over the medium to long term, as discussed previously.

3.4.1 Trading Block Implications

With the inception of the North America Free Trade Agreement (NAFTA), and the potential of adding new countries in the Americas to the agreement, there was the view that environmental standards as they apply to industry will move towards a "lowest common denominator", and this would adversely affect Canadian environmental technology companies. This situation has not materialized.

The environmental market impact of NAFTA has so far been neutral. It is quite possible, however, that over the long term a widening American free trade zone may actually create markets for environmental technologies.

- The US, due in large measure to labour concerns, has been assertive in pushing its existing NAFTA partners, especially Mexico, to meet its environmental standards.

- The US's environmental regime is the most complex and developed in the world. Implicit exportation of this regime across the Americas will create markets for environmental technologies.

- The NAFTA-related environmental agency, the Commission for Environmental Cooperation, has focused attention on poor environmental performance in various jurisdictions. The recently released CEC report on emissions noted that Ontario had the fourth highest rate of pollution among states and provinces in the NAFTA region. This type of activity may drive environmental markets.

3.5 The Role of International Financial Institutions

International Financial Institutions (IFIs) such as the World Bank and its agencies, regional development banks (ADB, IADB, African Development Bank) are having a profound impact on environmental technology markets. Borrowing requirements from these institutions now carry a number of environmental stipulations which are driving demand for environmental technology. Further, IFIs are also active in actual lending for environmental initiatives.

1. The World Bank has created a US$ 300 mn fund for industrial hazardous waste clean-up and prevention in India.

2. The Inter-American Development Bank is financing a number of water and wastewater projects in Latin America such as the Rural and Small City project in Ecuador.

3. The International Finance Corporation is launching an Alternative Energy Fund to seek out equity opportunities in developing countries.

Most of these initiatives encourage private sector driven environmental technology transfer, and lead to the creation of new joint ventures relationships between local and offshore firms.

3.6 Urban Environmental Markets

The term Urban Environmental Management (UEM) is relatively new to the environmental sector and to the management of cities. It has arisen because of a number of factors. First, the increasing importance of large cities, particularly in developing countries, has concentrated concern of environmental problems that occur due to rising urbanization.

Second, from a developmental standpoint, urban management, and associated environmental issues, is becoming of paramount importance to the economies of Asia and Latin America.

Third, it is apparent that many urban environmental issues cannot be dealt with separately - there is a need for an integrated approach. For example, to address air pollution adequately, one must also delve in the issues of urban planning, air monitoring, sustainable transportation, alternative fuels, among others. For these reasons, planners and environmental companies have concluded that the UEM umbrella offers a means to address a host of urban-related environmental problems.

A quote from a new book, jointly published by the World Resources Institute (WRI), The United Nations Environment Programme UNEP), the United Nations Development Programme (UNDP) and the World Bank, entitled: "*World Resources: 1996-97: The Urban Environment*" illustrates the importance of UEM.

> *"..... Urban environmental conditions are important to the health and quality of life of a city's inhabitants and can impose significant costs on economic and social development. The impact of urban areas on the surrounding environment is also an issue of growing concern. More than half of humankind will live in urban areas by the end of the century, and 60 percent by the year 2020. In most nations, cities generate a majority of the economic activity, ultimately consume most of the natural resources, and produce most of the pollution and waste. Thus, urban environmental issues, although often overlooked, are important both locally and on national and global scales ....."*

Urban environmental factors will drive much of the demand for environmental technologies in Asia and Latin America over the next two decades. These markets will source integrated "packages" of technologies that assist them to improve environmental conditions. The lesson for Canadian exporters is to ally with complementary companies in entering new markets.

IV. Technology Markets Review & Competitive Analysis

4.0 Market Overview: Fundamentals, Technologies & Competitive Positioning

Analysis of environmental markets is ideally done on a segment by segment basis. Indeed the larger, somewhat amorphous overall market for environmental technologies consists of a group of smaller, more defined markets.

Given this market reality, each market segment has been analyzed in some detail. Two key points should be made about this analysis.

1. *Market Numbers:* The production of Canadian and global market numbers and growth projections for environmental technologies is not based on exhaustive and complete empirical source data. This is because this type of comprehensive data simply does not exist. Market measurement and projection is based on the analysis of various geographic and segment empirical studies, and Key Informant responses, including:

   - Statistics Canada's 1995 Environmental Industry Survey, Preliminary Data,
   - US Segment Surveys Produced by Environmental Business International,
   - A Study of Canadian Environmental Markets produced by Richard Miller and & Associates Inc. (Norcross, Georgia),
   - US and Global Environmental Market Studies of McIlvaine Company (Northbrook Illinois),
   - Global Environmental Market analyses produced by the GLOBE Foundation of Vancouver,
   - A number of environmental market segment and geographic studies published by the World Bank and its agencies,
   - Publications of the United Nations Development Programme and UNEP,

- Key Informant responses and company activity and performance information, and

- Material from a range of environmental industry publications including Environmental Science and Engineering, Waste Age, US Environmental Market newsletter, The Gallon Report and Recycling Times,

While the approach utilized to generate market figures is not statistically pure, it does have a substantial amount of validity due the corroboration from and cross-checking of multiple sources, and meets the test of investment analysis.

2. ***Distinctness of Market Segments:*** The market segments analyzed are not mutually exclusive - there is some overlap between certain market segments. For example, there may be some overlap in projections for the Industrial Efficiency and Materials Recovery, and Energy Efficiency, Alternative Energy and Fuel Markets. The extent of this overlap is felt to be modes. It does not compromise investment analysis.

The above points made, on the next page is an Summary of Canadian and Global Environmental Markets on a segment by segment basis. The Summary shows total Canadian market size as being $27,074 mn which is substantially higher than the 1995 Statistics Canada Survey of the Canadian Environmental Industry. There are a number of reasons for this differential

1. There is a one year difference between market estimates (i.e. 1996 vs 1995).

2. The Statistics Canada survey does not include a number of market segments notably: R&D, Energy Efficiency, Alternative Energy and Fuels, Construction and Facilities, and Industrial Eco-Efficiency.

3. As a " first time survey" the Statistics Canada survey has likely underestimated the size of the market since some respondents did not, or did not have the information readily available, to respond.

4. Some niche markets (e.g. GIS, Informatics, and infrastructure capital) appear to be underestimated.

When the Market Summary made on the next page is discounted for the above factors, gross market numbers are similar to the Statistics Canada survey.

Schedule 1

Canadian & Global Environmental Markets
Summary of Market Activity

Market Segments	1996 Revenue ($ Millions)			
	CANADA	Annual Growth to 2000	GLOBAL	Annual Growth to 2000
Infrastructure & Industrial Water & Wastewater Markets	$6 630	4%	$380 960	9%
Transportation & Industrial Air Pollution Markets	$1 739	6%	$37 178	10.5%
Industrial Eco-Efficiency Markets (Narrow Definition)	$4 900	8%	$113 000	12%
Municipal & Industrial Waste Markets	$7 405	2%	$175 750	5%
Construction & Facilities Markets	$2 530	4%	$53 130	6%
Measurement, Instrumentation & Infomatics Markets	$329	2%	$6 074	3%
Remediation Markets	$215	-3%	$7 095	4%
Energy Efficiency, Alternative Energy & Fuel Markets	$423	5%	$7 255	5%
R&D in Environmental Technologies	$355.1	3%	$13 490	-4%
Non-Specific Engineering & General Services	$2 521	-3%	$60 504	-1%
Total :	$27 047	3%	$854 436	7%

Source: The Delphi Group
Secondary Source: Refer to Segment Schedules

4.1 Water and Wastewater Infrastructure Markets

Market Summary

The municipal infrastructure market segment water and wastewater technologies is the largest single component of the environmental industry. The domestic market has been growing marginally over the past five years, however, market development both in Canada and abroad will be very substantial over the next decade.

Demand & Business Prospects

While market growth is encouraging, business prospects for environmental technology companies supplying water infrastructure markets will depend on a number of factors.

1. Companies will either need to have large scale operations and the capacity to compete in domestic and global markets, or have specific market niches based on proprietary technologies. Small scale companies will find the going tough.

2. Price competition will be fierce, especially as markets liberalize. Technology solutions which are more cost effective will be attractive to the market.

3. The market will increasingly seek out integrated technology solutions rather than sourcing individual components. This will be partly attributable to the emergence of private financing which will result in the adoption of Build, Own Operate type models.

4. In Canada, demand for water conservation and efficiency technologies will grow rapidly as municipalities move towards full cost pricing regimes,

5. Both domestically and internationally buyers will value suppliers which include project financing solutions as part of their technology offerings. Companies would be well advised to

tie-up with project finance brokers and sources of capital.

6. Water infrastructure regulations in all markets are moving towards performance in contrast to process standards. This will tend to foster more technological innovation since operators will not be bound by legislation to a particular technology solution. The trend to regulatory reform will on balance, however, be slow and gradual.

7. There is a move on the part of some municipalities towards UV and ozone treatment of water to reduce reliance on chlorine for purification.

8. Vexing treatment problems include: algae in water and effluent streams (a big public issue), the impact on amonia on fish populations and habitats.

Market Numbers

Market activity in water infrastructure is on the upswing in all markets. Domestic markets will grow at an annual rate of 4%, and global markets at a rate of 9%, until the year 2000. This trend will continue into the next century. On the next page is a detailed set of market figures (note: this includes both infrastructure and industrial markets)

Supply & Competitive Factors

Supply of water and wastewater technologies will be very competitive. Major international competitors include the US, UK, France and Germany. Canadian water technology companies are in a position of technology comparative advantage in such areas as: UV disinfection, biosolids treatment, membrane technologies and application, and advanced oxidation. The sector is price competitive in aerobic and anaerobic wastewater treatment, water ozonation and sludge disposal. Canadian water technology companies are at a distinct disadvantage in large scale project development. US, UK and French companies are better positioned due to the existence of large companies which can help raise capital for major projects.

Schedule 2

Canadian & Global Water Technology Markets

Market Segments	1996 Revenue ($ Millions)			
	CANADA	Annual Growth to 2000	GLOBAL	Annual Growth to 2000
Water Technologies				
Integrated Technologies	60	8%	3 550	10%
Separation Technology	175	3%	9 910	8%
Destruction Technology	90	3%	4 865	8%
Chemical Technology	25	3%	1 700	9%
Delivery Technology	310	5%	20 400	10%
Biosolids Technology	45	4%	1 965	5%
Chemicals	100	4%	6 440	11%
Contract Operations	80	8%	4 520	6%
Water Services				
Consulting	140	8%	8 435	12%
Design Engineering	130	9%	8 700	18%
Maintenance Services, Consulting & Engineering	90	5%	5 130	5%
Instrumentation Technology	30	5%	1 645	7%
Analytical Treatment	25	7%	1 300	5%
Water Treatment	2 410	2%	158 760	9%
Waste Water Treatment	2 920	5%	143 640	7%
Total Water Markets	6 630	4%	380 960	9%

Source: The Delphi Group
Secondary Source: McIlvaine Company Scrubber/Adsorber Markets

Major Technology Platforms

Platform	Profile Company
UV Disinfection	Trojan Technologies
Membrane Technology	Zenon Environmental
Biosolids Treatment	Groupe Serrener
Advanced Oxidation	Hydroxyl Systems
Anaerobic Treatment	ADI Systems
Water Control Systems	Wastewater Centre
Water Info Systems	Thornburn-Penny

Financing Issues

Water infrastructure technology companies are well established. There are a few fair sized (i.e. $50 mn a year + earnings) companies, and a large number of smaller companies (in the range of 10-50 employees). Their equity position relative to most other segments of the industry is good. Share performance of traded companies has been superior to average ROI on Canadian exchanges. These companies are, though, beginning to seek capital for three purposes.

1. International expansion and the establishment of operations in global markets. This is largely for working capital requirements.

2. R&D in new technologies or innovation of existing technology to keep ahead of the market.

3. Project financing to ensure that they can compete against foreign competitors.

Of these, the latter may be the most important to the competitiveness of the sector, and for the promotion of growth.

Technology Investment Opportunities

A number of technology-oriented investment are open to TPC in this market segment.

1. Investment in the development of existing, well-established technology companies for the purpose of reducing the cost and increasing the efficiency of technologies.

2. UV radiation
3. Water ozonation

4. Project financing

4.2 Industrial Water and Wastewater Markets

Market Summary

Market transactions in industrial water market over the past three years has been much more active than municipal infrastructure markets, both in Canada and abroad. Industrial pollution

prevention efforts, eco-efficiency initiatives and regulatory changes, related to specific chemical groups, has driven demand. This trend is expected to continue and become stronger, especially as industries in emerging markets grow and capitalize new capital stock.

Demand & Business Prospects

Market Growth in the sector will be very positive for the environmental technology sector. Demand, however, will be diversified on an industry by industry basis and market features will be dependent on a number of variables.

1. Increasingly, there will be elements to industrial water markets. The first will be the individual technology components (egg. membrane technology). The second will be the technology packaging and application will often have a specific industry focus. To be competitive companies will need to ensure that integrated solutions are being supplied.

2. Rising water and wastewater charges in Canada will increase demand for conservation, reuse and recycling technologies on the part of major water users that currently source water from municipal infrastructure systems. The food products industry, in particular, consisting of 400 plants in Canada, is a major sector which will demand these technologies.

3. Similar to infrastructure markets, industries will increasingly seek out integrated technology solutions rather than sourcing individual components. This is because of greater outsourcing of operational environmental functions.

4. Industries will place a premium on new technologies which can address separation of toxic and hazardous pollutants from waste streams. The specific elements will vary by industry.

5. At this point supplier financing is not an issue in industrial markets, however, this may change for larger projects in new facilities.

6. Technologies of a monitoring and information nature are in demand because industries are moving to better reporting of releases and also need to identify liability situations to a greater extent than in the past.

7. Industrial water solutions are in major demand in Eastern, Western and Central Europe.

8. The automotive and manufacturing industries are seeking wastewater treatment technologies which: de-grease, de-oil, remove metals and balance ph.

Market Numbers

Market activity in industrial water is on the upswing. Domestic markets will grow at an annual rate of 4%, and global markets at a rate of 9%, until the year 2000. This trend will continue into the next century. Market numbers are on a previous page (note: these include water infrastructure markets).

Supply & Competitive Factors

Supply of water technologies to industry will depend largely on technological advantages and company/industry relationships. Price will be somewhat less important. Companies are placing greater value on environmental technology companies which can demonstrate that their products will meet the pollution prevention and treatment standards required.

Competition in this sector is fragmented - it will vary by industry or chemical class. Industries are as apt to choose a US versus a Canadian technology. Proven effectiveness, especially, in cases of particularly nasty pollutants will win in most instances. Canadian comparative advantages include: instrumentation and monitoring, remote sensing, membrane and ultra-filtration, and industrial application strengths in pulp and paper, minerals processing, fermentation, petro-chemicals and manufacturing. US, German, Swiss and

Japanese technology companies are stronger in the sectors of light manufacturing, chemicals, food processing (though not for the US industry), dyes and intermediaries, pharmaceuticals, fertilizers and sugar.

Major Technology Platforms

Platform	Profile Company
Membrane Technology	Zenon Environmental
Biological Nutrients	Stanley Associated
Anaerobic Treatment	ADI Systems
Ion Exchange	Eco-Tec
Wet Air Oxidation	kenox
Advanced Oxidation	Hydroxyl Systems
Anaerobic Treatment	ADI Systems

Financing Issues

Financing issues for this segment are similar to the water infrastructure markets. Additional factors include the following.

1. R&D to introduce new technologies, particularly for the treatment of certain chemical agents in specific industrial situations.

2. Commercialization and international expansion of measurement, instrument, monitoring and remote sensing technologies.

3. Strategic alliances with global agents and partners to create a presence in growing global industrial markets.

Technology Investment Opportunities

A number of technology-oriented investments are open to TPC in this market segment.

1. Closed-loop technologies in the resource processing and manufacturing sectors.

2. Transfer of European water conservation technologies for the food processing sector. This could also gain access for Canadian companies to US markets.

3. Membrane and ultra-filtration applications to specific industries.

4. Microbes for treatment of secondary wastewater.

4.3 Transport Oriented Air Pollution Markets

Market Summary

Transportation air markets will be driven by domestic and global concern for local air quality, and may be impacted by the Climate Change convention. Markets have been growing at a steady rate driven, in fair measure, by the solid automotive market over the past five years. Significant growth will be dependent on the degree of command and control action or consumer pinion with respect to Smog, and the strength of the mandatory elements of the Climate Change convention.

Demand & Business Prospects

A number of factors will affect demand for air pollution control technologies related to markets.

1. The US Clean Air Act has been a major driver for air quality improvement. If the US government continues to introduce new clean air measures this will tend to benefit the industry.

2. Innovation in car design by the automotive sector in North America has a major impact on air markets during the past decade. While this was partially due to their interest in fuel efficiency to compete with imports it has increased demand for catalytic converters and other control devices. It is likely that growth in this market will moderate and begin to plateau in North America. The growth markets in emerging economies in Latin America and Asia offer enormous potential, and aggressive expansion into these markets is a good strategy.

3. Rising concern oven human health risks from smog will increase pressure for governments to set stricter air quality standards, and will increase demand for air pollution control technologies. The recent move to have

mandatory automobile emissions testing in Ontario and BC will create more demand for technologies.

4. Natural gas conversion tends to be limited to high mileage vehicles such as taxis and buses. This market is becoming saturated in Canada, but some potential exists for conversion in the US. Global markets are fertile.

5. Market forces in the air quality area intersect with alternative fuels and battery technologies. This is dealt with in section 4.11.

Market Numbers

Market activity has risen steadily in most segments of the transport-oriented air emissions market. On the next page is a chart of market figures (note: this includes industry and energy-related market projections).

Supply and Competitive Factors

Canadian technology companies are fairly strong in the transport-related air pollution market, particularly in the automotive manufacturing sector.

Canadian air technology companies have a competitive advantage in the area of catalytic converters. US suppliers are more competitive in the supply of vapour recovery units.

Major Technology Platforms

Platform	Profile Company
Catalytic Converters	Engine Control
NGV Systems	Yugo-Tech
Gas Incineration Systems	Bovar Environmental

Financing Issues

There is limited capital activity in the air pollution technology market. Canadian companies are doing reasonably well primarily due to their access to the large US market.

Technology Investment Opportunities

Financing requirements for this sector are currently modest, however, they should grow if command and control measures related to Smog and Climate Change are introduced. Financing needs in this situation include the following.

Schedule 3

Canadian & Global Air Pollution Control Technology Markets

Market Segments	1996 Revenue ($ Millions)			
	CANADA	Annual Growth to 2000	GLOBAL	Annual Growth to 2000
Particulate Systems				
Fabric Filter Systems & Bags	174	4%	4 037	9%
Electrostatic Precipitators	202	5%	5 602	10%
Gas Treatment Systems				
FGD System & Parts	119	4%	3 864	12%
NOx Control Systems	84	6%	2 346	14%
Scrubber & Adsorber Systems	197	3%	4 960	14%
Thermal Incineration Systems	69	3%	1 863	12%
Transport Related Technologies				
Catalytic Converters	580	6%	6 230	9%
NGV Systems	40	5%	700	7%
Vapour Recovery Units	20	2%	400	13%
Other Air Equipment & Services				
Air Consulting	118	6%	4 002	8%
CEMs & Stack Testing	104	4%	3 174	6%
Indoor Air Technologies	32	7%		
Total Air Markets	1 739	6%	37 178	10.5%

Source: The Delphi Group
Secondary Source: McIlvaine Company Scrubber/Adsorber Markets

1. Domestic development of Remote, high-tech, real-time air emission monitoring and controlling systems.
2. Export of catalytic converters technologies.
3. Export of natural gas conversion technologies.

4.4 Industrial and Energy Oriented Air Pollution Markets

Market Summary

Industrial and energy-related air pollution markets have not experienced the growth that was projected through the first half of the 1990s. Domestic markets struggled and most export markets grew gradually. The exception to this situation was the US where markets boomed. In 1995 the Environmental Business Journal reported clean air technologies activity of $3.7 bn, 24 times larger than Canadian markets. Markets over the next five years appear much more positive due to a number of demand factors.

Demand & Business Prospects

A number of factors will increase demand for air pollution control technologies related to industrial activity and energy generation.

1. The de-commissioning of nuclear plants in Ontario will mean greater demand for a range of thermal power generation technologies. Ontario Hydro is the largest spender in the sector. In 1995 it spent $460 mn on air pollution control equipment.

2. Rising concern over human health risks are similar to the situation to transport-related emissions.

3. Global markets are growing, and will continue to grow substantially largely because of industrial growth, tightening of regulatory controls and the installation of more fuel generating capacity in the energy sector.

4. Indoor air technologies will be in greater demand in Canada, primarily due to an aging population which is more concerned about their health and is at higher risk for respiratory illness.

5. In Canada the pulp and paper and minerals processing sectors have increased their demand for air pollution control technologies. Regulations to lower levels of Total Reduced

Sulphur (TRS) in the P&P sector is increasing demand. Steel companies such as Dofasco are taking voluntary action to reduce a range of emissions including: benzene, hydrogen sulphide, and ammonia.

6. The US market continues to be very promising as numerous new rules and regulations associated with the Clean Air Act create markets for air pollution technologies.

7. Odour and dust control in air emissions is becoming more important to industry and regulations, and communities adjascent to plants, demand better sir quality.

8. Automotive and manufacturing facilities (e.g. white goods) are seeking cost effective technologies which reduce VOCs releases from painting and surface finishing.

9. The Pulp and Paper industry, and the thermal energy sector, is actively seeking, and will pay a premium for, air or process technologies which eliminate PM 2.5 from air emissions. This problem is particularly present in Canada's 47 kraft mills.

Market Numbers

Market activity is rising gradually in most segments of the air pollution technologies market. Major new markets are arising globally, notably the newly industrializing countries of Asia and Latin America. On a previous page is a chart of market figures (note: this includes transportation-related market projections).

Supply and Competitive Factors

Canadian technology companies are under-represented in the air pollution market globally, and imports represent a high proportion of domestic market activity.

Canadian air technology companies have a competitive advantage in the areas of air emissions monitoring, gas and thermal incineration controls, and particulates. Air pollution companies in Canada are particularly strong in serving the pulp

and paper, energy generation and minerals processing industries meet their regulatory requirements.

Canadian companies tend to be less competitive in such areas as Flue Gas De-Sulpherization (FGD), thermal and catalytic fume incinerators and scrubber and adsorbers.

Major Technology Platforms

Platform	Profile Company
Air Monitoring	RWDI
Filters & Dust Collectors	Albarrie Canada
Gas Incineration Systems	Bovar Environmental
Indoor Air Sanitization	FirstAir Technology
VOC Control	Chemetics Intern.
Indoor Duct Systems	Engineering Dynamics

Financing Issues

There is limited capital activity in the air pollution technology market. Canadian companies are doing reasonably well primarily due to their access to the large US market.

Technology Investment Opportunities

Canada's strength in air emission monitoring and intimate knowledge of certain industries highlights financing opportunities.

1. Remote, high-tech, real-time air emission monitoring and controlling systems.
2. Indoor air quality systems.
3. Gas and thermal based control systems.
4. Mechanisms and Filters which remove PM 2.5
5. COs Control
6. More economical NOx, particulates and SOx controls
7. New low emissions paint and surface coatings technologies
8. Replacement of cleaning solvents (e.g. 111 trichloroehtylene) with more benign substances.

4.5 Industrial Eco-Efficiency: Process Technologies & Materials Recovery Markets

Market Summary

Industrial eco-efficiency: process technology and materials recovery offer the greatest potential for environmental technology markets. The strong economic gains these applications provide other industries will drive demand for a diverse range of environmental technologies. In some instances, these technologies may be marketed as a specific industry-focused (e.g. for the steel sector) and/or an efficiency technology. They have been included in the analysis because in most instances the environmental benefits of these technologies are a major decision factor of purchasers, and often is the basis for the efficiency returns due to such things as the reduced cost of compliance.

Demand & Business Prospects

The Industrial Efficiency market has rapidly grown through the 1990s, and will boom over the next decade. The demand features of the market segment include:

1. A major focus will be on the efficient use of energy and water. In both industrialized and emerging countries price liberalization of these commodities will prompt industries to aggressively seek out solutions.

2. The global energy picture, (beyond price) will gradually evolve to have a major demand impact on efficiency markets. The implications of the Climate Change agreement, and other factors will have an impact on demand.

3. Overall, gradually rising commodity pricing will lead to an increase in the value being placed on materials recovery. Companies are actively looking for new proprietary technologies, especially in the case of metals, and expensive compounds.

4. Pollution prevention interests in closed-loop systems means that there is great demand for cost-effective technologies which can recovery

toxic and hazardous materials within the production process, notably if the chemicals/metals can be re-used. In Canada and the US this demand is being driven by the pollutant registries. A movement to enforce existing and strike new environmental regulations will drive markets in emerging economies.

5. Companies are open to allocating capital to eco-efficiency technologies. There is, however, some caution to spending capital because of two factors. Firstly, the demonstrated effectiveness of newer or even older technologies is often questioned. Environmental technology companies have not been effective in providing economic performance assurance to customers. Secondly, companies tend to expect a rather high internal rate of return for equity allocations. Technology companies must, therefore, demonstrate the full economic benefits of their products.

Market Numbers

Industrial eco-efficiency markets are very hard to quantify. There is no central source of market activity data for this market segment. The diversified nature of technologies and industries make it very difficult to aggregate market activity. It is possible to track the technology and market factors for specific transactions. On the next page is an example of a number of Canadian eco-efficiency technologies and their associated markets. Further, some estimate has also been made for domestic and global markets for industrial eco-efficiency. Both narrow and broad markets are estimated. Narrow markets are ones where demand forces would not be present is environmental benefits were not produced. Broad markets opportunities yield environmental benefits as a side benefit of economically-driven efficiency technologies.

Supply and Competitive Factors

Industrial eco-supply dynamics tend to have two types of technologies: ones which involve some competition and others which are technology-distinct (i.e. the technology is unique enough to create the market).

Schedule 4
Process Technologies & Materials Recovery Markets

Process Technology	Company	Product or Outcome	North American Estimate (1996-1997)
Microwave Process	EWMC	Carbon Black	$ 700 mn
Wood Waste Resin	Canfibre	MDF	$ 350 mn
Wet Mill Filtration	Chrysotile	Asbestos Long Fibre	$ 420 mn
Iron Plasma Process	Philip	Iron, Zinc, Lead	$ 60 mn
Carpet Recycling	Ford-Dupont	Engine Air Cleaner Housings	$ 75 mn
Municipal Solid Waste	LEX	Extruded Products	$ 20 mn
PET	Plastic Recycler	Numerous Plastic Products	$ 1.4 bn

Schedule 5
Canadian & Global Industrial Eco-Efficiency, Process Technologies & Materials Recovery Markets

Market Segments	1996 Revenue ($ Millions)			
	CANADA	Annual Growth to 2000	GLOBAL	Annual Growth to 2000
Narrow Definition: Technologies which could not be in demand if environmental benefits were not present	$4 900	8%	$11 300	12%
Broad Definition: Includes Narrow Definition. Technologies which produce some environmental benefits which are secondary functions in demand decision.	$88 200	4%	$203 000	9%

Source: The Delphi Group

Canadian companies are competitive in a wide range of eco-efficiency technologies. Major eco-efficiency strengths include areas such as: wood waste, mining recycling, steel technologies, and solid waste. US, German and Swiss environmental companies are more competitive in the high-tech, manufacturing, chemicals, and food processing sectors.

Major Technology Platforms

Platform	Profile Company
Wastewater Separation	Zenon
Wood Waste Recycling	Canfibre
Steel Processing	Dynamotive
Agricultural Processes	Agritek
Electric Arc Furnaces	Goodfellow

Financing Issues

The industrial eco-efficiency area is a segment requiring a large amount of investment. Technology development and demonstration is costly, and requires patient capital. It is estimated that at there is an annual appetite for a minimum of $230 mn in global investment.

Technology Investment Opportunities

Specific technology investment opportunities for TPC include the following.

1. Minerals recovery in extraction and processing.
2. Any technology which will relate to more efficient water use supplied by municipal systems.
3. Cost-efficient technologies for the recovery, disposal and transport of toxic and hazardous waste substances, including medical waste.
4. Re-mining waste by-product (e.g. tailings, wood chips) of extracted resources.
5. Materials recovery, for resale on the secondary markets (e.g. on the Chicago Recyclable's Exchange), of commodities in short supply (PET, Carbon Black, CFCs). This will have a strong global markets orientation.

6. Technologies which help Canada's high-tech sectors reduce the environmental impacts of their products through eco-efficiency. For example, Northern Telecom's interests in using recycled copper (versus virgin) in it's circuit boards.

7. Cost effective solutions for recovering basic oxygen ferrous (BOF - which traps zinc elements) for re-use.

8. Technologies which recover zinc from EAF dust (comprised of 30-40% zinc)

4.6 Municipal Solid Waste and Recycling Markets

Market Summary

Municipal solid waste and recycling markets are in a state of major transformation. Domestic growth in the market has been relatively flat, and for some segments declining, especially in terms of technology. The Canadian market is characterized by a large number of equipment manufacturing and distribution firms which utilize proven waste management technologies.

The market is going through a period of consolidation as evidenced by mergers and acquisitions. Global markets show more growth, but the lack of effective market (i.e. price) mechanisms will mean that growth will also be moderate.

Demand & Business Prospects

Demand conditions include the following:

1. Diversion of solid waste into recycling markets continues to catalyze interest in technologies which can convert this waste into competitive secondary products. It is felt, though, that this market is starting to flatten out.

2. Overall increase in the amount of solid waste is rising by 1-1.5%, however, this is having minimal impact on technology demand.

3. There is some demand for innovative recycling technologies such as composting, however, the low price for these technologies, and associated services, doesn't tend to justify investment.

4. Fine paper recycling demand in North America will drive demand for technologies in this area, especially if technologies for mini-mills can be made cost-effective.

5. Demand for major recycled commodities fluctuates. Certain commodities such as PET, Copper, White Ledger Paper and Red Brass continue to do well. Prices for mixed Office Bales and Steel Cans are flat.
6. Demand may rise in the sector when municipal landfill supply begins to become short in major urban centres. There is a bit of "ignoring the problem in the hope it will go away" in regions such as the Greater Toronto Area.

Market Numbers

Market growth is relatively flat, and there are some bright lights and low lights. The market numbers on the next page include measurement of industrial solid and hazardous waste markets.

Supply and Competitive Factors

This market segment is very competitive with price being a major issue. Solid waste is moving to becoming a true North American market, especially with the flurry of merger and acquisition activity. Philips Services of Hamilton has been particularly active in the acquisitions area. Laidlaw sold its waste systems to Allied Waste Industries which has emerged as a dominate player in the market, along with WMX, BFI, United Waste Republic Industries and Eastern Environmental Services. Philips has taken a "service" rather than a "waste" orientation to the market is going, likely a barometer of where things are going.

This market activity greatly influences technology demand. Canadian technology and equipment companies will need to "hitch their horse" to strategic relationships of these relatively well-financed conglomerates to be more competitive. It is the large waste companies which will move

Schedule 6

Canadian & Global Municipal Waste & Industrial Markets

Market Segments	Estimated 1996 Revenue ($ Millions)			
	CANADA	Annual Growth to 2000	GLOBAL	Annual Growth to 2000
Waste Technologies				
Hazardous Waste Tech.	220	5%	20 240	8%
Organic Waste Tech.	35	1%	2 590	3%
Solid Waste Treatment	340	0%	25 840	3%
Recycling Tech.	110	2%	9 350	4%
Solid Waste Management				
Hazardous Waste Tech.	1 230	5%	93 480	6%
Solid Waste Treatment	3 070	1%	24 250	4%
Wholesaling of Scrap Metals	2 400	2%	233 350	6%
Total Waste & Industrial Markets	7 405	2%	409 100	5%

Source: The Delphi Group
Secondary Source: Waste Age, EBJ, Statistics Canada, Recycling News

aggressively into, and be competitive in, foreign markets as the millennium ends. Rationale waste pricing in emerging markets will likely be a consequence of a number of converging forces including: higher per capita GDP, rising urbanization, growing middle classes and a need for additional private investment in solid waste infrastructure.

Major Technology Platforms

Platform	Profile Company
Landfill Design	Conestoga-Rovers
Shredding Technology	Shred-Tech

Financing Issues

Financing in this market segment is closely related to cash flow. There is less longer term investment capital in this area. Short term financing is preferable as a risk mitigation strategy.

Technology Investment Opportunities

There are a few investment opportunities for TPC in the market.

1. MRF Facilities in emerging markets
2. Cost effective solid waste diversion technologies creating secondary products
3. Fine paper recycling mini-mills
4. Garbage and leave de-baggers
5. Curbside compaction technologies for recyclables

4.7 Industrial Solid, Hazardous & Toxic Waste Markets

Market Summary

This market segment has been growing steadily in North America, and is about to grow rapidly in emerging and newly industrializing countries. The primary focus has been on hazardous waste particularly for chemicals and substances which are hazardous or toxic. The market has a strong price dimension generally, but in the case of particularly difficult and dangerous chemicals and substances, the quality of the technology is given a higher premium.

Demand & Business Prospects

Demand in this sector is quite evident in both industrialized and emerging markets.

1. Industrial waste generators are very concerned about the cost of waste disposal. Industry has taken major efforts, where price drivers are prominent (i.e. dumping prices reflect full cost), to divert solid waste away from landfills.

2. The ICI (i.e. Industrial, Commercial, Institutional) solid waste market is primarily serviced by private operators in North America. It is also a price competitive market. Even with this situation, however, landfills are often operated by municipalities with subsidized tipping fees.

3. Industry focus over the 1990s has been on the cost of toxic and hazardous waste treatment. Costs have risen due to a number of factors. a) restrictions on the use of incineration in some jurisdictions, b) More stringent regulations on the transport and disposal of substances, c) Increased insurance and liability costs associated with hazardous and toxic waste, d) the strong emphasis the US regulatory regime has placed on hazardous and toxic waste management, due to rising public concern, and e) the due diligence of financial institutions which aren't keen (or charge a high price) for lending to corporation with major hazardous and toxic waste problems.

4. Corporations are, therefore, actively seeking out technologies which can minimize the actual waste of hazardous and toxic waste, or ones which reduce disposal costs (the exception being substances like dioxin which industry will pay a high premium to dispose of).

5. Demand in global market is being driven by increased regulatory controls, IFI lending practices, importation of US standards, public outcry due to major disasters (e.g. Bhopal), greater court-based enforcement, and rising concern of the middle class about their health.

6. One segment where the market is bullish is the disposal of medical waste which the public is concerned about. Some provinces do not allow the incineration of medical waste because of the potential harm of such things as dioxin emissions. Cost effective non-incineration based medical waste technologies are in demand.

7. Industry is demanding "fail-safe" industrial waste systems which have 2-3 signals in case of variation from standard allowable emissions rates. They don't want to miss a "release" problem.

Market Numbers

Market growth is steady in domestic markets, and growing faster abroad. The market numbers on a previous page include measurement of municipal solid waste and recycling markets.

Supply and Factors

Market supply forces vary depending on specific market situations.

1. The ICI solid waste market normally consists of 2-3 major haulers, and several dozen smaller haulers in any urban North American markets. Competition tends to be price and service quality based.

2. Technology is most important in the hazardous and toxic waste area. Supply here tends to be quite concentrated in any given region due to the requirement for major capital investment, short and long distance hauling capacity, or specific technological advantages.

3. US companies tend to have much more competitive technologies in this market segment than Canadian firms. The Superfund driver in the US has created enormous demand in the US for hazardous and toxic waste treatment.

4. Canadian technology advantages tend to be in specific industries or for certain chemical classes such as PCB destruction, chlorine and phosphate control. The major Canadian strength in this area is in system and facilities design.

Major Technology Platforms

Platform	Profile Company
Mobile Waste Tech.	TriWaste
Waste Incineration	Chem-Security
Cyanide Destruction	INCO

Financing Issues

There is demand for capital in this market segment from Canadian companies. It tends to be focused on technologies which provide solutions to specific industrial waste problems.

Technology Investment Opportunities

Specific technology investment opportunities include the following.

1. PCB Destruction
2. Dioxins and Furans Destruction
3. Cost-Effective Hazardous and Toxic Sludge Treatment
4. Special Analytical Technologies to Assess the Level of Toxins in Material Content on a Real-Time Basis

4.8 Construction, Facilities & Infrastructure Markets

Market Summary

The construction, facilities and infrastructure markets are not generally seen as an area of "environmental" technology. However, the innovation in these sectors has seen an emergence of technologies which produce clear environmental benefits in many instances, or a point of marketing due to buyer interest. While some end buyers may be homeowners the actual market transactions occur between a series of industrial or institutional companies. This market segment intersects with other market segments such as alternative energy and air pollution, however, the nature of business activity is best appreciated from viewing transactions from a "build and development" perspective.

The construction/environmental market is being driven by: lower cost for recycled materials, consumer (industrial and resident) demand for healthy indoor environments, and more effective testing of facility operations.

Demand & Business Prospects

The following features characterize the market.

1. Corporations are becoming more concerned about the impact of working environments on workers. Superior indoor air quality, good ventilation, effective lighting (both in terms of energy efficiency and minimal eye strain on staff), noise control and risk exposure to hazardous substances are goals for many corporations. Digital, Newbridge and Northern Telecom all have facility development programs which promote the use of more environmental-friendly construction materials in plants and office buildings.

2. The widespread recycling and reuse of materials has created a cost-effective supply of feed stock for construction materials through the application of technology. Recycled materials are often lower in price than virgin stock leading to good demand for a range of products. Companies are using: waste oil products to produce a very high quality roofing tile, lumber waste to produce MDF, and PETs and other solid waste inputs to manufacturer number of extruded building products.

3. Sensing, measurement and information technologies are being used to improve the operation of facilities. This includes innovations such as the "smart building" (hard coaxial cable wired system with sensors for remote, or computerized, of indoor environments. Testing methods such as infrared technologies are being employed to assess the long-term performance of glazing technologies.

4. In terms of facility infrastructure, environmental technologies play a role in

minimizing the environmental impact during both the construction and operating phases. In large part, this aspect of the market has been driven by environmental assessment requirements, and lending provisions, of new real estate development. For certain facilities (e.g. industrial parks) demand is a consequence of a number of environmental regulations of emissions.

Market Numbers

The market appears to be coming out of a period of slack activity. Infrastructure and real estate development is driving demand in all segments of the market. The market numbers on the next page reflect estimated Canadian market activity. Comparable global data has not been found.

Supply and Competitive Factors

This can be both a price and technology competitive market segment. Price competition is a factor in the urban infrastructure segment. Several dozen engineering firms, which are competitive against foreign competitors, provide technology in this area. Technological advantages are more important in the building envelope and indoor air environment segments. Technological advantages do, though, need to capitalized and commercialized rapidly since R&D appears to be active. This is largely a North American market at this time. Exports to other markets have great potential, though, growth will be modest. One of the major benefits of technology in this area is the large job multiplier.

Major Technology Platforms

Platform	Profile Companies
Sewer Pipe Reconditioning	Re-Con Calgary
Waste in Asphalt	Novacor
Waste in Roofing Materials	Syntec

Schedule 7

Canadian & Global Construction, Facilities & Infrastructure Markets

Market Segments	Estimated 1996 Revenue ($ Millions)			
	CANADA	Annual Growth to 2000	GLOBAL	Annual Growth to 2000
Technologies				
Building Envelope Technologies	$44	3%		
Indoor Environment Technologies	$45	6%		
Repair Technologies	$60	0.06		
Urban Infrastructure Technologies	$132	3%		
Services				
Design & Planning	$349	4%		
Construction & Engineering (related to environment)	$1 900	3%		
Total Construction, Facilities & Infrastructure Markets	$2 530	3.5%	$53 130	6%

Source: The Delphi Group
Secondary Source: NRC, Statistics Canada, TAC, Industry Canada.

Financing Issues

The financing emphasis in this segment is on R&D. Innovation is a major driver of price and/or technological advantage. Some capital is being placed by larger, non-environmental companies whose operating units have developed a technology. Smaller companies, whose technologies carry significant potential, are also present in the market segment.

Technology Investment Opportunities

A wide range of investment opportunities are open to TPC in this area. Some attractive ones to explore include the following.

1. Technologies to reduce water pipe corrosion.
2. Waste materials in building materials including, claddings and roofing.
3. Ventilation and air quality improvement technologies.

4.9 Measurement, Instrumentation & Informatics Markets

Market Summary

Optimistic growth projections have been made for this market segment over the past decade. Reality has, though, been much more modest.

Measurement (i.e. Laboratory Testing and Analysis) of market activity has been characterized by a slightly shrinking market. Instrumentation has experienced a slow but steady growth. Informatics markets have yet to fulfill their predicted potential, though, there are portents that the market is about to emerge in significant ways.

Demand & Business Prospects

The following demand factors are present in these markets.

1. The measurement market has been subject to peaks and valleys over the past decade. The introduction of various regulations in the 1980s lead to an sharp increase in demand. As the market settled down, and price forces came into play, there was a slight recession which led to smaller players exiting the market. Bad news has been compounded recently as governments have reduced public expenditures in this area. This has led to some mergers and acquisitions as firms seek economies of scale and market clout. Technology development in this market has been more positive, and newer measurement technologies have been a large reason for increased price competition in the sector.

2. The instrumentation market has experienced greater demand for public bodies and resource/manufacturing companies due to compliance requirements, and an emphasis on information to manage risk. Instrumentation technologies are also being applied in production systems to control waste and emissions.

3. The diverse informatics market, including: remote and integrated sensing, and analytical, modeling and management software has bumped along through the 1990s. The growth experienced in other markets has not been mirrored in environmental applications. Companies have not bought into the need for sophisticated and integrated environmental software. This is clearly changing. Software companies are starting to prove the economic and technological effectiveness of their products. It would be unwise to say that this segment is poised for takeoff, however, significant growth appears likely.

4. GIS (Geographic Information Systems) is a hybrid technology family which falls within this market segment. There are a wide number of applications for GIS including a number of environmental uses such as resource management, emission monitoring, and land use planning. Canadian GIS demand has been flat and is expected to decline. However, Canadian companies have built up a strong competitive advantage, in terms of both price and quality, in this market, and have been aggressively entering foreign markets. One feature of Canadian competitive advantage is the expansion of the country's resource sector into foreign markets, and their tendency to utilize proven technology companies they know.

Market Numbers

The market is anchored by the laboratory testing and GIS segments. Software, remote sensing and other technologies are more modest in size. Growth, overall, in Canada will be flat to 2000.

Global markets are more promising. A presentation of market numbers is found on the next page.

Supply and Competitive Factors

Competition in market segment vary. The laboratory testing market is very price competitive, and ruthlessly so over the past few years, forcing some firms to leave the sector or be merged with others. This competition has tended to be an in-Canada factor, though some larger US companies got into the game by purchasing Canadian subsidiaries. The GIS market is becoming more competitive on a global market as other countries boost their capacity. US and UK firms tend to be the major foreign competitors. Software, remote sensing and instrumentation competition is based, in fair measure, on technology factors. Overall, Canada is a relatively strong competitor in the market segment in global markets.

Major Technology Platforms

Platform	Profile Company
Resource Planning GIS	Lynx Geosystems
Stack Emissions Testing Management Software	Novamann Caribou Systems
Remote Sensing	MacDonald Detwiller
Sensors	Campbell Scientific

Financing Issues

Financing is clearly required in this segment based as it is on technology. Capital does, though, need to be of the patient variety. This tends to be a problem. The technology development process in this segment takes between 1-2 years, but it takes an additional 2-4 years for the market to be penetrated. Uptake can be slow even for an effective technology.

Schedule 8

Canadian & Global Measurement, Instrumentation & Infomatics Markets

Market Segments	Estimated 1996 Revenue ($ Millions)			
	CANADA	Annual Growth to 2000	GLOBAL	Annual Growth to 2000
GIS	$117	-2%	$1 875	4%
Laboratory Testing & Analysis	$100	-1%	$2 900	2%
Remote & Integrated Sensing Systems	$47	3%	$179	3%
Modelling, Analytical & Management Software Products	$32	3%	$280	3%
Consulting Services	$33	4%	$840	4%
Total Markets	$329	2%	$6 074	3%

Source: The Delphi Group
Secondary Source: IAETL, Future Technology Surveys, EBJ, Industry Canada.

Technology Investment Opportunities

Some technology investment opportunities in This area include the following.

1. Emissions real-time, sensor-based analytical software.

2. GIS platforms which can integrate environmental, emissions, and land use information with other data through a flexible relational database.

3. Technologies which reduce the cost of testing of toxic and hazardous substances in-situ, in remote sites.

4. More sophisticated sensors which can be programmed remotely to track various chemical substances in water or air streams.

4.10 Remediation Markets

Market Summary

Rosy days were predicted for remediation markets in the early 1990s. A series of public initiatives were launched as part of the Green Plan, and there was rising awareness that public lands had to be cleaned-up. It was also expected that there would be a "halo effect" from the Superfund legislation in the US. Over the last three years, however, projections have not materialized, and the market situation is different than expected.

Demand & Business Prospects

Demand factors include the following.

1. After initial efforts of the National Contaminated Sites Remediation Program were completed, no new allocation of funds has been made. While pressure is mounting for action, no policy or fiscal pronouncement has been made.

2. Clean-up of contaminated sites on public lands has been one of the sacrifices to the concentration of deficit and debt reduction is the federal and most provincial governments.

3. The private sector is demanding remediation services primarily due to compliance or capital borrowing factors. Drivers for remediation projects include environmental assessment, sale of property, facility expansion and employee/community health concerns.

4. The market may experience a slight blip in the late 1990s as the federal government will take action on a range of site clean-up requirements.

Market Numbers

Market numbers in specific segments of the remediation are unavailable at this time, overall market size is estimated at $215 mn on the next page, with a -3% growth rate.

Schedule 9

Canadian & Global Remediation Markets

Market Segments	Estimated 1996 Revenue ($ Millions)			
	CANADA	Annual Growth to 2000	GLOBAL	Annual Growth to 2000
Bioremediation Air Sparging Underground Storage Tanks Sediment Remediation Soil Vapour Extraction/Thermal Distillation Thermal Desorption	N/A	N/A	N/A	N/A
Total Markets	$215	-3%	$7 095	4%

Source: The Delphi Group
Secondary Source: GLOBE Foundation

Supply and Competitive Factors

Technology plays an important role in remediation. Bioremediation, air sparging, sediment remediation, soil vapour extraction and thermal absorption and distillation are technologies which are applied to various technology solutions. Canadian firms are at a major competitive position to US companies which have fed off the Superfund-driven $15 bn remediation industry in that country. However, US companies have not sought to enter the Canadian market (primarily due to regulatory conditions and approvals) in a big way. It has meant that, apart from niche opportunities, Canadian firms are competing against much larger, better resources and technological competitive firms in markets south of the border. There have been instances, however, where Canadian firms have beaten US companies based on the price competitiveness.

Major Technology Platforms

Platform	Profile Company
Soil Remediation	Gartner Lee
Hydrocarbons Contaminated Soil Remediation	Jacques Whitford
Ground Water Remediation	Waterloo Centre for Groundwater Research

Financing Issues

Financing activity is limited in the market.

Technology Investment Opportunities

Remediation technology R&D is limited in Canada. There are a couple of application-based investment opportunities.

1. Harbour clean-up
2. Airport redevelopment clean-up

4.11 Energy Efficiency, Alternative Energy & Fuel Technologies

Market Summary

The energy efficiency, alternative energy and fuels markets have been on a slow burn in Canada, and warmer in the US and other international markets. Energy efficiency technologies, particularly through the application of energy performance contracting and Demand Side Management (DSM) has been growing steadily in Canada, and is about to grow substantially in export markets.

Alternative or renewable technologies have had a tough go of it in Canada due to poor market conditions (i.e. the lack of a level playing field against utility-based generation), and limited renewable resources (with the exception of hydro power). Globally, renewable energy has great potential is certain markets such as the US and India, however, there has been some setbacks from the growth of the late 1980s and early 1990s.

Demand for alternative fuels such as battery technologies and ethanol/methane appear on the rise in Canada, though, the market has yet to reach the takeoff point. Market hurdles include:

competitive pricing, thorough testing of technologies, mass production and distribution.

Overall, market conditions, and the potential of energy efficiency, alternative energy and fuels should make it an area of major Canadian investment and R&D.

Demand & Business Prospects

A range of market dynamics are influencing the energy market.

1. The potential impact of the Climate Change convention in terms of pricing and technology demand.

2. Energy deregulation in Canada and the US and the move towards decentralized generation, including the associated access of producers to "wheel" power through existing transmission lines.
3. The rising price of electricity, particularly in Ontario, which will drive demand for energy efficiency technologies and lower independent power.

4. Increasing concern about air quality which is already leading to greater demand for alternative fuels and battery technologies.

5. Trends in the automotive manufacturing sector to become more competitive through the application of new, more efficient internal combustion engines, emission controls, and associated technologies.

Market Numbers

Business activity in Canada for this segment is modest, though, growing. The one downside is the renewable energy markets for which Canadian installs are limited. Market activity is summarized on the next page.

Schedule 10

Canadian & Global Energy Efficiency, Alternative Energy & Fuel Technologies

Market Segments	1996 Revenue ($ Millions)			
	CANADA	Annual Growth to 2000	GLOBAL	Annual Growth to 2000
Technologies				
Energy Efficiency Technologies	$71	4%	$920	4%
Battery Technologies	$115	9%	$1 210	7%
Renewable Energies (Solar, Wind, Biomass)	$38	-0.04	$3 340	6%
Services				
Energy Project Development	$38	3%	N/A	N/A
Energy Performance Contracting & DSM	$68	2%	$410	2%
Engineering & Scientific Services	$93	1%	$1 375	N/A
Total Energy Markets	$423	4.5%	$7 255	5%

Source: The Delphi Group
Secondary Source: EBJ; NRCan, CAN WEA, American Council for an Energy Efficient Economy.

Supply and Competitive Factors

Competitive issues are as follows.

1. Canada is competitive in the application of energy efficiency technologies, particularly for northern climates. The competition is based on our systems and applications engineering.

2. Canadian companies are becoming more competitive in energy efficiency technologies, however, the US and European countries, especially the Nordics, tend to lead the pack in this area. Canadian companies are strong in the area of building systems and energy efficiency.

3. Canadian companies are largely not on the radar screen in renewable technologies. With the exception of a few niche products (see Profile Companies below), the Europeans (Swiss, Danish, UK) and the US are far ahead.

4. In the area of alternative fuels and energy, Canada is fairly strong. We have a number of leading edge companies, and the science, engineering and information technology base to build on. This area carries significant potential for the country's environmental technology sector.

Major Technology Platforms

Platform	Profile Company
Hydrogen Fuel Cell	Ballard Power
PV Controls	Statpower
Integrated Micro Renewable Power Systems	Ontario Hydro

Financing Issues

Financing of energy efficiency is more of a project financing nature. This capital market is well developed in the country and largely financed by insurance companies. There is a major need for long term, patient capital related to alternative fuel and energy technologies.

Technology Investment Opportunities

Technology investment opportunities for TPC include the following.

1. Battery based fuel for the automotive sector.

2. Energy efficient building systems

3. Niche renewable energy technologies

4. Ethanol from wood waste

4.12 R&D in Environmental Technologies

Data on R&D investment in the environmental technology sector is limited. The Delphi Group was able to access a number of sources of information regarding investment activity in the sector.

- The three Canadian Environmental Technology Advancement Centres (CETACs) monitor the investment requirements of their clients and track the actual capital placed.
- The Canadian Venture Capital Association identifies the sectors which receive capital from its members on an annual basis.
- Annual reports and, notably, Corporate Environmental Reports, of private, non-environmental, corporations often contain information about decisions to allocate capital to the development of new technological process which have environmental benefits.
- The Delphi Group tracks the share price and capitalization performance of the 98 environmental companies which are listed on Canadian exchanges.
- The Delphi Group also receives regular press release and company announcements from several dozen environmental companies reporting their business development, including capital raising.

Based on the above inputs, The Delphi Group made estimates of the amount of investment on the part of Canadian environmental companies into technology R&D, commercialization and expansion. The total estimate of investment in environmental technology development is $355.1 mn for 1996. An estimated breakdown of investment by industry segment is found on the next page.

This estimate does not factor in R&D being conducted or funded by the public sector in Canada. In addition, there are expenditures by research institutes such as the National Research Council.

Emerging trends in the area of environmental technology R&D include:

1. Consortia research by industry groups to resolve pressing industry-wide environmental problems is on the rise (e.g. Environmental Science and Technology Alliance of Canada),

Schedule 11

Private Research & Development Investment in Canadian Environmental Technologies

Market Segments	Estimated 1996 Investments ($ Millions)			
	Private Corporations (Non-Environmental)	Environmental Technology Companies (Equity & New Capital Raised)	Venture Capital	Total Investment
Water Technologies	5	37	N/A	42
Air Pollution Technologies	21	19	N/A	40
Process Efficiency & Recovery Technologi	38	26	N/A	64
Solid Waste Management Technologies	3	13	N/A	16
Industrial Hazardous Waste Technologies	27	23	N/A	50
Construction Technologies	5	15	N/A	20
Measurement, Instrumentation & Infomatics Technologies	14	24	N/A	38
Alternative Energy & Fuels	22	29	N/A	51
Remediation Technologies	4	18	N/A	22
Allocation Unknown	-	-	12.1	12.1
Total Investment	139	204	12.1	355.1

Source: The Delphi Group
Secondary Source: OCETA, CETAC West, Company Reports & Press Releases, NRC, Canadian Venture Capital Association.

2. It is clear that there is an active amount of industry-government R&D being conducted especially relating to specific sites or pollutants (e.g. CANMET's collaboration to develop PM 2.5 solutions),

3. There is no doubt that Canadian post-secondary institutions are becoming a more important part of environmental technology R&D.

Given the above factors, and the overall public involvement in environmental R&D, the estimate of market activity provided is understated by a significant margin.

This said, the total R&D estimate provided equates to approximately 2.5% of earnings (based on Statistics Canada 1995 data) of environmental technology and equipment. This is a relatively low percentage of R&D investment for a high technology sector.

V. Environmental Technology Investment Opportunities

5.0 Technology "Families" with Strong Market Prospects

The segment by segment analysis of the environmental technology markets identified a number of key technologies which appear to carry strong market prospects. In some instances, these technologies already exist. In others, demand for a new technology solution appears to exist at a certain level of pricing and an associated product/service delivery system.

TPC should regularly monitor demand and supply markets for these types of environmental technologies. Understanding how demand for, and financing of these "families" is unfolding is an important part of TPC's on-going market analysis.

5.1 Demands for Specific Technology Solutions

Industry and infrastructure markets often look for various environmental technologies which provide economic solutions to a specific pollution problem. This type of demand represents: "a ready and waiting market" which is the ideal situation for an environmental technology company. It also reflects a need for technological innovation.

TPC should actively seek out investment opportunities which address pressing pollution problems.

VI. Factors Relevant to TPC Investment Strategy

6.0 Positioning TPC in Environment Technology Financing

To make an impact on market growth and employment creation in the environmental technology sector, TPC needs to better position itself in capital financing activity. Survey results during the project have shown that although there is reasonably good recognition (75% or above) of TPC among environmental technology companies, there is some ambivalence to approaching the agency for a number of reasons.

1. ***Concern about Bureaucracy:*** There is a tendency to lump TPC in with previous technology development support programs such as DSERT, and relate it to tax related mechanisms (e.g. the Scientific Tax Credit). Industry experience is that these measures are very bureaucratic and cumbersome, and often not worth the time and aggravation incurred to obtain support.

2. ***Viewed as a Banker:*** TPC is viewed by the sector as a banker with strict terms and conditions. TPC is not seen as part of a capital raising transaction because of requirements to secure other financing first. While this perception may be unfair given TPC flexibility on recent placements, this view is a fact to consider. Further, TPC is not considered as part of the capital raising transaction, but an adjunct. This tends make TPC less relevant to larger transactions, and more promising environmental technology companies.

3. ***TPC's Venture Profile:*** TPC has rigorous standards for the placement of capital. Investment are tied to project and company performance. However, there is a sense that TPC's standards are too rigid in terms of repayment scheduling. In essence, that TPC's capital is not patient enough. Again, this may be a bit unfair, however, perception is reality. The sector has a great requirement for a public investor which can place capital as part of a transaction, and which can tie repayment to project or company performance over the medium to long term (3-5 years), and not require short term debt retirement upon first-time technology demonstration.

TPC needs to consider how the placement of its capital can be a part of the capital transaction process, and how it can position itself as an active player in

the venture financing of environmental technology companies. This is not too suggest that TPC act as a private investor, rather, it play a key role in reducing risk for a specific part of a larger transaction which involves private investors.

6.1 Proactive Investment Sourcing

Environmental technology investment opportunities are often hidden, even for large transactions. TPC needs to be actively seeking out investment opportunities in the sector. This is, in large measure, attributable to the concentration of SMEs in the environmental industry.

TPC should consider various types of actions to encourage deal flow, and attract larger investment opportunities.

TPC should track the activity of promising environmental technology companies which may be prospective investee enterprises. New companies will emerge regularly.

6.2 Market and Company Due Diligence

Successful and promising environmental technology companies posses many of the attributes present in strong performing enterprises in other knowledge-based sector. TPC needs to minimize risk by investing in strong companies. TPC already conducts a comprehensive due diligence process. Some additional diligence activities would be very helpful to the sector.

TPC should fine tune its due diligence criteria with input from the industry and environmental technology finance specialists.

VII. Closing Summary

TPC Environmental Technology Investment Impact on Employment & Economic Growth

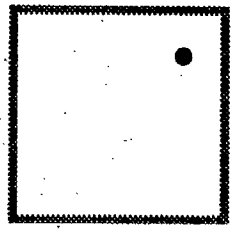
At the end of the day TPC's benefit to the Canadian economy must be measured in terms of employment creation and economic growth. The environmental technology sector has much to contribute on these accounts.

On the employment front, multipliers are high relative to resource industries, and compare very favourably with other knowledge-based sectors. Estimates for direct job impact per million dollars on investment range from 3.6 jobs for remediation markets to 14.0 for energy efficiency. Indirect job impact estimates have not been fully developed but one would expect them to be similar of slightly higher than the aerospace and defence sector.

On the economic growth agenda, as noted earlier in the report, the environmental technology industry is growing at a rate of 3% per annum domestically and 7% globally. Overall, the size of the industry in Canada is estimated from a low of $16.7 bn to a high of $27.0 bn (based largely on narrow or broad perspectives on the industry).

The financing requirements of the industry are such that TPC has an opportunity to make a significant impact on employment creation and economic growth.

The Delphi Group
September 1997



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Appendix "A"
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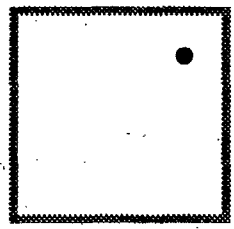

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Appendix "B"

Questionnaire

A Demand and Supply Analysis of Domestic and Export Markets for Canadian Environmental Technologies

1. Which of the following market forces are currently having a major influence on demand for your environmental technologies? In what manner?
   - Price Competitiveness against Competitors ❑
   - Pricing Regimes of Raw Inputs (water, energy) ❑
   - Technological Innovation of Competitors ❑
   - Financing of Purchases ❑
   - Supply Availability of Technology Products ❑
   - Capital Requirements for Technology Innovation ❑
   - Other/s ❑

2. Which of the following market forces do you expect to have a major influence on demand for your environmental technologies over the next three years? In what manner?
   - Price Competitiveness against Competitors ❑
   - Pricing Regimes of Raw Inputs (water, energy) ❑
   - Technological Innovation of Competitors ❑
   - Financing of Purchases ❑
   - Supply Availability of Technology Products ❑

- Capital Requirements for Technology Innovation ❑
- Infrastructure Development (Water, Roads, etc.) ❑
- Other/s ❑

3. Which of the following global or regional economic, political or environmental forces are expected to have a significant on demand for your technologies? In what manner?
   - Global Climate Change Convention ❑
   - Smog Reduction Efforts in N.A. ❑
   - Toxic Release Inventory ❑
   - CEPA ❑
   - Restrictions of Trans-Boundary Waste Transfers ❑
   - Other/s ❑

4. Which among the following factors are your customers emphasizing in their technology purchasing decisions?
   - More Operationally Efficient Technologies ❑
   - Cheaper Priced Technologies ❑
   - Technologies Required to Meet Higher Standards ❑
   - More Rapid Installation of Technologies ❑

5. What do you estimate the demand reduction or growth for your technologies to be over the next three years?
   - Reduction of more than 10% ❑
   - Reduction of 5-10% ❑
   - Reduction of)-5% ❑
   - Even Situation ❑
   - Growth of 0-5% ❑
   - Growth of 5-10% ❑
   - Growth of more than 15% ❑

6. What is the current and projected future (within three years) mix of your technology sales between domestic and export markets?

	Domestic	Export
Current	• _____ •	• _____ •
Projected	• _____ •	• _____ •

7. What is the ratio of your technology vs services product cost structure?

- Technology • _____ •
- Services • _____ •

8. Which are your targeted export markets, in order of priority?

- United States ❑
- Western Europe ❑
- Central and Eastern Europe ❑
- Mexico & Central America ❑
- Latin America ❑
- South East Asia (ASEAN Region) ❑
- Japan ❑
- South Asia (Indian sub-continent) ❑
- Middle East ❑
- Russia and former Soviet Republics ❑

9. Which do you believe are the major pollution concerns/interests for Canadian industry today in order of priority?

- Effluent Treatment ❑
- Closed Loop/Re-Use Water Systems ❑
- Metals Recovery ❑
- Soil Remediation ❑
- Process Technologies for Pollution Prevention ❑
- Remote or Real Time Measurement/Monitoring ❑
- Bio-Technological Treatment of Waste/s ❑
- Air Emissions Reduction/Control ❑
- Indoor Air Quality Improvement ❑
- Toxic Treatment and Disposal ❑
- Solid Waste Disposal ❑
- Other/s ❑

10. Which do you believe are the major pollution concerns/interests for Canadian industry within three years in order of priority?

- Effluent Treatment ❑
- Closed Loop/Re-Use Water Systems ❑
- Metals Recovery ❑

- Soil Remediation ❑
- Process Technologies for Pollution Prevention ❑
- Remote or Real Time Measurement/Monitoring ❑
- Bio-Technological Treatment of Waste/s ❑
- Air Emissions Reduction/Control ❑
- Indoor Air Quality Improvement ❑
- Toxic Treatment and Disposal ❑
- Solid Waste Disposal ❑
- Other/s ❑

11. What importance do your attach to infrastructure markets as a growth driver for your technologies in Canada and abroad? How?

12. What technology R&D priorities does your company have? Why?

13. Are the following barriers to your R&D and commercialization efforts relevant? How and why?

- Speed of Innovation ❑
- Need for Stronger Strategic Alliances ❑
- R&D Financing ❑
- Commercialization Financing ❑
- Financing of Product Sales ❑
- Demonstration of Technology ❑
- Lack of Domestic Market Base ❑
- Other/s ❑

14. What are the competitive advantages or disadvantages of your products in export markets, or against foreign firms operating in Canada?

- Price ❑
- Rapid Availability of Product ❑
- Operating Efficiency of Technology ❑
- Effectiveness of Technology ❑
- Life Span of Technology ❑
- Technology Servicing Capacity and Upgrades ❑
- Demonstrated Performance ❑
- Other/s ❑

15. Other Comments?