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Environmental Careers Organization



Canadian Environmental Sector Trends

LABOUR MARKET STUDY

2010

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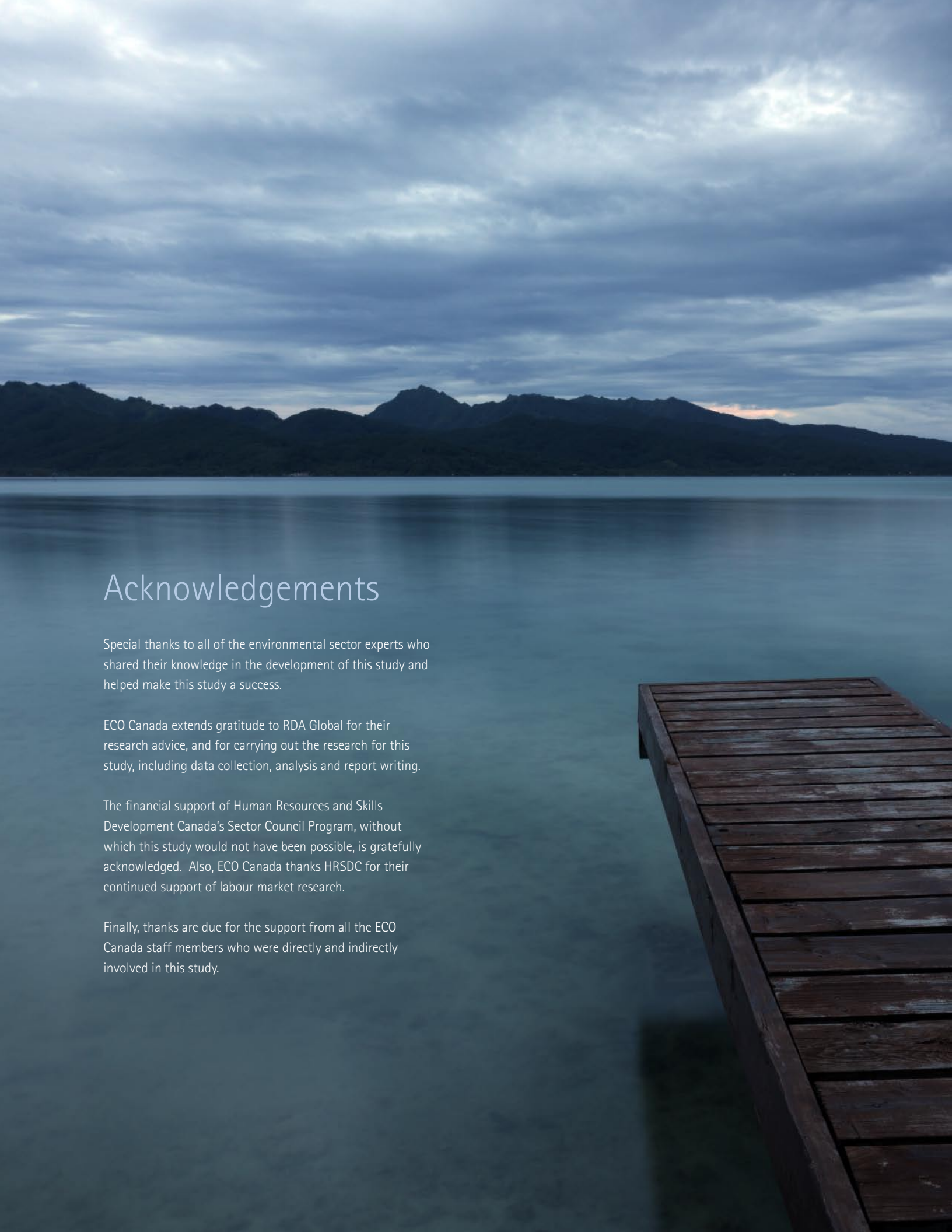
LABOUR MARKET RESEARCH

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1.0 INTRODUCTION

1.1 ABOUT ECO CANADA

Environmental Careers Organization Canada (ECO Canada) is a not-for-profit corporation that assists the Canadian environment sector in implementing sound human resource development policies. Since its founding in 1992 (as the Canadian Council for Human Resources in the Environment Industry, or CCHREI), ECO Canada has taken great strides toward developing a national human resource strategy that is focused towards the needs of environmental practitioners, employers and educators.

1.2 RESEARCH OBJECTIVES

ECO Canada has been collecting labour market information relevant to the environmental sector for over 15 years. Due to the dispersed and diversified nature of the sector itself, the majority of available information has had limited applicability, as regional and other modalities are often so substantive that it is hard to identify common denominators and monitor common indicators.

Consequently, ECO Canada commissioned this study to obtain baseline data from a macro and micro level, to help determine the factors and drivers of change and growth within the environmental sector, with a special focus on how those changes impact employment, occupations and labour issues.

The report provides employers, government, environmental practitioners and ECO Canada with a broad and detailed overview of the trends affecting growth in Canada's environmental sector. It also contains extensive background on the sector's history, as well as the drivers of and barriers to growth within the sector. The research in the report is organized according to a new model for categorization of employment in the environmental sector that is based on the definitional structure of the Environmental Goods and Services Sector. Use of this definitional framework, which was recently adopted by the United Nations and the European Commission, allows for comparisons between Canada and other nations.



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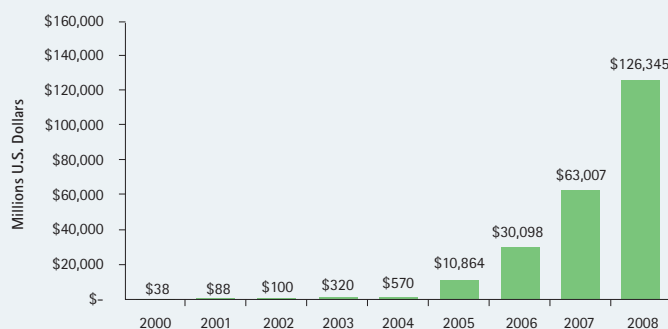


The report contains statistics and commentary useful for policy development to support growth of the sector. Findings have implications for developing a proactive policy for human resource development, and addressing current and future potential labour supply and demand gaps. It may also be used to inform government policy decisions on the direction of future environmental employment, providing insight on the impacts that social, economic and other drivers may have. The project also provides direction to government regarding what areas of environmental employment are of primary importance to support and, therefore, which policies may be implemented to ensure the healthy future development of environmental employment in Canada.

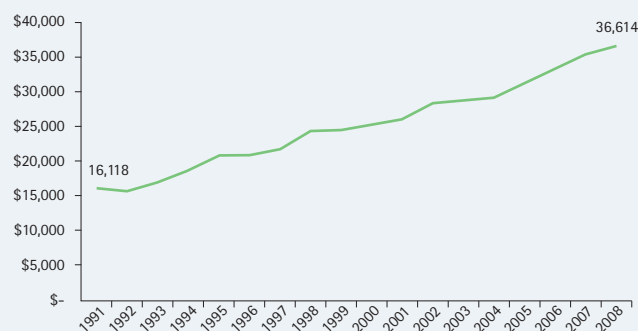
As part of this project, the research team spoke with several experts in the Canadian environmental industry and its sub-divisions. These informants identified key trends that they view as major factors currently driving changes in environmental employment in Canada, as well as potential drivers for the future. In the report, these trends are explored using secondary data to describe how they are likely to shape demand for environmental employment in the future. Beyond discussion of these macro trends, key micro trends in each sub-sector of the environmental sector and their potential impact on the environmental labour market are outlined in a separate ECO Canada report entitled *Future Growth Expectations for Worker Demand within Each Environmental Sub-Sector*.

Table 1
Divergent growth in the Environmental Sector

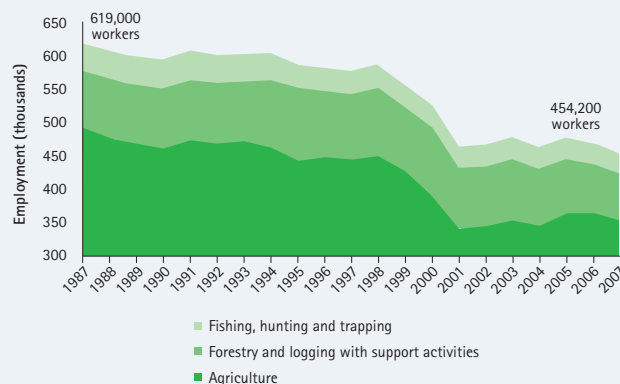
Growth in Global Carbon Offset Market:
176% Annual Growth



Growth in Canadian Waste Management Employment:
5.5% Annual Growth



Employment Growth in Agriculture, Forestry, and Fishing:
-2.8% Annual Decline



Sources: Carbon Finance Annual Report, World Bank 2009; Survey of Employment, Payroll and Wages, Statistics Canada; and Canadian Labour Force Survey, Statistics Canada

2.0 EXECUTIVE SUMMARY

DEFINING A COMPLEX SECTOR

The environmental sector is highly complex, being comprised of a diverse set of activities. These activities range from high-growth segments such as carbon emissions reductions markets, to regulated growth markets such as waste management, to declining employment markets in the natural resource industries (Table 1).

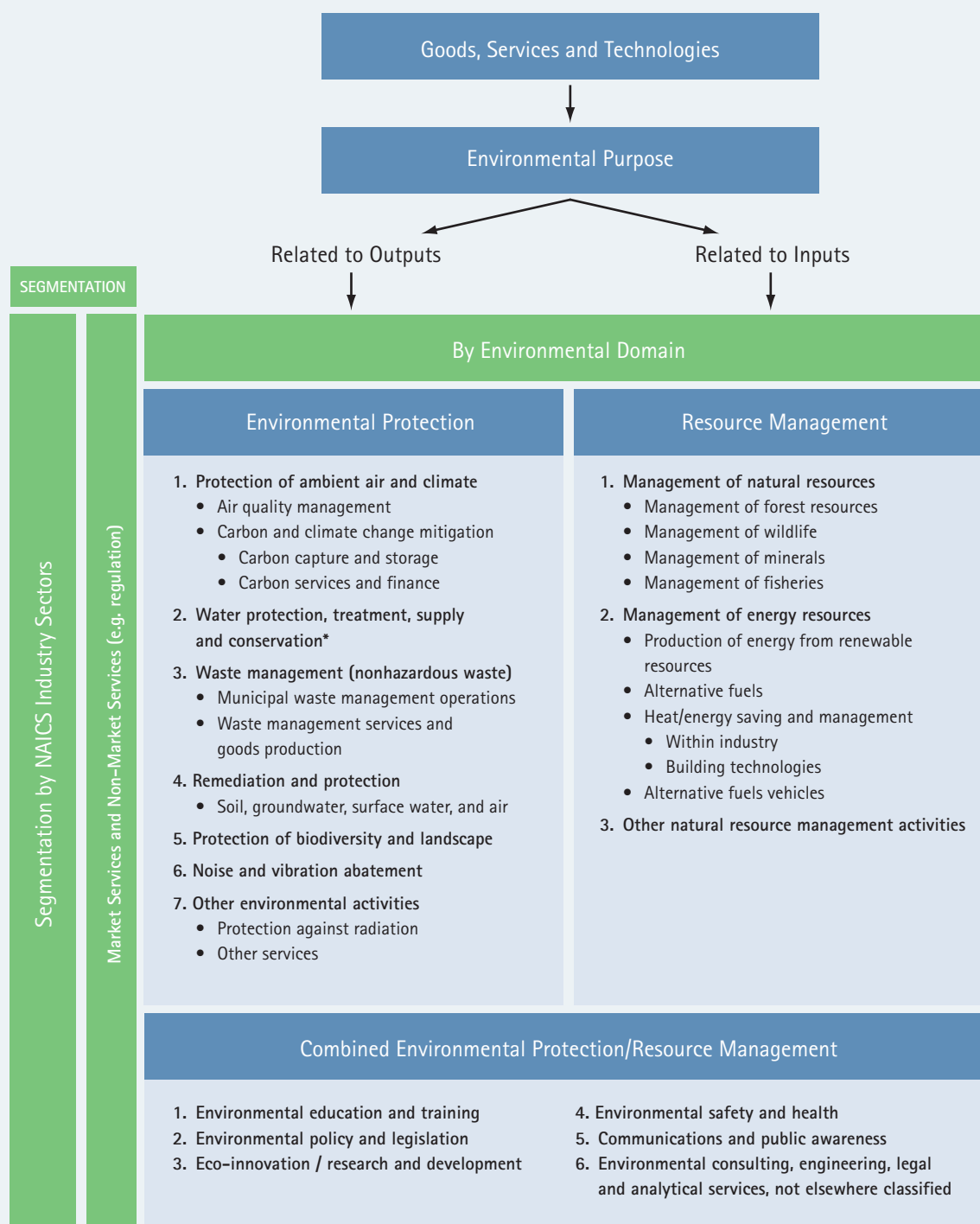
This study adopts an internationally recognized definition of the environmental sector organized according to the provision of environmental goods and services. The model was developed in consultation with Statistics Canada's Environmental Accounts Division and allows for comparisons to be made between Canada's environmental sector and that of other countries. Generally speaking, the model divides activities in the environmental sector into two environmental domains: environmental protection and resource management.

Within each domain of the environmental sector, there are sub-sectors:

- (1) The environmental protection domain includes protection of ambient air and climate, water protection, treatment, supply and conservation, waste management, remediation, protection of biodiversity and landscape, noise and vibration abatement, and other environmental protection services.
- (2) The resource management domain is divided into management of natural resources, management of energy resources, and other environmental resource management activities.
- (3) In addition, there are some goods and services that exist across both domains. These include environmental education and training, environmental policy and legislation, environmental research and development (or eco-innovation), environmental health and safety, environmental communications and public awareness, and other environmental services.

The model for classifying environmental domains for measurement is illustrated in Figure 1.

Figure 1
The Canadian Environmental Goods and Services Employment Model



* Note: Water supply and conservation can be classified in resource management but are included in Environmental Protection for simplicity

The model observes that the provision of environmental goods and services occurs in all industries. Environmental employment in each domain represents all employment related to the provision of the specified goods and services across the supply chain.

EMERGING ENVIRONMENTAL MARKETS

Emerging areas of the environmental sector, namely carbon & climate change mitigation and investments in energy efficiency and renewable energy resources will drive the greatest future growth for the environmental sector and should be incorporated into future definitions and models of the environmental sector.

Carbon & climate change mitigation

Very little data currently exists to measure employment growth resulting from carbon & climate change mitigation activities. However, several indicators suggest very high growth potential.

The global market for carbon credits has increased from \$38 MM USD in 2000 to over \$126 billion in 2008, averaging 175% growth per year over the period. The Province of Alberta has set aside \$2 billion for carbon capture and storage technology. Global retailer giant Wal-Mart now requires manufacturers throughout the firm's global supply chain to measure and reduce their carbon footprint.

Activities in carbon & climate change mitigation have the potential to have massive impacts on environmental sector investment and labour demand. Emissions cap and trade legislation in the EU and elsewhere has driven strong demand for low-carbon products and services, as well as a host of new professional and technical services to reduce, monitor, measure, monetize, and mitigate carbon emissions. Even without similar national legislation in Canada, provincial legislation and preemptive measures taken by firms is driving strong investment in the sector. National Canadian policy could also drive various forms of eco-innovation, giving Canadian firms an early-move advantage in North America.

Energy efficiency & renewable energy generation

Industry expenditures on energy efficiency were \$1.97 billion in 2006 and grew at 16% per year between 2002 and 2006. Cost reduction is the main driver for investment in energy efficiency with 77% of firms investing in energy efficient technology citing "sufficient return on investment" as a key driver of investment. Government incentives for energy-efficiency improvements in the residential and commercial sectors are driving high growth in green construction. Between 2008 and 2009, the number of approved energy auditors in Canada grew by 76% from 1,004 auditors to 1,770.

The renewable energy sector has experienced double-digit growth annually over the past decade. This is expected to continue in the next decade, accompanied by high market growth for alternative fuels and alternative fuel vehicles.

Activities related to climate change adaptation, eco-innovation, and environmental management practices will also likely see strong growth in the future.

ASSESSMENT OF FUTURE GROWTH IN ENVIRONMENTAL SUB-SECTORS

Due to limited data availability on the sector, it is difficult to estimate the exact rate of growth of the individual sub-sectors. Analysis of the drivers and indicators of growth highlights that the rates of growth for individual sub-sectors likely differs significantly, with some sub-sectors experiencing very high growth and others experiencing structural decline. Figure 2 shows a qualitative assessment of the future growth of sub-sectors in the environmental sector, based on recent trends and expert opinion on future prospects. The table represents growth in demand for the total number of workers and does not reflect replacement demand or demand for changing skills.

A Trend toward Prevention

Over the last decade there has been a gradual trend toward pollution prevention activities as a replacement for pollution abatement and control activities. This trend has, for instance, resulted in a difference in the type of capital expenditures firms made for environmental protection. As this trend continues to evolve, it is blurring the distinction between the environmental sector and traditional industries. For instance, manufacturers initially introduced environmental innovations such as energy-efficiency improvements to their products as a means of adding value for differentiation in the marketplace. As the trend continues, energy efficiency may be seen as a characteristic common to products in the marketplace, making it difficult to discern where the environmental sector ends and other sectors begin.

Figure 2
Future Growth Expectations for Worker Demand in each Environmental Sub-sector

| EMERGING / VERY HIGH GROWTH | MODERATE TO HIGH GROWTH | STABLE GROWTH | FLAT | DECLINING |
|---|--|---|---|--|
| Carbon & climate change mitigation | Environmental remediation | Protection of ambient air quality | Water quality protection | Agriculture (incl. organic farming) |
| Heat savings and energy-efficiency | Eco-innovation and environmental R&D | Water systems design for water supply | Operation of water and wastewater utilities | Sustainable forestry |
| Renewable energy resources (wind, solar, thermal, etc.) | Environmental health and safety | Waste management | Noise and vibration abatement | Conservation of wildlife and fisheries |
| Alternative fuels and alternative fuel vehicles | Protection of biodiversity and landscape | Environmental education | | Minerals management |
| | | Environmental policy and legislation | | |
| | | Environmental communications and public awareness | | |

GROWTH CHARACTERISTICS OF THE SECTOR

There are two distinctive but related characteristics of the environmental sector that set it apart from other economic sectors: (1) the diversity of the sector and (2) the pattern of growth of the sector.

Growth of the sector occurs mainly through diversification and the rise of new environmental markets. For instance, traditional waste management and basic water and sanitation markets diversified through legislation passed in the 1970s into more complex forms of environmental protection involving the protection of ambient air from pollution. Over the last decade, the environmental sector has grown through the emergence of new markets such as renewable energy and investments in energy-efficiency. Future growth of the sector will also occur in emerging markets such as services for carbon emissions reductions or climate change adaptations as well as other markets developed through ongoing environmental innovation.

Diversification in the environmental sector has resulted in the creation of significant new jobs globally. Emerging markets for environmental goods and services have driven environmental employment – both in national markets, and in the international export market, as countries increasingly trade environmental goods and services. These exports play a significant role in the growth in employment in the sector.

KEY DRIVERS OF GROWTH

At the macro level, the main drivers that are affecting growth in the sector are:

- **Environmental policy and regulation** including direct government spending on the environment, environmental regulation and incentives to encourage environmental investment
- **Financial and economic drivers** such as high energy costs or access to developing markets
- **Consumer demand** for environmentally-friendly products and practices
- **Environmental management practices** in the business sector such as lifecycle assessment, green purchasing policy and other environmental business practices

Among these drivers, policy changes and economic drivers are the main drivers influencing growth of the sector. These drivers are inter-related. For instance, changes in consumer attitudes affects purchases but also affects voting behavior, which could have an impact on environmental policy. Changes in policy and regulation can result in higher costs for businesses that pollute, increasing the financial incentive for firms to invest in cleaner processes. Although it is difficult to determine the exact extent to which a change in business practices and consumer attitudes affects the environmental sector, these drivers all are moving in the same direction—increasing the demand for environmental goods and services.

In addition to drivers, there are two key trends that are shaping the way in which the sector grows. These include:

- (1) **A trend toward diversification**—new environmental markets such as renewable energy or carbon emission reduction give rise to new types of worker demand.
- (2) **A trend toward pollution prevention**—this trend is blurring the lines between a traditionally well-defined environmental sector and environmental protection practices that are integrated throughout industries that are not traditionally *environmental*, per se.

Changes to these trends and the key drivers will have significant impacts on future growth in the sector. In particular, rising energy costs and the rise of a market for carbon mitigation each have the potential to drive significant investment across the sector.

GLOBAL TRENDS

The global market for environmental goods and services has been experiencing strong growth over the last several decades. Estimates of global market growth over the 2000-2006 period range from 7% to 9% growth per year. Future global spending in the sector is expected to see average annual growth between 4.7% and 7.7% over the next ten years, outpacing global economic GDP growth of 3.5%.

Growth in demand for environmental goods and services drove 13.5% annual growth in environmental goods exports from 1990-2002 (exports from all countries combined). Canada represents about 1.7% of the global market for environmental goods and services, highlighting significant global demand opportunities for Canadian firms.

Canada has benefited from growth in these export markets. For example, about one third of all Canadian solar panel manufacturing revenues come from global exports. However, Canada lags far behind Germany, China, the US, Italy, the UK and other countries in total environmental exports.

The EU and other highly-developed environmental markets have benefited from the growth in demand for environmental goods and services. Increasing levels of demand for environmental products contributed to impressive employment growth in the EU environmental sector of 6.9% per year from 2000 to 2008.

Canada's competitiveness in the global environmental industry is strongly influenced by the design of national environmental regulation, by policy-based incentives for eco-innovation, and through direct government investment in capital-intensive industries such as wind energy production.

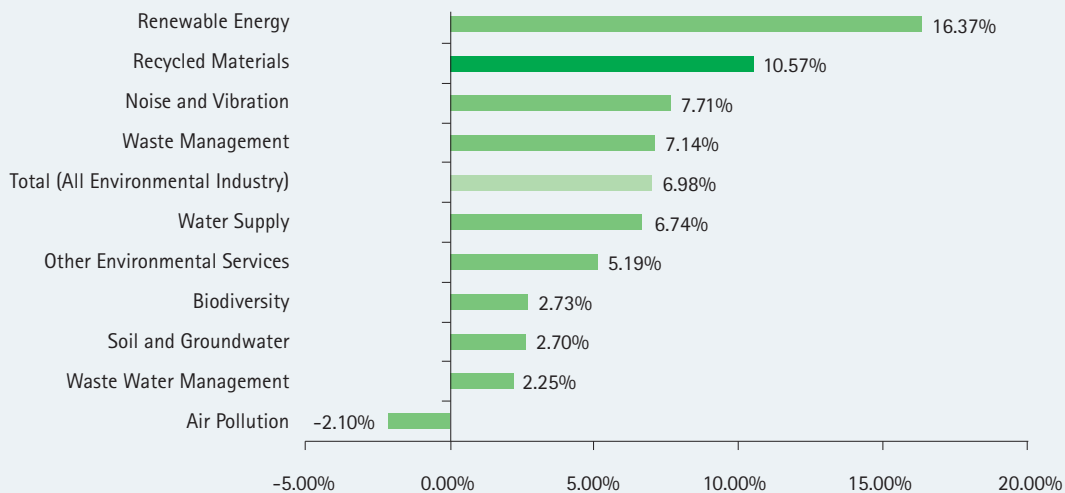
KEY RECOMMENDATIONS FOR ENCOURAGING FUTURE GROWTH OF THE SECTOR

(1) LEVERAGE PUBLIC POLICY TO DRIVE ECONOMIC DEVELOPMENT OF THE ENVIRONMENTAL SECTOR

Environmental legislation and public policy plays a critical role in driving the environmental sector as a whole. Many employees working in the sector are engaged in some way with environmental regulation, either through development of such regulation or compliance with it. For instance, compliance with environmental regulation has driven much of the growth in pollution control activities in the last forty years.

Well-designed environmental regulations and compliance mechanisms drive innovation in environmental products and services. Countries that make early changes to domestic environmental policy benefit from those policies in exports markets because domestic firms have developed technology that makes their products competitive in global markets. Germany and other EU members have this advantage because they have been among the earliest to adopt environmental protection measures.

Figure 3
EU Annual Employment Growth in Environmental Sub-Sectors 2000-2008



Source: Competitiveness of the EU Eco-Industry

There are several emerging opportunities for Canada to develop a North America early-adopter advantage. Key growth areas include markets for carbon emissions reductions, technology for climate change adaptations, renewable energy and energy efficiency markets, and markets for recycled materials. Clear rules for climate change policy will give rise to growth opportunities in carbon finance, demand for carbon accounting skills, carbon trading, and a variety of investments in carbon emissions reductions.

Recycling regulations are a good example of how different requirements can have different employment effects. Recycling policy in Canada has not placed many restrictions on manufacturers to take responsibility for the waste generated by products that they sell. The EU has enacted 'take-back' legislation requiring manufacturers to take responsibility for recycling of products once they have reached the end of their useful lives. This has driven double-digit growth in employment in the EU recycling industry over the past decade. The recycled materials market in the EU created 283,000 new jobs in the EU between 2000 and 2008, making it the third largest sub-sector for new job creation in the EU environmental industry. Employment in the EU recycled materials market grew by over 10% per year during this period as a result of the regulatory design (Figure 3).

Similar 'take-back' legislation has been introduced in provinces for targeted products (e.g., batteries).

Public policy also influences the *competitiveness* of the sector for exports in the global environmental market. It has been observed that the EU has a competitive advantage in the global environmental industry, in part because it has been the first to implement new regulation to protect the environment. Policy that requires or encourages eco-innovation can make Canadian environmental products more competitive internationally. Policy instruments such as R&D tax credits and environmental investment funds assist Canadian firms in the development and commercialization of new environmental technology. In some cases, policy in the form of direct governmental investment is needed to drive growth, especially in capital-intensive sub-sectors.

Since industry has traditionally viewed environmental regulation compliance as an expense, most policy has been designed to look at the economic costs vs. the environmental benefits of a policy. Future evaluation of policy and regulatory design should evaluate not only environmental quality benefits, but *economic* benefits that can be achieved through policy, including new environmental sector job creation. Since the sector grows mainly through the emergence of new environmental markets, economic cost-benefit analyses should be performed on environmental legislation to estimate the job creation potential for various policy alternatives. Ongoing policy economic analysis for all sub-sectors of the environmental sector should be a priority for encouraging future employment growth.

(2) STRENGTHEN LABOUR SUPPLY AND SKILLS FOR THE ENVIRONMENTAL SECTOR

Canada's competitiveness in the environmental industry depends upon the availability of a skilled workforce. For environmental practitioners to be prepared, more coordination is needed between employers and educational and training institutions.

Labour requirements in some industries are easily defined, such as in the construction industry, which is largely comprised of workers in a set of well-defined construction trades. This is not the case with the environmental sector, which is highly complex and is in a constant state of flux. The skills required in the sector are constantly changing in response to new innovation, and the evolution of emerging environmental markets.

Ignoring this complexity will likely result in an inefficient labour market where skills of workers are not well-suited to the specialized needs of employers. Such gaps will likely cause adverse effects on Canada's economic and employment potential. Skills gaps must be analyzed in a highly detailed manner, with special attention given to the significant differences in each industry and environmental sub-sector. This should be performed in a manner that considers the entire supply chain for each sub-sector and the specific skills requirements throughout.

In particular, ongoing research should be conducted on the requirements of employers in the high-growth segments of the environmental sector, such as energy efficiency, alternative energy generation, climate change mitigation and adaptation, and other growth markets. Labour and skills requirements in these markets can change significantly in response to legislation, new technology, or changes in consumer or business-to-business demand. Close monitoring of labour demand will help increase coordination of educational and industry stakeholders, thereby helping Canadian businesses to capture emerging growth opportunities both at home and abroad.

(3) INCREASE THE STATISTICAL OBSERVATION OF THE ENVIRONMENTAL SECTOR

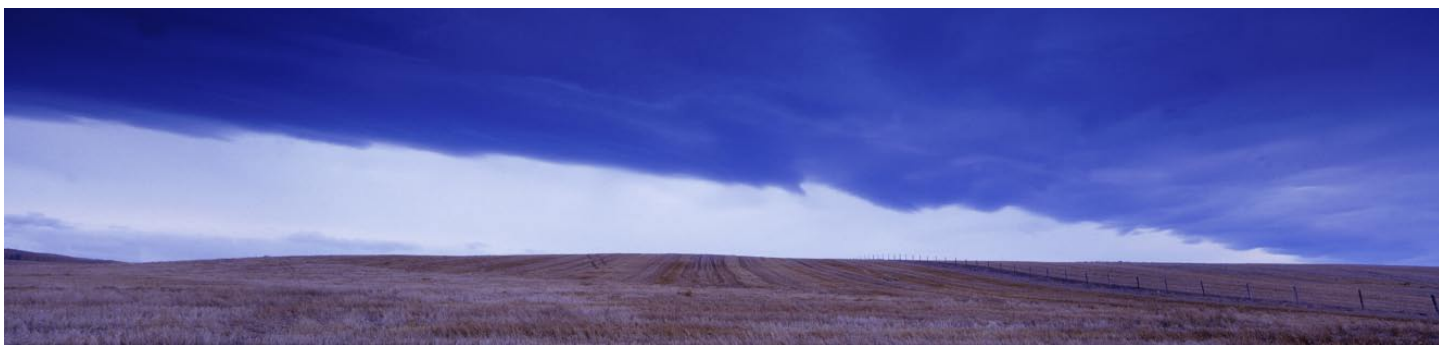
Statistics Canada and ECO Canada conduct several surveys on the sector, however, due to the sector's complexity, it is difficult to design studies that account for all sub-sectors. Thus, some environmental sub-sectors are well reported but other sub-sectors are not well-tracked, particularly emerging growth areas. The lack of detailed data on environmental employment reflects two key aspects of the sector: (1) the sector is highly complex, being comprised of numerous sub-divisions, and (2) as the sector grows and matures, the level of diversification within the sector has increased. As a result, a centralized source of information on all sub-sectors and aspects of the environmental sector does not currently exist in Canada.

During the writing of this report, extensive efforts were made to identify statistics that may describe the sector. However, the information that could be found was limited, making it difficult to understand the size and growth of the sector and its sub-sectors.

The lack of statistical information on the environmental sector is perhaps one of its greatest constraints to growth. Investors have limited information on the development of environmental markets to inform their investment decisions and policy-makers have limited information on the impacts of regulatory decisions on growth in the industry. Readily available information will facilitate better policy-making to optimize growth of the sector, and timely reporting of this information will assist firms to capture new emerging opportunities as the environmental sector diversifies.

In particular, this information should capture details on employment, revenues, and exports, as well as operating statistics of Canadian firms engaged in environmental sub-sectors. Demand for workers by occupation should also be included in this data collection effort, as availability of skilled and specialized labour in the environmental sector is key to its growth. Information tracking should be designed to allow for easy comparisons with other countries and jurisdictions within Canada. Using the Canadian Environmental Goods and Services Sector Model (CEGSS), as described in Section 3.1 of this report, would make the model and resulting data comparable internationally.

This information should be collected by an organization critical to the growth of Canada's environmental industry, and should be coordinated with sub-sector stakeholders and Statistics Canada. The information will be most valuable if it is collected with a mandate to increase Canada's economic development throughout the environmental sector, as well as to guide policy and economic incentives to increase private sector investment.



3.0 DEFINING THE ENVIRONMENTAL SECTOR

Summary

Because the environmental sector is complex, being comprised of a wide variety of activities, special attention must be given to the framework for classifying and measuring the sector. A variety of models are in use globally, however recently there has been a trend toward international standardization through the use of the Environmental Goods and Services Sector definition, developed by Eurostat in consultation with Statistics Canada. The model is designed to allow for estimation of environmental revenues, exports, employment and other economic measures using existing national accounts statistics. National accounts and environmental accounts statistics in Canada differ somewhat from the EU and the research team involved in this report has made adjustments to the model to simplify and adapt it to the Canadian context. This section gives a brief overview of the Canadian Environmental Goods and Services Sector Model (CEGSS) and a review of the statistical information available for the model in Canada.

Defining the sector

Due to the complex nature of the environmental sector, it is necessary to examine its composition in order to understand the trends affecting its growth. Employment in the sector is difficult to measure and define for several reasons:

- (1) The diverse and complex nature of the environmental sector itself makes it difficult to track statistically.
- (2) Analysis of the sector is further complicated by the nature of environmental work activities. Skills used by environmental practitioners typically include a mix of environmental skills and a set of core technical skills that are not, in essence, *environmental*.

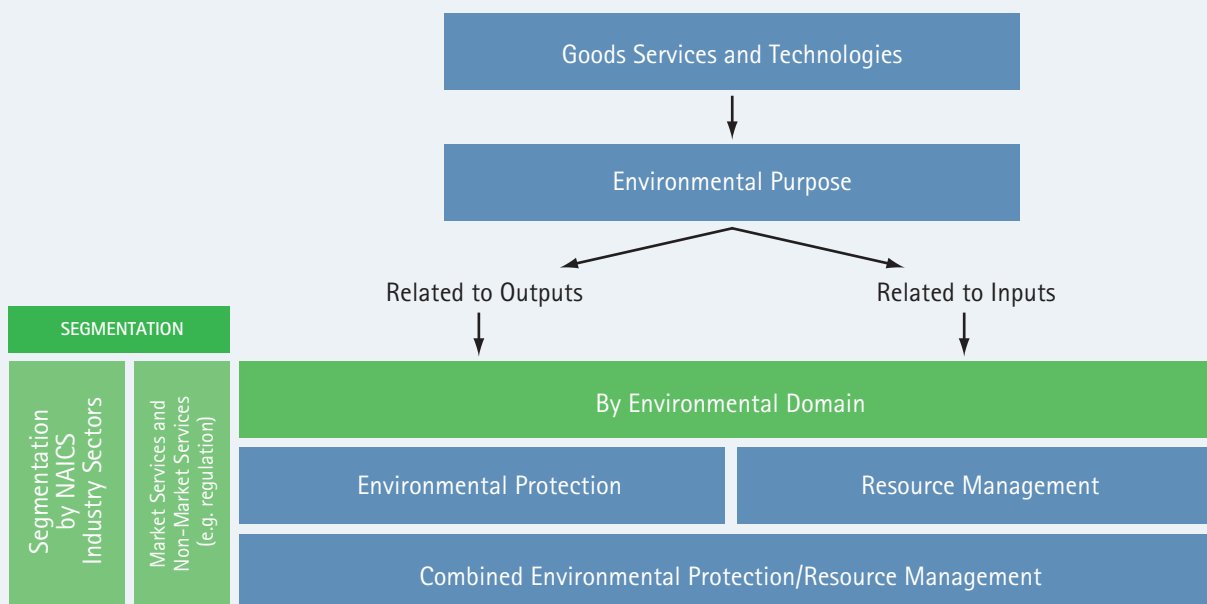
- (3) Measurement of employment in the environmental sector is further complicated because the labour force is comprised of a mix of workers employed in the provision of *market* goods and services (such as manufacturing of filters for air quality protection or air quality testing services) and *nonmarket* services (such as development of new legislation and regulation).

Because of these complications, there has been a movement toward an international standard for defining and measuring the environmental sector. The omission of several key growth areas in the 1999 framework led to a substantial revision to the model. In September 2009, Eurostat and the Organization for Economic Co-Operation and Development (OECD) published *The Environmental Goods and Services Industry Handbook*¹. The handbook was developed in cooperation with Statistics Canada Environmental Accounts Division and is the emerging global standard for defining and measuring the environmental sector.

As part of this study, the research team reviewed the Environmental Goods and Services Sector Handbook and its applicability to data on the environmental industry in Canada. While there are significant gaps in the data currently available from existing surveys, the research team and ECO Canada viewed the model as a positive step toward defining the sector as it exists today and as it is likely to develop over future years. The research team also made recommendations for adjustments to the model to better reflect the composition of the environmental sector in Canada. In the following section, we provide a brief description of the Canadian Environmental Goods and Services Sector which is used in this study to explore macro and micro trends throughout the environmental sector.

¹ The Handbook may be accessed from the Eurostat Working Papers Series and is available at the following link (last accessed February, 2010)
http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-09-012/EN/KS-RA-09-012-EN.PDF

Figure 4
The Canadian Environmental Goods and Services Employment Model

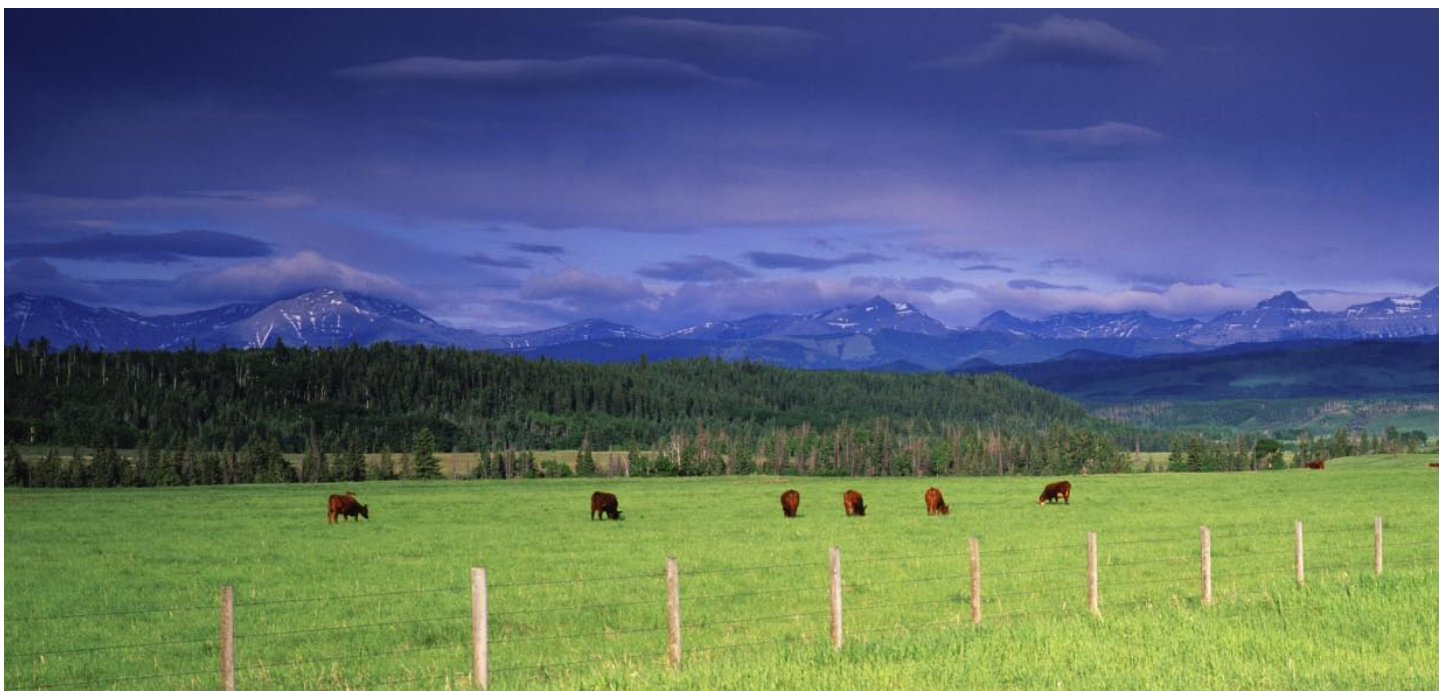


3.1 CANADIAN ENVIRONMENTAL GOODS AND SERVICES SECTOR MODEL (CEGSS)

The Canadian Environmental Goods and Services Sector Model defines the sector as activities that are involved in the provision of goods, services, and technologies that have an environmental purpose. The sector is divided into activities related to environmental inputs and outputs. Environmental inputs largely have to do with activities related to resource management. Resource management is comprised of both natural resource management (such as management of minerals, wildlife, forest resources, etc.) and energy resource management (including the provision of renewable energy resources and management of efficient use of energy resources). Activities involving environmental outputs are generally related to environmental protection, and are comprised of activities such as air and water quality management, waste management, remediation, protection of biodiversity and landscape and other activities. There are also a set of activities which are related to both environmental inputs and outputs. These include activities such as environmental policy development, environmental education, and environmental research and development (or eco-innovation). Figure 4 contains a model for classification of the environmental sector according to inputs and outputs.

It is important to note that the activities in the environmental sector occur in essentially all industries. Similar to the energy industry or the aerospace industry, the environmental industry is comprised of firms and workers from most industries. This includes primary natural resource industries (such as agriculture and mining), secondary industries (such as energy generation and manufacturing), and service industries, including business services, technical services, transportation, government, education and others. Furthermore, environmental goods and services include:

- **Connected Products** including goods and services that have no use except for environmental protection or resource management. Examples include maintenance services to septic tanks or installation of renewable energy facilities.



3.1.1 CANADIAN CONTEXT

- **Adapted goods** which are less polluting or more resource efficient than equivalent normal goods which furnish a similar utility. This includes 'cleaner' goods, which help to prevent pollution or environmental degradation because they are less polluting at the time of their consumption and/or scrapping compared to equivalent 'normal' goods. It also includes 'resource efficient' goods, which help to prevent natural resource depletion because they consume fewer natural resources in production.
- **Environmental technologies** which are technical processes, installations, equipment (goods) and methods or knowledge (services), the technical nature or purpose of which is environmental.
- **Ancillary goods** and services that firms create for their own consumption—such as design of energy efficient processes that reduce costs and use of natural resources, but are fully consumed internally.
- **Both Market and Non-Market Services:** Non-market services are services that are not 'bought' and 'sold' in a strict sense (e.g., there is no 'buyer' for creation of new regulation or for some forms of environmental education).

The Canadian Environmental Goods and Services Sector model is a modified version of the Environmental Goods and Services Sector Handbook published by Eurostat. The modifications include:

- In the Eurostat EGSS, education, training, policy development, communications, public relations and research and development activities are classified under the main divisions for resource management and environmental protection. For instance, research and development for air quality management is classified in EGSS Environmental Protection Activities Division 1: protection of ambient air and climate. In the Canadian EGSS model, these functions are classified separately because statistical tracking for these activities is not detailed enough to distinguish the type of environmental protection activity. For instance, environmental research and development statistics do not support distinctions between research on air quality and research on water quality.
- Under the Resource Management division, management of energy resources has been modified to include all energy resource management activities, even if they occur for environmental protection. In the Canadian EGSS, energy resource management is divided into: (1) Production of energy from renewable resources, (2) Alternative fuels, (3) Heat and energy savings management (energy-efficiency), and (4) Alternative fuels vehicles. This change was made to simplify the model so that all energy-related environmental activities may be grouped together.



- Some similar simplifications were made in the divisions of Environmental Protection. This includes, for example, consolidation of water management into a single category in the Canadian EGSS (Water protection, treatment, supply, and conservation). In the original EGSS, water management is divided into two categories: (1) Management of water resource availability – this is classified under resource management, and (2) Water quality protection – classified under environmental protection.

3.2 EMPLOYMENT DATA AVAILABILITY AND QUALITY

Currently, no centralized source of information for all aspects of the environmental sector exists in Canada. The largest set of statistics on the environmental industry is collected by the Statistics Canada Environmental Accounts & Statistics Division. The division conducts several surveys and produces analytical publications based on survey data pertaining to various components of the environmental industry.

Statistics Canada does not specifically measure *employment* in the environmental sector. In 2003, the division explored four methods for estimating environmental employment using existing survey sources², but did not draw conclusions on a preferred method for estimating environmental employment using those surveys.

To measure employment in the sector, ECO Canada has conducted its own survey of employers in Canada on a bi-annual basis. The survey has traditionally collected information on the number of environmental employees.

The lack of detailed data on environmental employment reflects two key aspects of the environmental sector: (1) the sector is highly complex, being comprised of numerous sub-sectors, and (2) as the sector grows and matures, the level of diversification within the sector has increased. In previous research dating back to the early 1990s, environmental surveys focused primarily on reductions in pollution, and less so on efficient use of natural resources and energy resources. As the sector has matured, there has been increasing attention paid to the energy efficiency investments of firms and other matters related to energy. Still, with the existing body of research on the sector in Canada, there are significant gaps in the data, which make estimation of employment in each sub-sector difficult.

To evaluate trends in Canadian environmental employment, the research team drew upon a diverse set of secondary literature and research, as well as the body of survey research conducted by Statistics Canada, including the following surveys that are conducted at regular intervals by the Environmental Accounts and Statistics Division: Waste Management Industry Survey: Business and Government Sector; Households and the Environment Survey; Environment Industry Survey: Business Sector; Survey of Environmental Protection Expenditures; Industrial Water Survey; Agricultural Water Use Survey; and Survey of Drinking Water Plants.

In addition to the surveys listed above, some information relevant to the environmental sector may be gleaned from the 1996, 2001 and 2006 Census of Canada, the Labour Force Survey (monthly), the Canadian Business Patterns Database, and other sources of statistics published by Statistics Canada that cover a broad set of topics, including topics relevant to the environment. It should be noted that definitions differ significantly among the various surveys available to describe the environmental sector. For this study, the research team exercised caution in drawing conclusions from the diverse sources of information. Readers are advised to interpret the trends identified in this report while taking into consideration that the findings are based on disparate sources.

² See Working Paper ISBN: 0-662-36570-4: "Measuring Employment in the Environmental Industry" (Orok, 2003).

4.0 KEY EMERGING TRENDS

Summary

In interviews with key stakeholders, a number of emerging growth areas were discussed as prime opportunities for growth in the environmental industry. The following two areas were mentioned in every interview with a key expert:

- (1) A diverse set of activities prompted by efforts to reduce carbon emissions and mitigate climate change; and
- (2) Activities related to improvements in energy efficiency (notably in the construction sector) and development of renewable energy sources which reduce consumption of environmental resources.

In addition, alternative fuels, alternative fuel vehicles, adaptation to climate change, eco-innovation, and environmental management practices were all mentioned as emerging growth areas in the environmental sector.

Carbon and climate change mitigation will have wide-reaching impacts on labour demand and skills. This will include increased investment in technologies that reduce greenhouse gas emissions by all sectors of the economy. This will drive growth in the market for carbon offsets (activities that offset carbon emissions). The market will necessitate changes in accounting skills for carbon tax purposes. It will also drive changes in the finance and commodities-trading industries as a new market is organized for trading of carbon on a level similar to other global commodities.

Activities to make improvements in energy efficiency will drive changes in demand for environmental skills in the construction sector. As homes and businesses take advantages of energy efficiency incentives for retro-fits, there will be growing demand for energy auditors, blower door testers and a handful of other niche occupations. Energy efficiency is likely to drive ongoing demand for workers in the manufacturing industries, although strong total employment growth is not expected. Energy efficiency will be a priority for development in electronics, appliances, and other products with energy requirements, and research and development for these products will require electrical design skills.

Renewable energy technology including solar, wind, and thermal energy generation will drive demand for workers to install and maintain these systems. In the biofuels sector, production capacity is expected to increase significantly over the next few years but will not likely have dramatic impacts on employment in the sector. Direct employment in eco-innovation is difficult to measure and spending on research and development drives cyclical changes in the demand for workers as new technologies are developed and implemented. Employment growth in climate change adaptation will likely be large and project-driven. However, many of these adaptations will not require workers with specific environmental skills.

Other key growth trends in the sector are more likely to impact demand for skills than demand for additional workers. While the automotive manufacturing industry is in decline, there is growth in the production of alternative fuels vehicles. Improvements to the design of these vehicles require ongoing skill and knowledge upgrades for engineers. The implementation of environmental management practices will cause changes in the skills that a variety of workers require to be effective in their jobs.

4.1 CARBON & CLIMATE CHANGE MITIGATION

Under the Kyoto Protocol, Canada has a goal to reduce carbon emissions to 6% below the 1990 levels. In 2007, Canadian Ministry of Environment announced a revised Climate Plan. Canada intends to reduce its annual carbon emissions by approximately 20% below 2007 levels by 2020. While this plan does not attain the level of emissions reduction that is encouraged in the Kyoto protocol it did call for aggressive measures, including requirements for industry to cut emissions in half by 2015.

In December 2007, Canada's federal government began to formally require industry to provide information on its greenhouse gas (GHG) emissions and in March of 2008, Environment Canada released *Turning the Corner*, which outlined further details of the proposed climate change plan. Canadian provinces have also participated in emissions-trading schemes set up by various regional groups, and Alberta has implemented its own trading program.

Figure 5
Global Market for Carbon Credits



Source: World Bank Carbon Market 2009 Report

According to the national Climate Plan, companies will be able to choose the most cost-effective way to meet their targets from a range of options: in-house reductions, contributions to a capped technology fund, domestic emissions trading and offsets, and access to the Kyoto Protocol's Clean Development Mechanism (CDM)³. The introduction of the Climate Plan has prompted companies to make preparations to reduce carbon emissions.

Analysts tend to expect only limited demand for international carbon credits from Canada⁴. Nevertheless, future implementation of a trading program in Canada and across North America will drive demand for carbon offsets. Development of the carbon market outside of North America has been dramatic in recent years, with the global market growing from \$38MM USD in 2000 to over \$126 Billion USD in 2008 (Figure 5).

The growth of markets for carbon credits and offsets has multiple labour market effects. First, it has given rise to new firms, such as Eco Securities, that specialize in the development and sale of carbon credits. These firms are increasingly used by global firms wishing to purchase carbon offsets.

Even though the carbon offset market is much less developed in Canada than it is in the EU and Asia, Canadian firms have an opportunity to enter this market. The ECO Securities Survey showed that buyers of carbon offsets were unlikely to view the location of the supplier as a major factor contributing to purchase decisions. The most important purchase decision criteria included experience (88%), brand (85%), range of project types (82%), and the location of projects (79%)—all of which were viewed as more important than price (78%) (ECO Securities Survey 2008).

³ The Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO₂, which can be counted towards meeting Kyoto targets. A CDM project activity might involve, for example, a rural electrification project using solar panels or the installation of more energy-efficient boilers. The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets.

See the following UN FCCC for more information on the program (last accessed February, 2010)
http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php

⁴ See Point Carbon, 2007a

Table 2
**Industry Expenditures on energy-related
environmental processes and technologies**

(In Millions of Dollars)

| Years | 2002 | 2004 | 2006 | Annual Growth 2002-2006 |
|------------------------|------------|----------|------------|----------------------------|
| Operating Expenditures | \$ 523.0 | \$ 575.8 | \$ 1,009.0 | 18% |
| Capital Expenditures | \$ 583.3 | \$ 379.3 | \$ 964.0 | 13% |
| Total Expenditures | \$ 1,106.3 | \$ 955.1 | \$ 1,973.0 | 16% |

Source: Statistics Canada Survey of Environmental Protection Expenditures 2002, 2004, 2006

Other employment effects of this market will likely be felt in finance and accounting, where demand for carbon accounting skills will grow, as will finance for carbon reduction projects. Understanding of carbon markets will increasingly become prerequisite for credit officers as they consider the exposure of loans to firms which must incur expenses to comply with emissions reductions targets. Carbon emissions reductions are expected to have a very wide and diverse set of effects on skills required across many industries. While the details of effects of growth of this market are difficult to predict at this point, the consensus among the experts we spoke with was that the market is growing significantly in anticipation of future regulation. When such regulation comes into existence at a national level, it is expected that the environmental sector will likely undergo a significant expansion.

4.2 ENERGY EFFICIENCY

Spending on energy efficiency has grown dramatically over the past few years. Canadian businesses made expenditures of \$2 billion for energy-related environmental processes in 2006. From 2002 to 2006, industry spending on energy efficiency nearly doubled (a 16% average annual growth rate). Energy efficiency spending for environmental processes was almost evenly split between capital expenditures (on environmental products) and operating expenditures which are more labour-intensive (Table 2).

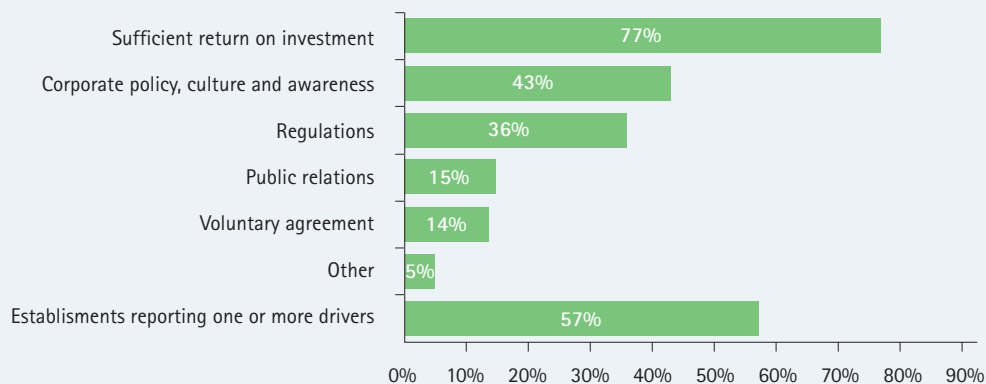
Similar demand may be observed in the commercial and residential energy retrofitting sector. Natural Resources Canada's ecoENERGY program⁵, combined with provincial tax incentives has prompted many businesses and consumers to make investments in their facilities and homes to improve energy efficiency. Much of this work is performed by workers in the construction industry. Construction spending on energy efficiency is not well-tracked in statistics, nor is the number of workers engaged in such activities.

A good indicator of growth is the number of certified energy advisors under the ecoENERGY program. Under the program, an energy audit must be performed by a certified advisor both before and after the implementation of energy efficiency upgrades. Between 2008 and 2009, the number of certified energy advisors in Canada grew from 1,004 in 2008 to 1,770 in 2009, a 76% increase (ecoENERGY Program).

Investment in energy efficiency is driven by financial benefits of lower energy costs over time, with lower energy consumption as an overall environmental benefit. As previously mentioned in this report, firms have many reasons for investing in energy efficiency. However, sufficient return on investment has been the most important driver (Figure 6).

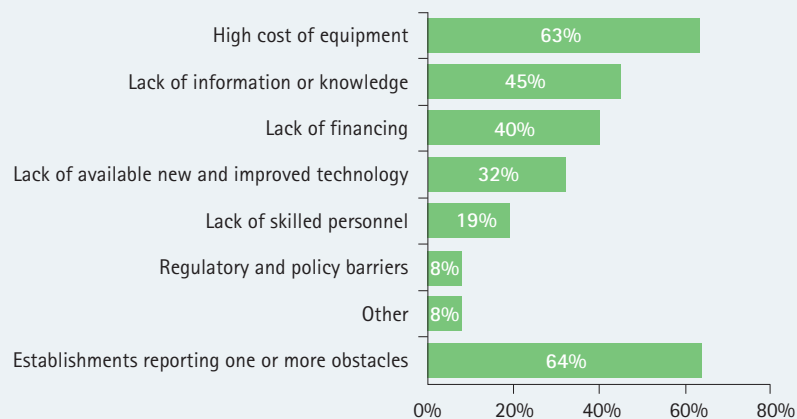
⁵ For more information on the EcoENERGY Program, see <http://oee.nrcan.gc.ca/corporate/retrofit-summary.cfm> Last accessed February, 2010

Figure 6
Why Did Your Firm Invest in Energy Efficient Technology?



Source: 2006 Survey of Environmental Protection Expenditures

Figure 7
Reported obstacles to adopting energy efficient technologies



Source: 2006 Survey of Environmental Protection Expenditures

High cost of equipment is the most important obstacle to implementation of energy efficient technology. In the 2006 Statistics Canada Survey of Environmental Protection Expenditures (SEPE), businesses also cited "Lack of knowledge and information," "lack of financing," and "lack of available new and improved technology" as major constraints to investment. In addition, about one in five firms indicated that a lack of skilled personnel limited their ability to invest in energy-efficient technology (Figure 7).

4.3 RENEWABLE ENERGY SOURCES

In the last three decades, there has been tremendous investment in development of renewable energy resources in Canada, particularly in wind, geothermal, and solar generation. The generation capacity of these three forms of renewable energy have each seen double and triple-digit average annual growth rates since 1990 (Table 3).

Table 3
**Canadian Energy Generation Capacity for Solar,
 Wind and Geothermal Energy 1980-2009**

| (KW Capacity X 1,000) | 1980 | 1990 | 2000 | 2009 | Annual Average Growth 1990-2000 | Annual Average Growth 2000-2009 |
|-----------------------|------|------|---------|-----------|---------------------------------------|---------------------------------------|
| Solar | 405 | 417 | 2,121 | 43,150 | 20% | 40% |
| Wind | - | 20 | 124,107 | 1,045,567 | 164% | 27% |
| Earth and Geothermal | 387 | 492 | 9,754 | 30,266 | 39% | 13% |
| Total | 792 | 929 | 135,982 | 1,118,983 | 74% | 26% |

Source: CIEEDAC Renewables Database

The growing investment in renewable energy is driving demand for maintenance, installation, manufacturing, as well as research and development professionals in the green energy sector. Statistics on employment in the sector are very limited (and are further explored later in this report). However, the tremendous levels of investment are likely driving strong growth in employment, especially as demand for these products grows.

4.4 ALTERNATIVE FUELS AND ALTERNATIVE FUEL VEHICLES

Alternative fuels and alternative fuel vehicles have seen strong growth in North America over the last decade. The number of alternative fuel vehicles manufactured in the US has grown at an average annual rate of 12% from 2003-2007. In that time period, manufacturing of alternative fuel automobiles has grown by 50% per year and manufacturing of alternative fuel pickup trucks has nearly doubled (94%) each year (Alternatives to Traditional Transportation Fuels 2007). Comparable statistics tracking the alternative fuel vehicles industry in Canada could not be identified. However, the trends in growing demand for these vehicles are likely to be similar in the US and Canada.

The growth in investment in alternative fuel vehicles is an example of how manufacturers are introducing eco-innovation to add value to their products. Growth in production of alternative fuel vehicles has occurred against a backdrop of tremendous employment declines in the automotive manufacturing and service sector.

As the number of alternative fuel vehicles has grown, so has investment in the production of alternative fuels. There are currently 12 biodiesel plants in operation in Canada with 468 million liters per year (MMly) of production capacity, and over 30 ethanol plants with 1,731 MMly of production capacity. The Canadian Renewable Fuels Association estimates that Canadian biofuel production will rise 76% from 2010 to 2012. Regulations on renewable content in gasoline and other policy support for the industry will continue to drive investment.

Labour market impacts from growth in alternative fuels and alternative fuel vehicles are diverse, occurring across supply chains. Sustainable Development Technology Canada operates a \$500 million fund to support commercialization of biofuels technology. In addition to research and development, growth in alternative fuels and alternative fuels vehicles is driving growth in demand for biodiesel mechanics and other types of workers with specialized skills in the labour force.

4.5 ECO-INNOVATION

As noted previously, research and development is a key factor influencing the competitiveness of Canada's environmental sector. Most of the experts interviewed mentioned environmental innovation as a key growth area. However, because of the integrated nature of this sub-sector, it is difficult to determine its growth and the overall level of employment.

Energy expenditures on research and development among businesses declined in the early 2000s, and rebounded after 2004. Research and development in energy conservation in Canada has seen the greatest growth from 2004 to 2007 (Figure 8).

Figure 8
Energy R&D Expenditures in Canada 1996, 2000-2007

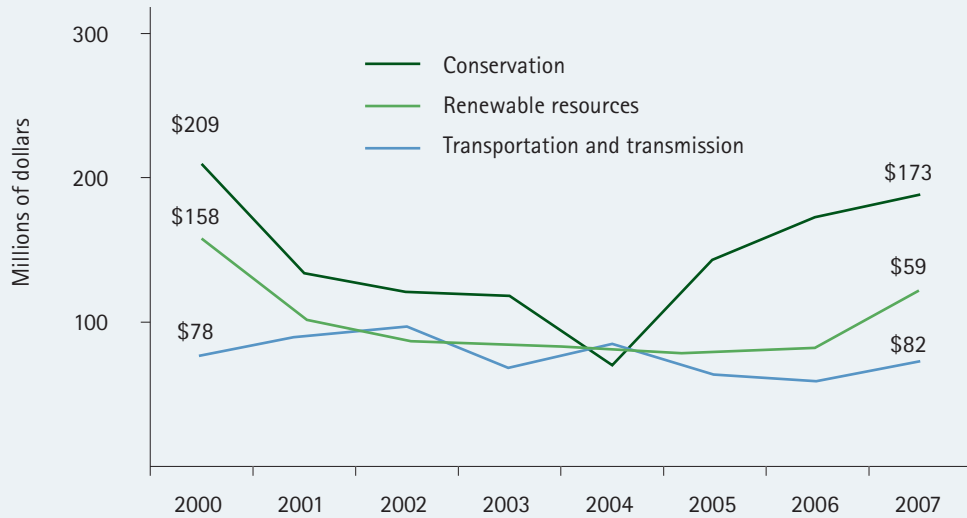
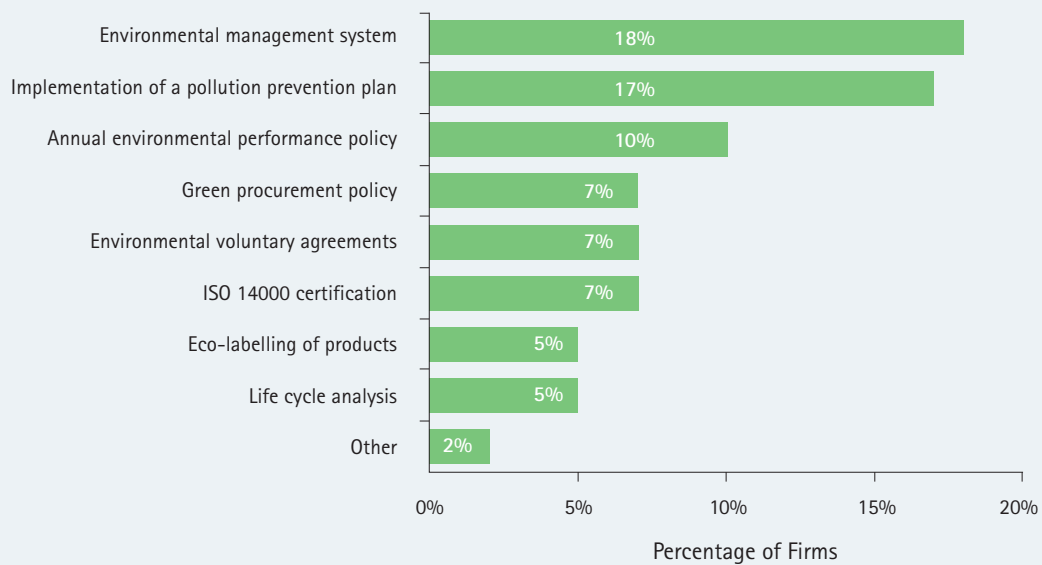


Figure 9
Firms in Canada with Environmental Management Practices 2006



Source: Statistics Canada 2006 Environmental Protection Expenditures in the Business Sector

Eco-innovation in resource industries (natural resources and electric power) has seen growth from 1,525 research personnel in 1998 to over 2,664 workers in 2007—an annual average growth rate of 5.7%. There has been significant growth in the agriculture sector where research and development personnel have grown from a mere 410 workers in 1998 to 1,320 workers in 2007.

4.6 ENVIRONMENTAL MANAGEMENT PRACTICES

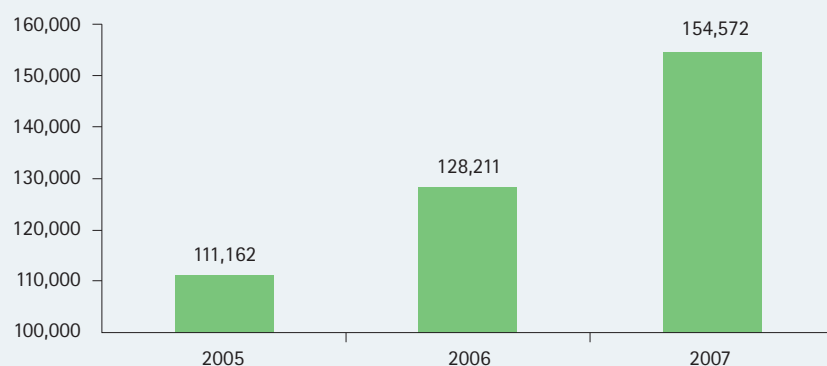
Use of environmental management practices was identified as a growth area within the environmental sector by some of the key experts interviewed. Environmental management systems are in use in Canada by 18% of firms in the manufacturing and resource sectors. Seventeen percent of these firms have implemented a pollution prevention plan and 10% have created an annual environmental performance report. A smaller percentage of firms have attained ISO 14000 certification, used green procurement policy, or made voluntary environmental agreements. As of 2006, only 5% of these firms used eco-labeling or life cycle analysis (Figure 9).

Growth in the use of these practices is difficult to measure. Globally there is a trend toward ISO 14000 certification. The number of certifications globally grew at an annual average rate of 18% per year between 2005 and 2007, mostly with Chinese manufacturers (Figure 10).

The lack of time-series data regarding the use of these practices makes it difficult to verify the recent levels of growth.⁶ Anecdotal, the use of eco-labeling and green procurement processes appears to be on the rise. Wal-Mart, for instance, requires all suppliers to submit a carbon footprint assessment and have a plan for reducing their carbon footprint over time. Vancouver-based firm ecolabeling.org has identified over 300 eco-labels that are in use across a variety of sectors including building, energy, food, forest products and other sectors.

Similar to trends in eco-innovation, trends in the use of environmental management practices is highly integrated within traditional industries, and employment related to these trends is difficult to track discretely. Indications from the Survey of Environmental Protection Expenditures imply that the use of these practices is in demand by employers who will require workers with environmental management practice experience.⁷

Figure 10
Global ISO 14000 Certifications 2005-2007



⁶ Reporting does exist in the 2002, 2004 and 2006 surveys of environmental expenditure. However, differences in the sample of firms surveyed make it difficult to draw conclusions on the growth of implementation of these practices.

⁷ See Survey of Environmental Protection Expenditures, Statistics Canada (2006)

5.0 DRIVERS OF SUB-SECTOR EMPLOYMENT

Summary

In this section, we review trends in each division of the Environmental Goods and Services Sector. The sections discussed are based on the model explained in Chapter 3 of this report. In the chapter, we focus primarily on identifying the size and growth of employment in each sector.

The greatest growth will occur in the energy-related divisions (energy efficiency, renewable energy generation, alternative fuels, and alternative fuel vehicles). Several of the energy-related sectors have seen double-digit growth over the past decade and will continue to grow. Climate change mitigation has been growing as provinces implement provincial emissions reduction and trading schemes. Further compliance mechanisms could stimulate future growth in both new jobs and new skills in this areas (Figure 11)

High to moderate growth is expected in eco-innovation, protection of biodiversity, environmental health and safety, and environmental remediation. Spending on eco-innovation for energy efficiency is related to energy prices with demand for more efficient processes and products going up when energy prices spike. Protection of biodiversity is a small but growing area, with most provinces developing a biodiversity protection division within the last few years. Accelerated spending on federal contaminated sites will drive high growth in site assessments and site remediation in the next few years. Environmental health and safety employment has grown by 8% per year between the last two census periods (2001 and 2006), driven by regulation and efforts by firms to mitigate exposure to injury litigation.

Figure 11
Future Growth Expectations for Worker Demand in each Environmental Sub-sector

| EMERGING / VERY HIGH GROWTH | MODERATE TO HIGH GROWTH | STABLE GROWTH | FLAT | DECLINING |
|---|--|---|---|--|
| Carbon & climate change mitigation | Environmental remediation | Protection of ambient air quality | Water quality protection | Agriculture (incl. organic farming) |
| Heat savings and energy-efficiency | Eco-innovation and environmental R&D | Water systems design for water supply | Operation of water and wastewater utilities | Sustainable forestry |
| Renewable energy resources (wind, solar, thermal, etc.) | Environmental health and safety | Waste management | Noise and vibration abatement | Conservation of wildlife and fisheries |
| Alternative fuels and alternative fuel vehicles | Protection of biodiversity and landscape | Environmental education | | Minerals management |
| | | Environmental policy and legislation | | |
| | | Environmental communications and public awareness | | |

Growth in some sectors has been flat for some time. These include water quality protection, and water and wastewater utilities. Industry capital expenditures for water quality protection have been flat for the past decade and employment in water utilities has been flat for several decades, with essentially the same number of workers employed in the sector today as were employed 20 years ago. Retirements of these workers, however, will drive replacement demand.

“

The greatest growth will occur in the energy-related divisions – energy efficiency, renewable energy generation, alternative fuels and alternative fuel vehicles, along with climate change mitigation.

”

Employment in the natural resources industries—agriculture, forestry, fishing, and minerals (except oil and gas)—have been in long-term structural decline. Most growth in these areas is in changes in the skills required of workers. There is significant growth in the number of farms using organic farming practices, but the total number of workers employed has declined. There is growth in demand for forestry professionals in the government sector where efforts are made to manage sustainable forests. However, overall the demand for professionals and workers in all parts of the forestry sector are in decline. Employment in the minerals sector is highly cyclical, with employment driven by commodity prices. The industry experiences long-term structural declines in employment as technology and innovation make mines more efficient.

The future growth expectations for worker demand in each environmental sub-sector are discussed in detail in a separate report entitled *Future Growth Expectations for Worker Demand within Each Environmental Sub-Sector*.



6.0 GLOBAL TRENDS

Summary

As various types of environmental pollution have diversified, so have the services to protect environmental quality, driving growth and evolution of the environmental sector. Over the 1990–2000 period, global spending in the environmental industry grew at about 5% per year. More recently (2000–2006), growth in the sector has been stronger, with growth estimates ranging from 7% to 9% growth per year. Forecast estimates for the sector range from a low of 4.5% to a high of 8% growth per year through to 2020. According to the UK Department for Business Enterprise and Regulatory Reform (BERR), the global market for the environmental sector is in excess of £3 billion. Exports of environmental goods are growing at more than twice the rate of total merchandise exports. The US, Canada's largest trading partner, is the largest global environmental market, while Canada's domestic market represents about only 1.7% of the global market for environmental goods and services.

Much of the growth is occurring in the emerging low-carbon sector and in renewable energy. Countries with strong environmental exports, especially in high-growth sub-sectors, are experiencing strong environmental employment growth.

In addition to other factors, environmental regulation plays an important role in this growth. Regulations are always becoming more stringent, which drives demand for environmental products and ongoing innovation in those products. Businesses that anticipate future changes in regulation also play an important role. Notably, global retailer Wal-Mart has required its suppliers to submit carbon footprint assessments as well as plans to reduce their footprint. Corporate policies like these have far-reaching implications for suppliers throughout the global supply chain—driving environmental investments throughout the economy.

6.1 GLOBAL ENVIRONMENTAL EMPLOYMENT GROWTH

Historical Growth

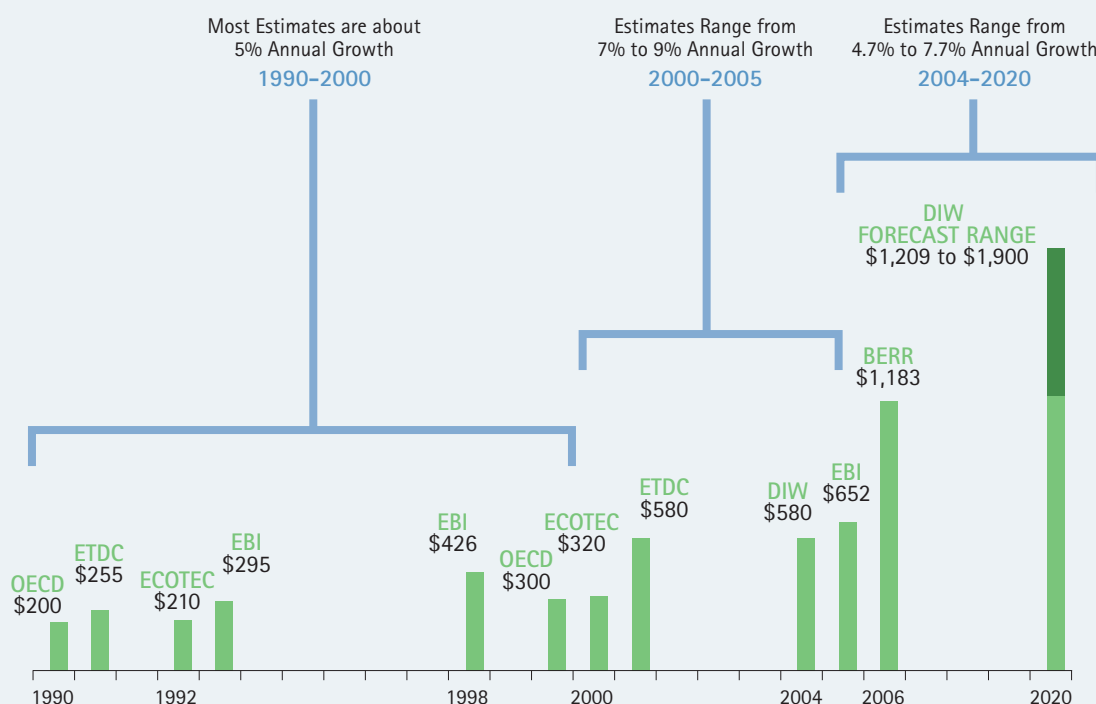
Since the 1990s, there have been several organizations that have developed estimates of the market size of the global environmental industry, including the Organisation for Economic Co-operation and Development (OECD), ECOTEC (www.ecotec.com), Environmental Business International (EBI), Environmental Technologies Development Organization (ETDC), UK Department for Business Enterprise and Regulatory Reform (BERR) and German Institute for Economic Research (DIW Berlin). These estimates vary somewhat in the definitions used to define the environmental sector, which makes it difficult to compare studies. However, looking at their findings over time, we may discern that the industry has likely been growing significantly over the last several years, experiencing something in the range of 5% annual growth over the 1990s and growth in the range of 7% to 9% per year in the period between 2000 and 2005 (Figure 12).

“

The US, Canada's largest trading partner, is the largest global environmental market, while Canada's domestic market represents about only 1.7% of the global market for environmental goods and services.

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Figure 12
Estimated Size of the Global Environmental Goods and Services Market



Sources: OECD, ECOTEC, Environmental Business International (EBI), Environmental Technologies Development Organization (ETDC), UK Department for Business Enterprise and Regulatory Reform (BERR) and the DIW in Berlin. Figures are expressed in US Dollars (Billions)

Recently Released Future Growth Estimates

Looking forward, German policy think-tank DIW Berlin estimates that the global spending on environmental goods and services will grow at an annual average growth rate between 4.7% and 7.7% per year from 2004 through 2020⁸ (Figure 12). In the group's forecast scenarios, the international market for environmental goods and services will reach between \$1.2 trillion USD and \$1.9 trillion USD by 2020. DIW's conservative annual growth estimate of 4.7% growth in demand for environmental goods and services will easily outpace global economic growth, which the group estimates at 3.5% over the 2004-2020 period. Exports of environmental goods and services are expected to grow at two to three times the rate of growth of the national economy, opening strong economic growth opportunities for environmental industry exporters.

DIW estimates that North America will see some of the highest growth in expenditures on environmental goods and services, with annual growth rates between 6.3% and 9.9% per year through to 2020. The group estimates that growth will be somewhat lower in Europe where the environmental industry is larger and more mature, and anticipates high growth of the environmental industry in Asia where demand for environmental goods and services are expected to grow at an annual growth rate of 6.0% to 8.3% over the 2004-2020 period. The growth in the industry opens significant export opportunities for Canadian environmental goods and services firms. Imports of environmental goods in North America (predominately the US) are expected to grow at an annual rate of 8% to 11.5%. Imports are expected to grow most significantly in Asia (annual growth rates in the range of 9.7% to 12.2%), driven largely by growth in demand for environmental services in China (Table 4).

⁸ German Institute for Economic Research (DIW Berlin, September 2009).

Table 4
World Market for Environmental Goods and Services⁹
Average Annual Rate of Growth 2004–2010: High & Low Growth Estimates

| | GDP Growth | Environmental Expenditures | | Environmental Imports (import region) | |
|-------------------|------------|----------------------------|-----|--|-----|
| | | High | Low | High | Low |
| Europe | 2.5 | 5.4 | 2.1 | 6.5 | 3.0 |
| North America | 3.3 | 9.9 | 6.3 | 11.5 | 8.0 |
| Asia | 4.8 | 8.3 | 6.0 | 12.2 | 9.7 |
| Rest of the world | 3.8 | 9.0 | 7.0 | 10.7 | 8.7 |
| World as a whole | 3.5 | 7.7 | 4.7 | 9.4 | 6.4 |

Source: DIW Berlin

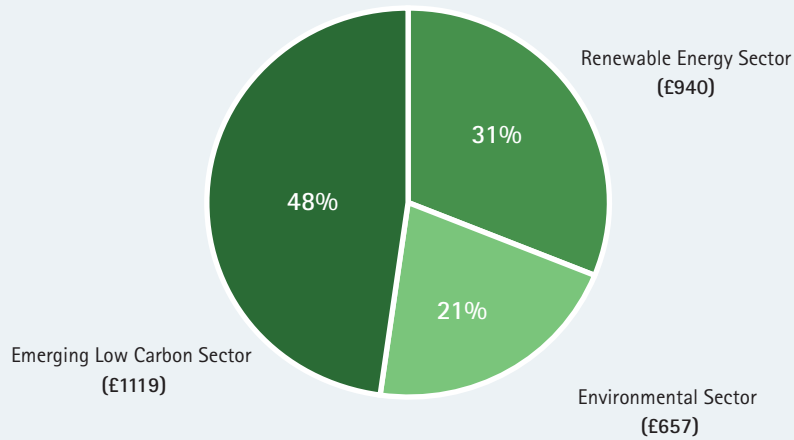
In late 2009, The UK Department for Business Enterprise and Regulatory Reform (BERR) also released estimates of the size and growth of the global environmental industry. Recognizing the importance of the continuing diversification of the environmental sector, the report defines analysis of the market size using a broader industry definition, referred to as the Low Carbon and Environmental Goods and Services Sector (LCEGS Sector). The report highlights the impact of two important recent trends affecting growth in the environmental industry: (1) growing demand for renewable energy, and (2) the emergence of demand for lower carbon emissions. The report found that the traditional environmental sector, valued at £657 billion in 2007/2008 (or about \$1,293 billion CAD), represented only 21% of global market demand. By comparison, renewable energy spending represented 31% of global demand and spending in the emerging low carbon sector represented 48% of all global spending in the LCEGS Sector (Figure 13). Including these two emerging environmental domains, the report estimates the global market at £3,046 billion in 2007/2008 or nearly \$6 trillion CAD, over three times the size of the nominal GDP of Canada.

Notably, the report highlights that traditional environmental goods and services such as waste management services, recycling, water and waste water, air pollution, environmental consultancy and monitoring, and other traditional environmental goods and services represent a smaller and lower growth segment of the total industry. The report expects that the greatest growth will occur in the renewable energy and emerging low carbon sectors, which include all forms of renewable energy (biomass, wind, geothermal, hydro, tidal/wave, and photovoltaic solar energy) as well as alternative fuels, alternative fuel vehicles, carbon finance, energy management, building technologies, carbon capture and storage and additional energy sources.

The report ranks Canada as the 13th largest national market for the Low Carbon and Environmental Goods and Services Sector at over £54 billion (\$106 Billion CAD) (Figure 14). The report further highlights the tremendous export potential of the environmental industry. Canada represents about 1.7% of the global market for environmental goods and services, highlighting significant global demand opportunities for Canadian firms.

⁹ Note that the DIW estimates were made in 2009, taking into account the effects of the global recession on growth of the industry. For more information, see "Global Demand for Environmental Goods and Services on the Rise: Good Growth Opportunities for German Suppliers" German Institute for Economic Research (DIW Berlin, September 2009). Last accessed February, 2010 at: http://www.diw.de/documents/publikationen/73/diw_01.c.334079.de/diw_wr_2009-20.pdf

Figure 13
LCEGS Sector 2007/2008



Source: Low Carbon and Environmental Goods and Services: an industry analysis, (BERR 2009)

Figure 14
National Markets for LCEGS Sector



Source: Low Carbon and Environmental Goods and Services: an industry analysis, (BERR 2009)

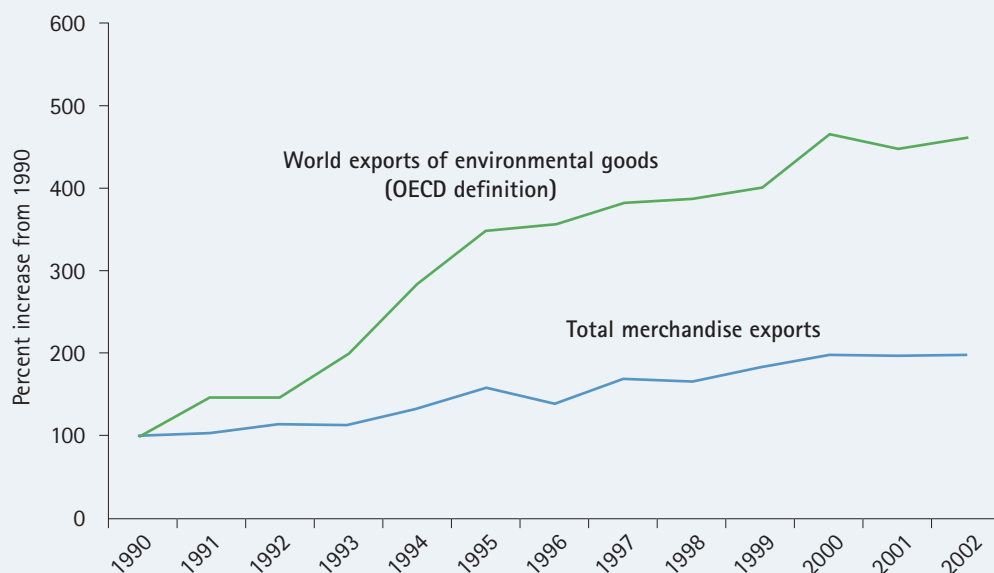
6.2 GLOBAL ENVIRONMENTAL GOODS AND SERVICES EXPORTS

In the late 1990s, the EU Directorate General for the Environment commissioned several country studies to estimate the size of environmental employment in EU member states. The findings of these studies highlighted the economic importance of the industry which, at the time, was estimated to be roughly the same size as the aerospace and pharmaceuticals industries. Recognizing the importance of the environmental industry as driver of new job creation, the EU commissioned a study in 1999 to evaluate the export potential of the eco-industry.¹⁰ This study was quickly followed up by a series of studies that assessed barriers to trade of environmental goods and services and identified policy measures to encourage growth of eco-industry exports and related environmental employment.

Research conducted in 2004 found that world exports of environmental goods significantly outpaced growth in total merchandise exports over the past decade. During the 1990-2002 period, total global merchandise exports essentially doubled. During the same period, exports of environmental goods increased to 4.6 times their 1990 levels. This equates to about 13.5% annual growth, on average (Figure 15).

Germany is the world's largest exporter of environmental goods with over \$38 billion (USD) in exports in 2008. China, the US, and Japan, the world's three largest economies, comprise the 2nd, 3rd, and 4th level positions as environmental exporters. EU members Italy, France, Belgium and the UK are all in the top ten environmental exporters, as are South Korea and Taiwan (Figure 16).

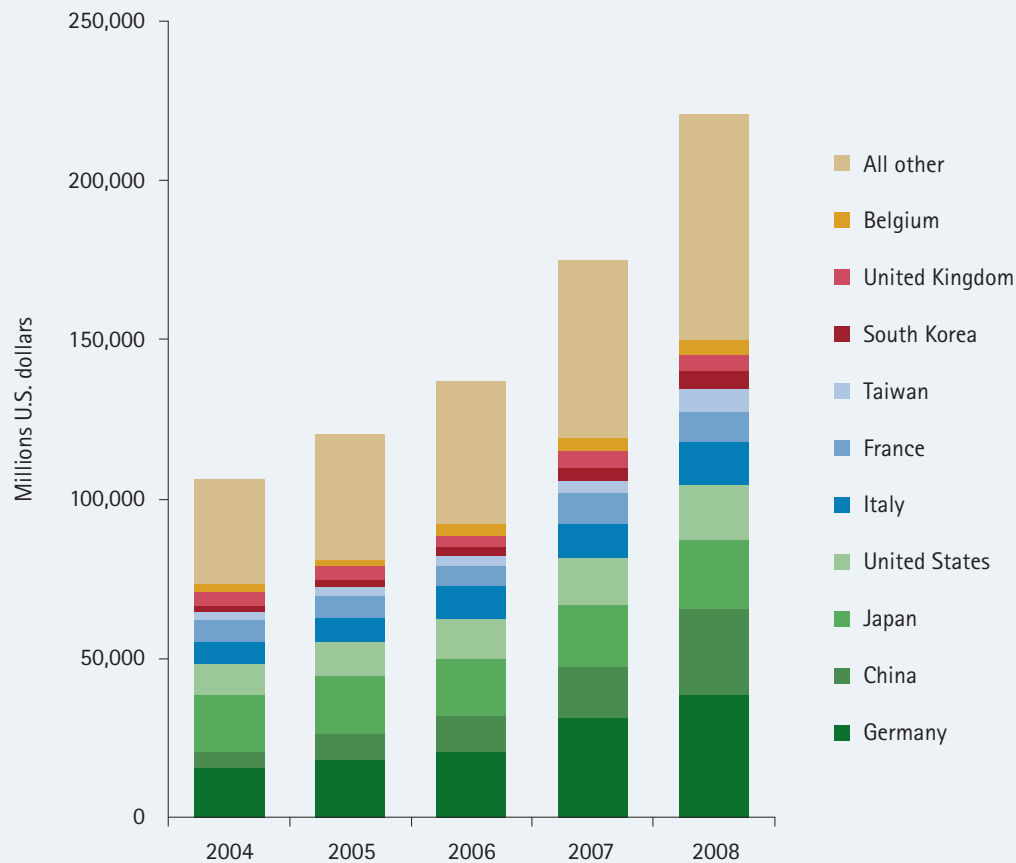
Figure 15
Growth of Trade in Environmental Goods



Source: Bijit, Bora and R. The (2004), "Tariffs and Trade in Environmental Goods", presentation to the WTO Workshop on Environmental Goods, Geneva. Last Accessed February, 2010 at <http://www.oecd.org/dataoecd/63/15/35415839.pdf>

¹⁰ See the EU Eco-Industry's Export Potential (1999) <http://ec.europa.eu/environment/enveco/jobs/index.htm>

Figure 16
Global Exporters of Environmental Goods

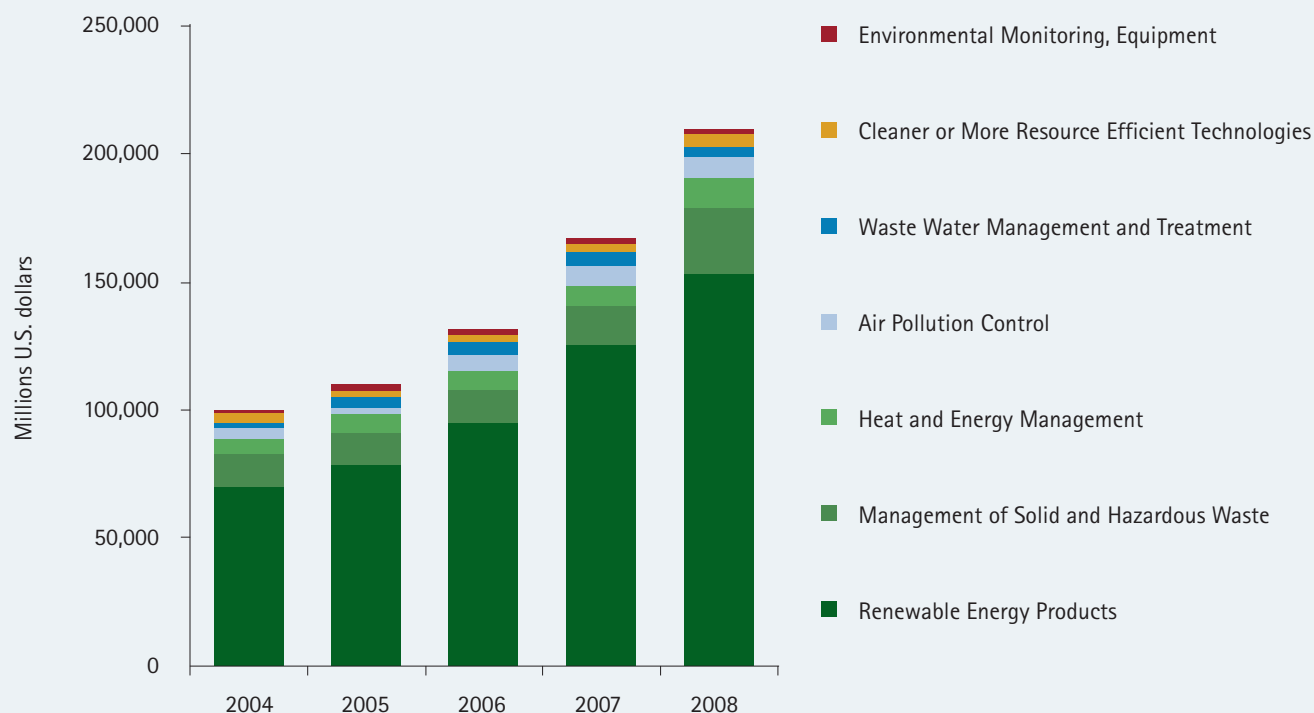


Source: *Major Opportunities and Challenges to US Exports of Environmental Goods*, US Congressional Research Office | Senator Wyden, (December 2009). Report last accessed February, 2010 at http://wyden.senate.gov/newsroom/120809jw_enviro_goods_report.pdf

According to the US Congressional Research Office, most international exports of environmental goods in the last few years have been for renewable energy products, which represent 73% of environmental goods exports. Goods for management of solid and hazardous waste represent 12% of exports, and heat/energy management goods represent 5%. Environmental monitoring, waste water treatment, air pollution control, and goods with cleaner technologies represent a smaller percentage of exports (Figure 17).

It should be noted that the figures from the Congressional Research Office are based on trade of goods only (excluding trade of services) and that the goods counted in the estimates were limited to those for which an environmental use could be identified in trade statistics. This may result in under-counting of some environmental goods.

Figure 17
Global Exports of Environmental Goods



Source: *Major Opportunities and Challenges to US Exports of Environmental Goods*, US Congressional Research Office | Senator Wyden, (December 2009). Report last accessed February, 2010 at http://wyden.senate.gov/newsroom/120809jw_enviro_goods_report.pdf

6.3 GLOBAL TRENDS AFFECTING ENVIRONMENTAL EMPLOYMENT

Total global environmental employment is difficult to measure because no global data collection systems currently exist. While several studies have made estimates of environmental employment for specific countries and regions based on economic models, no single authoritative estimate exists at a global level. In the EU, a recent 2009 report by the EU Directorate General for the Environment found that environmental employment in Europe has grown to over 3.4 million workers in 2008.¹¹

The same report finds that environmental employment has been growing in the EU at an annual average growth rate of 6.98% from 2000-2008. The greatest growth in the sector in Europe has been in renewable energy at over 16% growth per year. The recycling sector in Europe has also experienced double-digit employment growth, largely due to so called 'take-back' legislation requiring producers to take responsibility for the costs of recycling and disposal of their products once they have reached the end of their useful life. Air pollution is the only industry to have declined in employment over the 2000-2008 time period in Europe, due largely to the maturity of this industry (Table 5).

¹¹ See Report on Competitiveness of the EU Eco-Industries 2009. Last accessed February, 2010 at http://ec.europa.eu/environment/enveco/eco_industry/pdf/report%202009_competitiveness_part1.pdf

Table 5
Environmental Employment In the EU

| Environmental Sub-sector | Employment (2000) | Employment (2008) | Employment: Annual Growth Rate | Annual Market Growth Rate (Corrected for Inflation) |
|--------------------------|----------------------|----------------------|--------------------------------------|---|
| Waste management | 844,766 | 1,466,673 | 7.14% | 5.89% |
| Water supply | 417,763 | 703,758 | 6.74% | 4.04% |
| Waste water management | 253,554 | 302,958 | 2.25% | 3.62% |
| Recycled materials | 229,286 | 512,237 | 10.57% | 13.12% |
| Others | 129,313 | 193,854 | 5.19% | 6.23% |
| Renewable energy | 49,756 | 167,283 | 16.37% | 17.65% |
| Air pollution | 22,600 | 19,067 | -2.10% | 3.10% |
| Biodiversity | 39,667 | 49,196 | 2.73% | 5.29% |
| Soil & Groundwater | 14,882 | 18,412 | 2.70% | 3.02% |
| Noise Vibration | 4,176 | 7,565 | 7.71% | 7.76% |
| Total | 2,005,764 | 3,441,102 | 6.98% | 6.69% |

Source: Competitiveness of the EU Eco-Industry

BERR estimates environmental employment in the UK in 2007/2008 at about 800,000 workers, approximately 2.9% of total UK employment. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety estimates environmental employment in Germany at 1,136,600 in 2006¹², representing about 2.8% of employment in Germany. ECO Canada estimated that there were about 530,400 workers employed in the environmental industry in Canada in 2007, or about 3.2% of all workers employed in Canada.

Growth Drivers

A number of international trends are influencing growth in the sector.

- (1) At the most basic level, population growth has placed increasing demands on natural resources and energy while generating increasing volumes of waste. The UN estimates that the global population will reach 9.15 billion by 2050, a 37% increase over the estimated global population of 6.7 billion people in 2010. Economic growth associated with the population increases have driven up commodity prices and costs of energy in recent years, prompting firms to develop methods of reducing materials and energy inputs as a way of managing production costs.
- (2) Within the energy sector, ongoing depletion of oil and gas reserves has been a concern, as has the pollution associated with the production and use of these fuels. This concern continues to drive demand for pollution prevention processes as well as growing demand for development of renewable energy resources.
- (3) International agreements to reduce greenhouse gas emissions, such as the Kyoto protocol, also drive growth in the demand for environmental goods and services. These agreements have prompted countries to pass a diverse array of legislative measures intended to reduce the level of greenhouse gas emissions.
- (4) Although a regulated carbon reduction market has not been legislated at national levels in the US and Canada, many corporations have developed corporate sustainability or environmental management plans in anticipation of such legislation. These plans also respond to demand for these practices by shareholders or consumers. For instance, through the firm's Sustainability 360 approach, Wal-Mart has required its suppliers to submit a verified carbon footprint measurement and to identify how they will reduce their carbon footprint. This business practice has far-reaching global impacts on Wal-Mart's suppliers which are dispersed along global supply chains.

¹² See Umweltwirtschaftsbericht 2009 (Environmental Industry Report 2009), Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

“

Countries wishing to remain competitive in the global eco-industry are investing heavily in environmental research and development, commercialization of environmental technology, and development of a highly skilled labour force to maintain or increase their global market share.

”

- (5) It should also be noted that technology is an important enabler of eco-innovation and development of environmental goods and services. Germany and California, for instance, have highly developed green technology sectors that have helped them experience growth in exports of environmental goods and services.
- (6) As demand and international trade in environmental goods and services grows, competition for international trade is intensifying. As noted by the EU Directorate General for the Environment, “The EU eco-industry has a competitive edge globally, in large part due to the early adoption of environmental policies and regulations and the fact that earlier than elsewhere Europe was confronted with the negative effects of environmental pollution.” The EU’s competitive advantage is being challenged by China where environmental technology development has resulted in China gaining an increasing share of the environmental exports market. Countries wishing to remain competitive in the global eco-industry are investing heavily in environmental research and development, commercialization of environmental technology, and development of a highly skilled labour force to maintain or increase their global market share. These investments have become essential to countries as they compete in the global eco-industry.



7.0 SOCIAL, ECONOMIC AND POLITICAL TRENDS

The trends that have been driving growth in the environmental sector will likely continue to do so in the future. In addition to these established trends, there are emerging trends as well as uncertainties that will impact growth of employment in the sector. In this section, some uncertainties that may have significant impacts on the future growth of the sector are explored.

Uncertainties in the future can be grouped into three main categories: (1) uncertainties on future international environmental agreements, (2) uncertainties in future regulatory and policy design, and (3) uncertainty in the level of future integration of the environmental sector into all industries. Future international agreements and regulations have the potential to introduce dramatic changes in employment demand in the sector. Increased integration of the sector into all industries is likely to continue growing gradually over time as parts of the environmental sector become difficult to distinguish from traditional industries.

International Environmental Agreements

At the time of writing of this report, the UN Global Climate Summit in Copenhagen has concluded without providing clear direction on the future of international climate change agreements. Essentially, no substantive binding commitments to actions to mitigate climate change were made, and the future of such agreements is uncertain, as is Canada's participation.

In a series of key informant interviews for this study, carbon emission reductions were seen by every participant as a key growth area for the environmental sector. Participation in future climate change agreements will accelerate growth in this sector. However, the probability and timing of such an international agreement occurring in the future is uncertain.

Changes in Regulatory Mechanisms

It is estimated that developed countries spend roughly the same percentage of GDP (2 %) on environmental protection.¹³ This is based on similar legislation and regulations on pollutants. Countries differ, however, on the regulatory mechanism used for implementation and enforcement of this legislation. In the EU, 'take-back' mechanisms are in place to support growth in the recycling industry. Producer 'take-back' is a product and waste management system in which manufacturers are financially responsible for the environmentally safe management of their products when they are no longer useful to consumers. Pollution permitting is another mechanism in use in the EU which has driven demand for integrated environmental impact assessments (air, land, and water) in order to obtain pollution permits. Voluntary agreements and incentive structures are a more commonly-used enforcement method in the US and Canada.

These choices in regulatory design and methods have impacts on the growth of sub-sectors of the environmental sector and future changes to this regulation can affect growth.

Integration of the Environmental Sector into Traditional Industries

Environmentally sustainable business practices have been implemented by many firms. As environmental management systems become more common in businesses and governments, the distinction between environmental industries and all other industries is being blurred. Traditional manufacturing businesses are increasingly employing environmental technologies to add value to their products or reduce costs. Convergence between eco-industry and conventional manufacturing is taking place, resulting in a transition from eco-friendly products from an alternative to the standard. This trend is making the boundaries of the environmental goods and services industry more difficult to discern. The industry structure and form for green technology is uncertain. Some experts view the trend in eco-innovation as one that will independently generate employment growth, while other experts view the integration of environmental business practices as evidence that this segment of the environmental sector is dissipating into an integrated characteristic common to all business practice.

¹³ See Study on the Competitiveness of EU Eco-Industry

8.0 DRIVERS OF GROWTH IN CANADA'S ENVIRONMENTAL SECTOR

Summary

The Canadian environmental sector represents about 3.2% of employment in Canada¹⁴, making it larger than the nation's aerospace or pharmaceutical industries. The dynamics that affect growth of the sector are as diverse as the sector itself. At the sub-sector level, unique drivers can play an important role in shaping growth and these trends are discussed in the last chapter which covers each sub-sector individually. This chapter focuses on the macro-level factors that shape the sector. At a macro level, the main drivers that are affecting growth are:

- **Environmental policy and regulation** including direct government spending on the environment, environmental regulation and incentives to encourage environmental investment
- **Financial and economic drivers** such as high energy costs or access to developing markets
- **Consumer demand** for environmentally-friendly products and practices
- **Environmental management practices** in the business sector such as lifecycle assessment, green purchasing policy and other environmental business practices

These drivers are inter-related. For instance, changes in consumer attitudes affects purchases but also affects voting behaviour, which could have an impact on environmental policy. Changes in policy and regulation can result in higher costs for businesses that pollute, increasing the financial incentive for firms to invest in cleaner processes. Among these drivers, policy changes, particularly at the provincial level, and economic drivers are the main drivers influencing growth of the sector. It is difficult to determine the exact extent to which a change in business practices and consumer attitudes affects the environmental sector. These drivers all are moving in the same direction—increasing the demand for environmental goods and services.

In addition to drivers, there are two key trends that are shaping the way in which the sector grows. These include:

- (1) **A trend toward pollution prevention**—this trend is blurring the lines between a traditionally well-defined environmental sector and environmental protection practices that are integrated throughout industries that are not traditionally environmental, per se.
- (2) **A trend toward diversification**—new environmental markets such as renewable energy or carbon emission reduction give rise to new types of worker demand.

Changes to these trends and the key drivers will have significant impacts on future growth in the sector. In particular, rising energy costs and the rise of a market for carbon mitigation each have the potential to drive significant investment across the sector.

Germany, the UK, the US, and other countries have increasingly adopted policies that promote growth of the environmental sector as a source of exports and an engine of job creation. Investments in tracking and analysis of the sector by economic development organizations in these countries show how the industry is increasingly viewed as a source of economic growth rather than a constraint to growth of other industries. These changes have given rise to venture capital and green technology commercialization funds that seek to capture environmental sector growth opportunities. This shift has contributed to global investments in clean technology venture investment, which reached \$8.4 billion in 2008, up 38% from \$6.1 billion in 2007, despite the global recession and US credit crisis.¹⁵

¹⁴ ECO Canada 2007 Profile of Canadian Environmental Employment

¹⁵ See CleanTech (2008). Last accessed February, 2010 at <http://cleantech.com/about/pressreleases/010609.cfm>



8.1 POLICY AND REGULATION DRIVERS

Legislation and regulations are perhaps the most easily identified driver of growth in the environmental sector. There are four ways in which public policy has affected growth in the environmental sector:

- (1) Direct government spending on environmental services
- (2) Employment demand resulting from actions taken to comply with environmental legislation and regulations
- (3) Policy compliance has resulted in technology related eco-innovation which has made Canadian firms competitive for exports of environmental goods and services
- (4) Tax credit and other forms of policy-based financial incentives have enabled investment in environmental goods and services

Ongoing direct government spending on the environment offers a level of stability to the environmental industry. Changes to environmental regulations, which typically become more stringent over time, have the greatest potential for affecting growth in the environmental industry. Depending on the type and level of regulatory change, the impact on employment in the sector can be large or small.

Several studies have shown that the use of incentives for environmental protection can result in lower costs for pollution control when compared to traditional environmental compliance methods.¹⁶ While incentives do not require environmental policy compliance, they do promote innovation and the rise of new markets. Competing products and services for environmental protection are developed in the marketplace as a result, driving ongoing improvements. Incentives such as research and development tax credits further encourage innovation. These innovations make the national markets more flexible, and ongoing technology development makes Canadian products more competitive internationally. Direct government spending on the environment offers a level of stability to the environmental industry.

¹⁶ See Cost Effectiveness and Environmental Effects of Incentive Systems; EPA (2001) Last accessed February, 2010 at [http://yosemite.epa.gov/ee/epa/eeermfile.nsf/vwAN/EE-0216B-04.pdf/\\$File/EE-0216B-04.pdf](http://yosemite.epa.gov/ee/epa/eeermfile.nsf/vwAN/EE-0216B-04.pdf/$File/EE-0216B-04.pdf)

Table 6
Canadian Government Revenues, Expenditures,
and Environmental Expenditures 2005-2009

| | (in \$ Millions) | | | | | |
|---|------------------|---------|---------|---------|---------|----------------------------|
| | 2005 | 2006 | 2007 | 2008 | 2009 | Annual Growth 2005-2009 |
| Total Revenue | | | | | | |
| (Federal, Provincial, Territorial, Local) | 499,676 | 533,031 | 561,238 | 600,575 | 585,799 | 4.1% |
| <i>Growth</i> | | 6.7% | 5.3% | 7.0% | -2.5% | |
| Total Expenditures | | | | | | |
| (Federal, Provincial, Territorial, Local) | 487,365 | 516,669 | 545,533 | 580,922 | 594,594 | 5.1% |
| <i>Growth</i> | | 6.0% | 5.6% | 6.5% | 2.4% | |
| Environmental Expenditures | | | | | | |
| (Federal, Provincial, Territorial, Local) | 11,903 | 13,158 | 14,420 | 15,516 | 16,933 | 9.2% |
| <i>Growth</i> | | 10.5% | 9.6% | 7.6% | 9.1% | |
| Environmental Expenditures | | | | | | |
| (Provincial, Territorial, Local) | 10,215 | 11,687 | 12,581 | 13,658 | 14,756 | 9.6% |
| <i>Growth</i> | | 14.4% | 7.6% | 8.6% | 8.0% | |
| Environmental Expenditures | | | | | | |
| (Provincial, Territorial) | 1,822 | 2,009 | 2,314 | 2,506 | 2,827 | 11.6% |
| <i>Growth</i> | | 10.3% | 15.2% | 8.3% | 12.8% | |

8.1.1 EMPLOYMENT DEMAND AS A RESULT OF DIRECT CANADIAN GOVERNMENT SPENDING

Direct government spending on environmental services influences growth in the environmental sector. From 2005-2009, government spending on the environment has grown at an annual average growth rate of 9.2%, significantly faster than overall government expenditures which grew at 5.1% per year. The majority of direct environmental spending occurs at the local government level, which represents roughly 70% of all government direct spending on environmental services.

These figures indicate that government spending on the environment has continued to grow throughout the recession in 2008 and 2009. Total consolidated government revenues declined in 2009 by 2.5%, following several years of revenue growth in excess of 5%. Total government expenditures rose in 2009, with environmental expenditures representing 2.8% of all government expenditures. Total expenditures on environmental services continued to outpace total government expenditures (in 2009, 9.1% annual growth compared to 2.4% respectively). Provincial government spending on environmental services experienced the most growth in 2009 with a 12.8% increase (Table 6).

8.1.2 EMPLOYMENT DEMAND DRIVEN BY POLICY COMPLIANCE ACTIVITIES

Policy and regulatory measures taken by governments are strongly tied to growth of the environmental sector as private sector firms make investments to comply with federal, state/provincial, and local regulations. The federal and provincial governments in Canada both have jurisdiction over environmental matters. Municipal governments are responsible for solid waste management, water and sewage systems, and noise issues, but also regulate use of certain substances. Regulations at each level of government often overlap, making compliance with environmental regulations complex. Compliance activities often require a diverse set of specialized workers, including:

- Attorneys and policy analysts which specialize in environmental law
- Chemists and natural sciences professionals who perform environmental consulting services to insure compliance with regulations
- Emissions testers, verifiers, and similar technicians who assist with environmental compliance activities
- Land use and planning officials who develop and enforce environmental policy
- Mechanical, electrical, chemical, and environmental engineers who develop production systems that are able to meet environmental regulatory guidelines, and
- Other specialists

This set of workers in the environmental sector is dispersed throughout manufacturing industries, especially those which are relatively heavy emitters of pollutants. They are also employed in the professional, technical, and scientific services industries.

Compliance with public policy regulations also drives demand for environmental goods made by Canadian manufacturing firms. Environmental manufacturers like General Electric benefit from demand for environmental goods. This in turn drives demand for manufacturing engineers and other professionals who apply specialized environmental knowledge and skills in the manufacturing process.

Climate Change and Greenhouse Gas Control

Climate change regulation is an emerging issue that will have significant demand for skills related to measurement of carbon footprints or water-use footprints as well as various forms of carbon finance. The Province of Alberta was the first North American jurisdiction to legislate the regulation of greenhouse gas emissions from large industrial emitters. The Provinces of British Columbia, Manitoba, Ontario and Québec have committed to participating in the Western Climate Initiative along with seven American States. Each of these regimes place a cap on permitted emissions (in Alberta, based on emissions intensity) and permit at least some degree of emissions reduction credit trading to achieve compliance.

The federal government has also proposed climate change legislation involving a proposed cap and trade system. Like Alberta, it would be based on emissions intensity. However, more recent statements from the federal government have suggested an intention to adopt an approach similar to that generally outlined by the Democrats in the United States. Until more details are disclosed on the US approach, it is unclear what approach will be taken by the Canadian government.

Federal Environmental Regulation

There are several pieces of federal legislation that have driven growth in the environmental sector. The legislation itself, as well as its implementation by regulatory bodies, has undergone numerous changes over time, contributing to ongoing need for firms to adjust and respond. In this section, we introduce the main segments of federal environmental legislation, in their most current form.

At the federal level, the *Canadian Environmental Protection Act* of 1999 (CEPA 1999) is Canada's federal environmental legislation aimed at preventing pollution and protecting the environment and human health. The CEPA is perhaps the most influential federal legislation driving demand for an environmental labour force. The CEPA states that the legislation is intended to contribute to sustainable development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The Act essentially makes pollution prevention the cornerstone of national efforts to reduce toxic substances in the environment. The Act has contributed to the trend toward pollution prevention by ensuring that most harmful substances are phased out or not released into the environment in any measurable quantity. It regulates toxic substances across all stages of a product's lifecycle, from research and development through to production, marketing, use, and disposal.

In addition to the CEPA, there is other federal legislation governing environmental protection. Examples are¹⁷: the *Fisheries Act*, the *Transportation of Dangerous Goods Act*, the *Canadian Environmental Assessment Act*, the *Canadian Criminal Code*, the *Environmental Enforcement Act*; and *Brownfields Regulation*.

Provincial Environmental Regulation

Canada's ten provincial and three territorial governments each have legislation governing environmental quality. Key experts interviewed for this study indicated that changes in provincial environmental regulation had potential for dramatically impacting environmental labour demand. Each province is active in updating and changing environmental legislation and regulatory frameworks. This results in constant demand for environmental professionals of all sorts to support development, enforcement, and compliance with provincial environmental legislation.

The forms of legislation enacted by provinces are similar to those enacted at the national level. However, specific regulations and requirements vary.

8.1.3 POLICY COMPLIANCE AS A DRIVER OF ENVIRONMENTAL INNOVATION

As mentioned previously, compliance with CEPA's pollution prevention regulations has driven significant investment in product and process eco-innovation. Evidence of this is found in Statistics Canada's most recent survey of environmental expenditures in the business sector (2006). In the survey, 36% of firms introducing energy efficiency innovations indicated that they did so to meet regulatory requirements. While evidence of the connection between environmental policy and eco-innovation is limited, the connection has been observed and has informed the development of environmental policy in the EU.

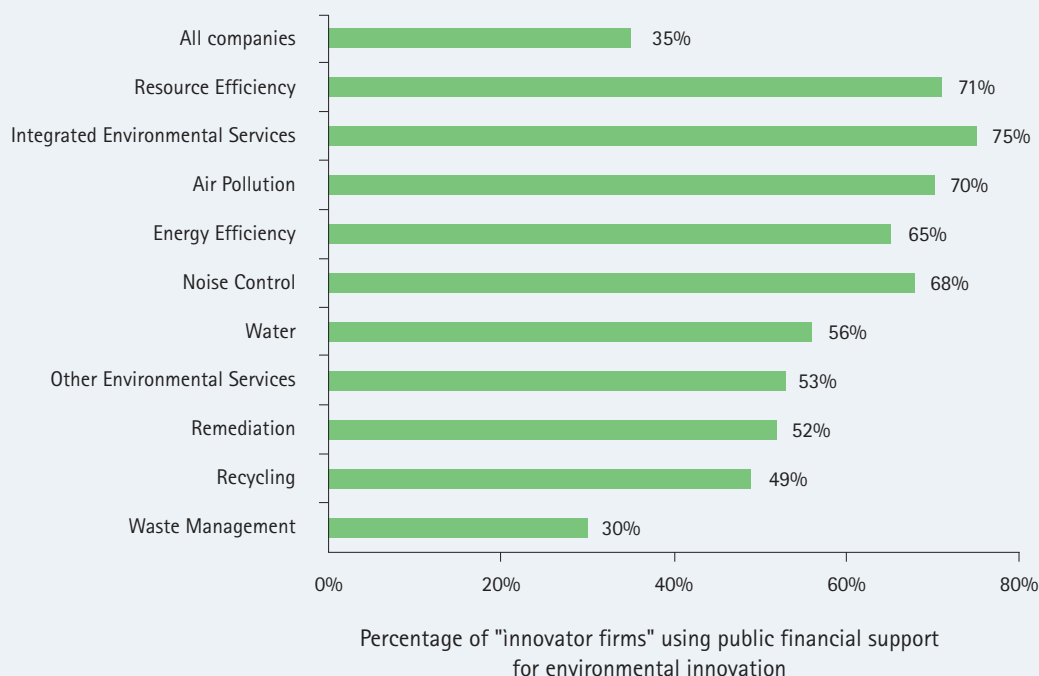
Germany in particular, as the world's largest exporter of environmental goods, serves as a good case study of the connection between policy and environmental research and development investment. Environmental regulation for climate change mitigation and reduction in greenhouse gas emissions is advanced in Europe. A survey in Germany by the Mannheim Innovation Panel (MIP) in 2003 found that more than one in five innovative companies in Germany indicated that their innovation was triggered by laws and regulations. The survey further found that environmental innovations in response to regulations occurred in a wide variety of industries. Advances in pro-environmental regulations in the EU has arguably given the region a technological advantage for environmental goods and services, and has likely contributed to making Germany the world's largest exporter of environmental goods.

8.1.4 POLICY INCENTIVES AS A DRIVER OF ECO-INNOVATION

Policy drivers affecting growth in the environmental industry are not limited to regulation. Policy incentives, whether through direct financial support or through the use of tax credits, has been an important enabler of growth in the environmental industry. The 2009 Environmental Industry Report by Germany's Environment, Nature Conservation and Nuclear Safety Department noted that firms introducing environmental innovations did so in response to regulatory requirements, but more so as a result of government financial incentives.

¹⁷ Legislative summaries were provided by Osler's "Doing Business in Canada Environmental Legal Guide". Last accessed February, 2010 at: <http://www.osler.com/resources.aspx?id=8745>.

Figure 18
Firms Taking Advantage of Public Financial Support
for Environmental Innovation



Source: ZEW: Mannheim Innovation Panel Survey 2005; UMFIS database - Calculations by the ZEW.

In the German Mannheim Innovation Panel Survey (2005), 16% of all firms and 35% of "innovator firms" (firms investing in any type of innovation) indicated that they took advantage of public financial support for environmental innovation. Resource efficiency, environmental services, and air pollution made the most use of public financial support (Figure 18). Most firms receiving financial support obtained it through federal programs.

There are a variety of such financial incentive programs in existence in Canada. An extensive directory of federal and private/non-profit financial incentive programs is available on the CanmetEnergy portal.¹⁸ These include: Sustainable Development Technology Canada, the Scientific Research and Experimental Development (SR&ED) Tax Incentive Program, the Environmental Technology Advancement Corporation – WEST, the Canada Foundation for Innovation (CFI), the Centre of Excellence for Energy, the ecoENERGY Technology Initiative, the ecoENERGY for Renewable Power Program, the ecoENERGY for Renewable Heat Program, the ecoENERGY Retrofit Program, and the Green Municipal Fund.

In addition to the programs mentioned above, Environment Canada offers several incentives including grants, rebates, discounts, and other incentives available to consumers and businesses to encourage them to use less energy, switch to renewable energy, and produce less waste. A variety of other programs are available, all of which contribute to growth in eco-innovation.

¹⁸ See the following link for more information (last accessed February, 2010)
http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/about_us/ottawa/funding/incentive_program.html.

8.2 FINANCIAL AND ECONOMIC DRIVERS

8.2.1 EFFICIENCY & COSTS SAVINGS

Financial and economic drivers are perhaps some of the most important types for investment in environmental goods and services, especially as related to energy efficiency. In the 2006 Survey of Environmental Protection Expenditures, firms were asked which drivers influenced them to adopt technology to improve energy efficiency. "Sufficient return on investment" was seen as the top driver for investment, with 77% percent of firms indicating it as a key driver (Figure 19). This finding suggests that the savings from installation of energy efficiency investments are alone enough to drive investment in industry. Return on investment far exceeded corporate policy, government regulations, public relations, or other drivers of energy efficiency investment.

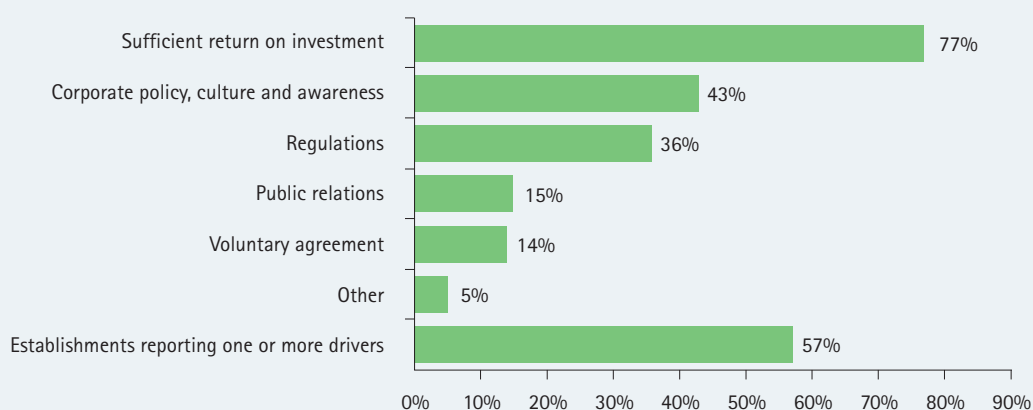
8.2.2 ACCESS TO DEVELOPING MARKETS

As noted earlier in this report, the global environmental industry has grown significantly over the last few decades and is expected to grow significantly over the next decade. Much of this growth will occur in the US, Canada's largest trading partner, and in developing markets. The financial opportunity to access and benefit from these growth markets is obviously a key driver of growth for Canada's eco-industry.

8.3 OTHER ECONOMIC AND ENVIRONMENTAL LINKAGES

There are many industries linked to environmental quality. Canada's tourism and growing eco-tourism industries are particularly dependent on environmental quality. Agricultural, fishing, and forest resources are also dependent on environmental quality to sustain these industries. It has been recognized at all levels of government in Canada that much of Canada's future population growth will occur through immigration. Canada's high quality of life and pristine landscapes are perhaps one of the country's greatest assets in attracting the world's brightest and most talented workers to relocate to Canada. While these linkages are not drivers of growth in environmental employment, they are important considerations affecting policy-making decisions.

Figure 19
Did Your Firm Invest in Energy-Efficient Technology?



Source: 2006 Survey of Environmental Protection Expenditures

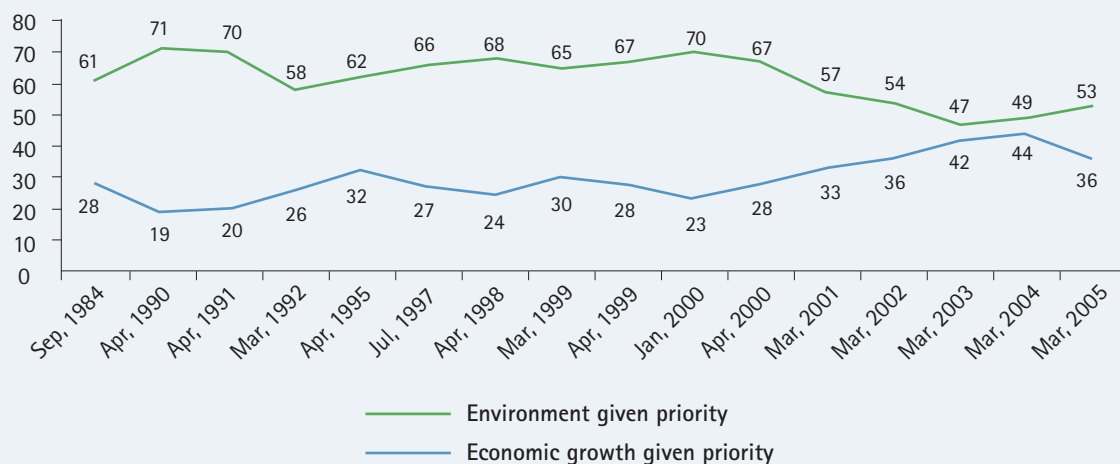
8.4 CONSUMER AND BUSINESSES-TO-BUSINESS DEMAND

Consumer Attitudes

Public attitudes toward protection of the environment have been the basis for much of the environmental legislation enacted in the past 50 years. A longstanding consumer concern for the environment supports ongoing government support for environmental protection regulation. There are indications that environmental concerns are affecting consumer purchasing decisions and that a growing number of consumers are actively seeking out environmentally friendly or green products and services. These preferences are driving integration of sustainable business practices and eco-innovation in essentially every industry. A trend toward 'buying green' has influenced the way that firms develop, market, package, and provide for future disposal of their products. This trend indirectly drives demand for environmental skills for managers and specialists throughout the workforce.

Investigation of consumer attitudes toward the environment and demand for eco-friendly products highlighted a mixed set of findings. Clearly, consumer awareness and concern for the environment has been strong for a long time. Consumer surveys conducted by Gallop in the US since 1984 have asked consumers which should be given preference—protection of the environment or economic growth. Since 1984, there has not been a period where the economy was given preference over the environment, although concern for the economy over the environment increased somewhat following the 2001-2002 recessionary period (Figure 20).

Figure 20
Environment vs. Economy: Which should be given priority?

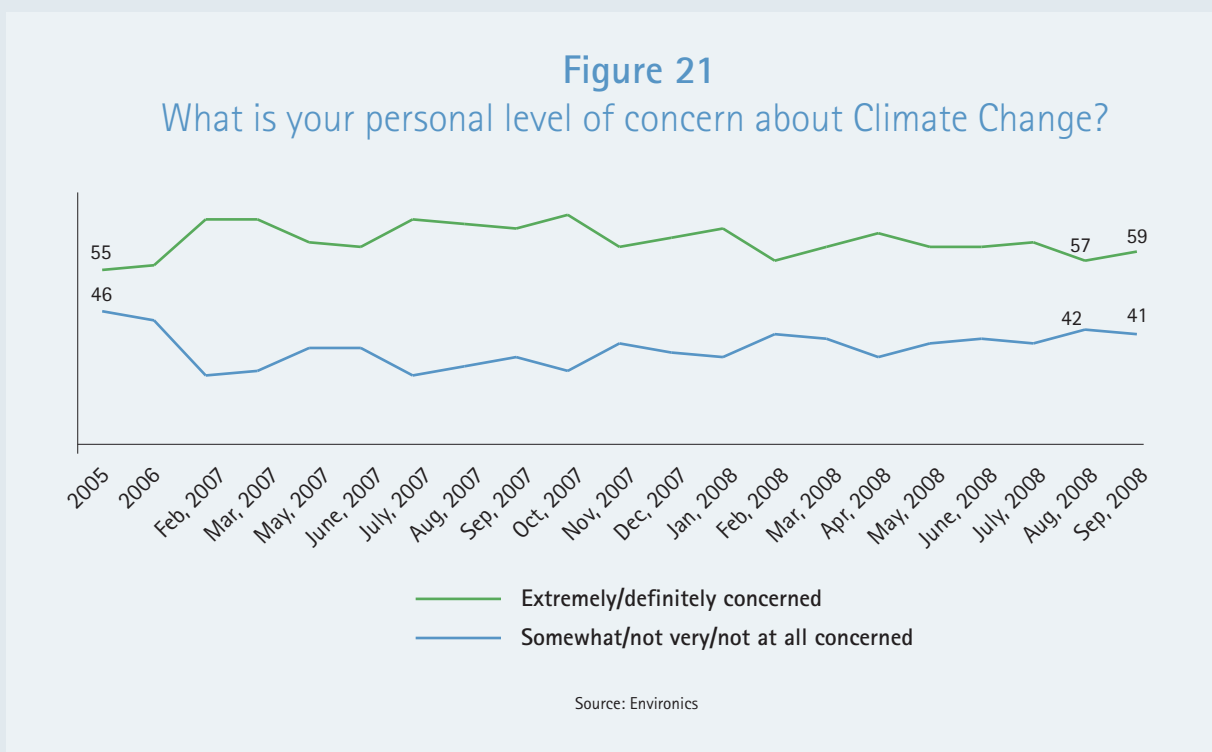


Source: Gallop USA

Recent surveys in Canada conducted by Environics have similar findings—over the last few years, consumer attitudes toward the environment have been relatively stable. Beginning in 2005, Environics asked Canadians about their level of personal concern about climate change. In 2005, about 55% of Canadians indicated that they were strongly or extremely concerned about climate change. This figure rose only slightly between 2005 and 2008, when 59% of Canadians indicated strong concern for climate change (Figure 21).

Google Trends provides analytics on the volume of Google searches for search terms and in news references. Analysis of similar search terms such as “go green” and “green products” revealed that the search terms are relatively new, beginning to appear in search criteria around the end of 2006.

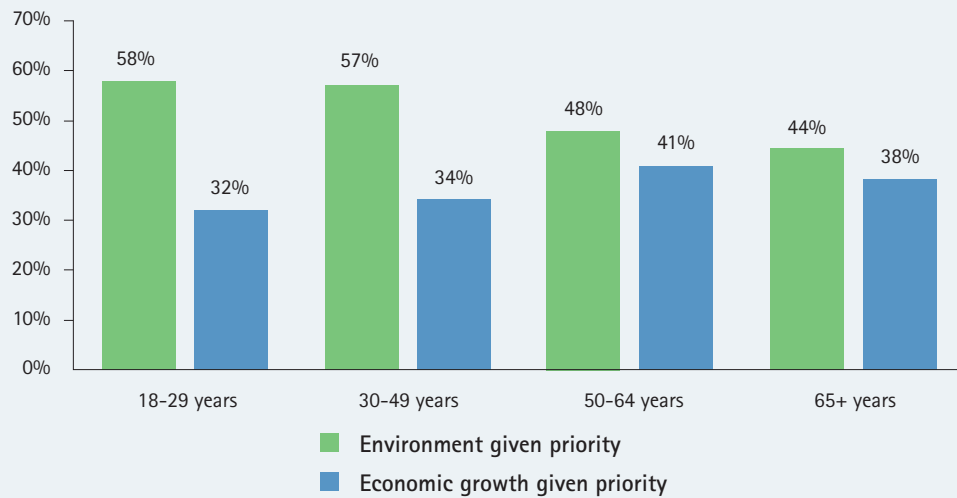
Notably, the search term “buy green” has seen strong growth in search volume since the beginning of 2007. The rising use of “buy green” as a search term suggests that consumer awareness of environmentally-friendly or green products is likely increasing, and that a growing number of consumers are actively seeking out environmentally-friendly products and services (Google Trends).



It is interesting to note the age demographics of consumer attitudes. A 2005 Gallop survey in the US revealed that younger people are generally more likely to view the environment as more important than economic concerns. Over the long term, it is likely that priority for environmental concerns will drive ongoing demand for environmental services due to an aging population (Figure 22).

Increased consumer interest in purchasing of environmentally-friendly products suggests that consumers may have been willing to pay premiums for certain eco-industry products, such as green energy and eco-friendly buildings. As a result, some businesses with environmental business practices have been able to profit—despite higher costs. As Canada and the world emerge slowly out of the global recession, levels of savings among consumers have been rising. Frugal consumers may be less willing in the future to pay a premium for environmental products or services.

Figure 22
Environment vs. Economic growth by age



Source: Gallop USA

It should be noted, however, that there is not always a price premium associated with environmentally friendly products. Some eco-friendly products are equal in price to alternatives. The degree to which these products can be price-competitive will to some extent determine the growth of demand for green products. It is difficult at this point to determine the level of impact that such a trend may have on growth in the environmental industry.

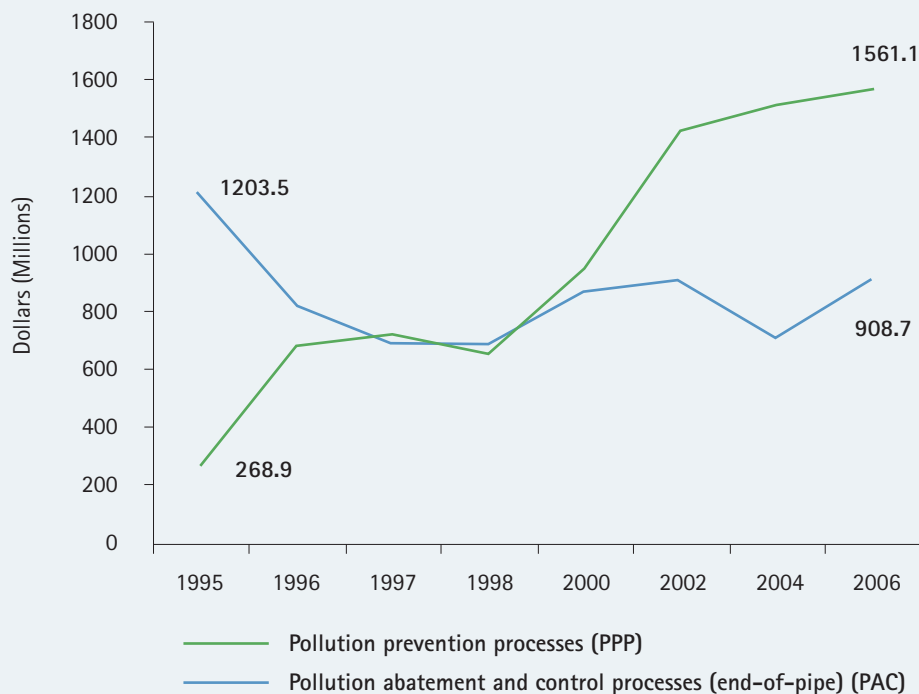
Business Demand

In the business sector, green purchasing policy is influencing demand for eco-innovation in goods and services, as business purchasing managers assign more weight toward climate impacts in their purchasing decision criteria. Green purchasing practices have been in place in public sector purchasing criteria for some time. The same is also occurring in the private sector. Global retailer giant Wal-Mart requires that suppliers provide a carbon footprint measurement for the lifecycle of goods sold through Wal-Mart stores. Wal-Mart suppliers must also present a plan to reduce their carbon footprint over time.

“
Global retailer giant Wal-Mart requires that suppliers provide a carbon footprint measurement for the lifecycle of goods sold through Wal-Mart stores.
”

As of 2006, 7% of firms surveyed in the Survey of Environmental Protection Expenditures indicated that they used a green procurement policy. Larger employers were more likely to use green procurement practices (24% of employers with 500-999 employees and 17% of very large employers with over 1000 employees used a green procurement policy). Only 6% of small firms with less than 100 employees had a green procurement policy.

Figure 23
Capital Expenditures on Pollution



Source: Statistics Canada Survey of Environmental Protection Expenditures

8.5 TREND TOWARD POLLUTION PREVENTION

From 1995 to present, there has been a gradual trend toward investment in pollution prevention processes as a preferred method of pollution control. Capital expenditures on so called "end-of-pipe" pollution abatement processes have declined from \$1.2 billion in 1995 to about \$909 million in 2006. By comparison, capital expenditures on pollution prevention processes have grown from about \$269 million in 1995 to \$1.56 billion in 2006, an increase of over 480% (Figure 23).

8.6 TREND TOWARD DIVERSIFICATION

One key trend of the sector is that much of its growth has occurred through diversification. Over time, the environmental sector has evolved from natural resource management and waste management services toward increasingly sophisticated environmental protection services including consulting services, lab testing services, environmental goods development, and other new markets. In the most recent decade, environmental concerns have opened key strategic growth opportunities for energy firms. This has given rise to dramatic increases in the development and use of renewable energy source alternatives such as wind and solar power which reduce pollution and demand for natural resources. New markets have also opened opportunities in energy efficiency, alternative fuels, alternative fuel vehicles, and other sectors.

The trend toward diversification is likely to continue in the future in growth frontiers such as climate change mitigation, carbon trading, adaptation to climate change, and various forms of eco-innovation.

These markets have been developing, to a greater extent in Europe, and have in some cases seen tremendous growth, impacting the skills required in the labour force. As noted in the report *GreenTech: Made in Germany 2.0*, the value of green technology emerging in Germany and the EU is diversifying dramatically. This 'technology atlas' of green technology companies in Germany highlights the incredible diversification of the German environmental industry and how this diversification is expected to drive environmental revenues for these firms from €1.4 billion in 2007 to over €3.1 billion in 2020, more than doubling the size of the German green technology industry. Growth in development of the green technology sector and exports of environmental technology and products is viewed by government and industry in Germany as a key strategic economic growth sector for Germany. Sigmar Gabriel, Federal Minister for Germany's Environment, Nature Conservation and Nuclear Safety Department, noted in the *2009 Environmental Industry Report*:

“

'Environment and economy are opposites.' If the Environmental Economics report shows one thing, then it is that this statement is false. As numerous scientific studies show, the opposite is true: thinking economically and ecologically is complimentary and doing so is clever—for companies and the economy.

”

The report goes on to highlight how diversification in the environmental sector resulted in the creation of over 291,000 new jobs in Germany between 2004 and 2006, at an annual growth rate of 9.4%. Total employment growth in Germany during the same period was 1.6%.



9.0 CONSTRAINTS TO GROWTH OF THE CANADIAN ENVIRONMENTAL SECTOR

Key experts interviewed for this study had difficulty identifying key structural constraints to growth of the environmental sector. The lack of understanding of constraints to growth may be connected to the limited amount of statistical information collected on the environmental sector and its sub-sectors. Lack of information on the sector limits the ability of investors to identify opportunities in the sector. It further limits the ability of policy analysts to develop policies that support economic and employment growth in the sector. A lack of statistical observation of the sector is the most important constraint affecting growth of the sector.

Other constraints to growth of the environmental sector include the size of capital-intensive investments in the sector, the level of privatization of the sector, and the availability of skilled workers. These constraints are sometimes related to regulations that affect growth of the sector. An unfavourable regulatory environment may also deter investment in capital-intensive industries. For instance, non-privatization of regulated electric utilities and waste management can limit growth of Canadian businesses in these industries. Electric feed-in tariffs for renewable energy generation recently enacted in Ontario are driving growth of the solar and wind industries in the province¹⁹. Provinces without similar incentives or support may experience slower growth on renewable energy investment. These regulatory differences can have profound effects on the level of investment and growth of some environmental industries.

Limitations to Understanding Constraints

The European Commission Directorate General of the Environment has recently performed a review of factors that limit the competitiveness of the European eco-industry²⁰. The report developed a set of key recommendations on economic policy changes that can remove constraints and strongly impact growth in the sector. Interestingly, the top recommendation by the research team is to increase the level of statistical data collection on the EU environmental sector as a means of increasing understanding of the sector.

The report observes that some sub-sectors are well reported, especially if they do not fall within NACE industry classification. The same is true in Canada where industries such as waste management and environmental consulting services are well tracked but other sub-sectors are not. The sub-sectors that are not well-tracked include alternative energy systems, air quality services, and emerging growth areas such as eco-innovation, carbon emissions reductions, and climate change adaptation activities.

Without detailed and regular statistical tracking of sub-sectors it is difficult to determine even the size and growth of employment in each sub-sector. Admittedly, tracking of the sector is difficult. Statistics Canada conducts several surveys on the sector, however, because of the sector's complexity, it is difficult to design survey instruments that account for all sub-sectors. This is complicated by the nature of growth of the sector, which largely occurs through diversification. By the time a survey is designed, implemented, and reported, several years may have passed, during which time the growth in the environmental sector may change directionally and categorically.

The strategy for achieving this level of detailed reporting on the environmental sector in the EU is to implement a new set of guidelines to indirectly estimate growth characteristics of the sector using existing survey data. This process has only commenced in late 2009, and at the time of this report, only a few countries have started to release information estimated in this way. However, initial releases are providing insight into the industry, which has given European policymakers strategic information on which to base environmental policy decisions.

Increasing the statistical observation of the sector in Canada will greatly improve the ability of policy-makers to design optimal regulatory measures that will support growth of the sector. This sort of information is also essential to investors wishing to understand the growth prospects of industries when making investment decisions.

¹⁹ For more information, see Information on Ontario's Standard Offer Program: <http://www.powerauthority.on.ca/Page.asp?PageID=122&ContentID=6858>

²⁰ See Study on the Competitiveness of EU Eco-industry
NACE is the acronym for "Nomenclature statistique des activités économiques dans la Communauté européenne" ("statistical classification of economic activities in the European Community").

Table 7
Employment in Waste Management Services

| | 1996 | 1998 | 2000 | 2002 | 2004 | 2006 | Annual Average Growth 1996–2006 |
|------------------|--------|--------|--------|--------|--------|--------|------------------------------------|
| Business Sector | 19,351 | 20,429 | 24,197 | 23,916 | 25,089 | 23,871 | 2.1% |
| Local Government | 7,924 | 7,222 | 7,405 | 7,215 | 6,798 | 7,146 | –1.0% |
| Total Employment | 27,275 | 27,651 | 31,602 | 31,131 | 31,887 | 31,017 | 1.3% |

Source: Waste Management Industry Survey: Business and Government Sectors, 1996–2006.

Size of Investments & Access to Capital

Growth in some parts of the environmental sector is driven by massive investments in infrastructure. This is particularly true in waste management, water supply, water and waste water treatment, renewable energy, and other sub-sectors of the environmental sector. Investments in new water treatment facilities, for example, can be in excess of several hundred million dollars. The period for returns on these investments can span thirty-year or even fifty-year time horizons, posing risks that are typically too high for private investors. As a result, most infrastructure investment has required partial or total public involvement in financing. Access to capital, the costs of capital, and municipal capital budgeting constrain growth in these investments.

Regulation

Although regulation is one of the strongest drivers of demand for environmental goods and services, regulations can also act as a constraint to growth. Stringent and costly environmental regulations in Canada (as compared to other countries) may drive some manufacturers to move their operations elsewhere, especially if the regulations are harsher as compared to the US and other industrialized countries. While over-regulation can be a constraint, lack of regulatory support can also limit growth.

Privatization of Public-Controlled Services

Privatization of some environmental services can help firms develop the capacity to bid for projects and services and may further contribute to innovation through private competition. This is particularly beneficial for small and medium-sized firms.

Over the last decade, there has been a trend toward privatization in the waste management and electric utility sectors in North America. The percentage of waste management jobs in the private sector grew from 71% of all workers in waste management services in 1996 to 77% of workers in 2006 (Table 7).

Privatization in energy utility management, recycling and other sub-sectors is needed to develop the expertise for Canadian firms to compete effectively in international markets.

Skilled Labour

Emerging and high growth sectors such as climate change mitigation and renewable energy, as well as traditional environmental consulting services have requirements for highly skilled workers. In addition, eco-innovation, a major growth area for the environmental sector, is increasing demand for workers with environmental, scientific, and technical skills across a broad set of manufacturing and service industries.

In interviews with informed stakeholders, it was felt that access to workers with the right mix of advanced technical and technology skills was a constraint to growth for environmental consulting firms. It was further felt that there is an inadequate level of technical skills among recent graduates from environmental education programs. While many of these students possessed a broad understanding of ecological issues and environmental practices, students graduating from these programs typically do not possess the requisite scientific or engineering skills to succeed in environmental consulting firms. A lack of coordination between training and educational organizations and employers will constrain growth in the segments of the environmental sector for which specialized skills are required.

Skilled labour is also likely to be a constraint in more traditional environmental services such as wastewater treatment. Informants in this sector noted that the older average age of workers in this industry, along with future requirements will drive growth in replacement labour demand.



APPENDIX A:

RESEARCH METHODOLOGY AND DATA SOURCES

RESEARCH OBJECTIVES

ECO Canada has been collecting labour market information relevant to the environmental sector for over 15 years. Due to the dispersed and diversified nature of the sector itself, the majority of available information has had limited applicability as regional and other modalities are often so substantive that it is hard to identify common denominators and monitor common indicators.

Consequently, ECO Canada commissioned this study to obtain baseline data from a macro and micro level, to help determine the factors and drivers of change and growth within the environmental sector, with a special focus on how those changes impact employment and labour issues. Initial questions that the study sought to answer included:

- Who are the major players in the environmental sector?
- What factors impact or trigger growth? Are they interrelated, and if so, how?
- What macro/micro level indicators (i.e., social, economic, and political) should be monitored in terms of their potential impact on environmental employment?
- How are identified social, economic and other issues (i.e., consumer demand, technology change) impacting the sector's many sub-sectors as well as related employment and labour context?
- How are macro/micro changes within the environmental sector impacting / impacted by changes in the regulatory framework?

In the initial stages of the research, it became clear that the current ECO Canada definition of the environmental sector may not capture some of the most important recent trends occurring in the sector. Defining the environmental sector therefore became an important objective of the study. In particular, the research team sought to develop a comprehensive definition of the sector and its subsectors that reflect emerging trends and new growth areas. It was desired that the definition conform to international standards to allow for comparisons and it provide for a framework that allows for long-term measurements of environmental sub-sectors.

The steps taken in the research were performed in two phases as follows:

Phase I Research

- (1) Preliminary interviews with fourteen key experts in the sector.
- (2) A preliminary literature review on key trends impacting the sector and its fifteen sub-sectors (using the pre-existing definition of the sector).
- (3) Development of a model for definition of the Canadian environmental sector for the Environmental Trends Study.
- (4) Recommendations for research for Phase II of the study.

Phase II Research

- (5) Literature review and review of existing statistics on the environmental sector (as redefined using the Canadian Environmental Goods and Services Sector Employment Model).
- (6) Collection of secondary data and statistics on key macro/micro trends in the environmental sector identified by experts in Phase I research into a trends database.
- (7) A combined literature and secondary data collection and analysis of major macro drivers affecting growth in the sector.
- (8) Development of the report with key findings of the study.

PHASE I RESEARCH

The key expert interviews were conducted to identify perceptions of the current and future key growth areas in the environmental sector. The goal was to identify areas of the environmental sector that are likely to experience significant changes in labour demand in the near-term or long-term as a result of economic, political, consumer market, or other forces. Specifically, the interviews sought to uncover perceived drivers of demand for environmental employment and the effects that drivers have on occupational demand. Interviews were qualitative and designed to identify any key growth areas that should be explored as part of this study. The goal was to conduct interviews with eight to twelve carefully selected respondents with a broad understanding and knowledge of the environmental sector.

Respondent Profile and Screening Criteria

Respondents were asked to provide insight on the evolution of the environmental sector and identify the most relevant existing and emerging key sectors and sub-sectors that will have the most impact on environmental employment in the future.

A total of fourteen experts participated in the study. ECO Canada provided a list of eight experts that have very broad knowledge of and experience in the sector. The list was also augmented through a highly-selective screening process. Experts participating in the study had to meet the following criteria:

- Participants were professors, researchers, or other individuals who study the environmental sector, or industry experts recommended by ECO Canada who have a broad understanding of the sector. Participants could not be educators of environmental workers or experts in a particular sub-sector—they needed to have high-level strategic knowledge of changes occurring in the sector.
- Participants had at least 10 years of work experience in the environmental sector (preference was given to experts with longer tenure of experience).
- Participants had a broad and interdisciplinary background in the sector.

PRELIMINARY LITERATURE REVIEW

The goals of the preliminary literature review were:

- (1) Identify current perspectives on the definition of the environmental sector with respect to the industries, occupations, and skills that define the environmental labour force.
- (2) Identify paradigms used to define the sector that are in use by industry, educational stakeholders, and others.
- (3) Identify current perspectives with regard to changes in the environmental labour force and emerging sectors within the environmental sector.
- (4) Collect statistics describing employment in the environmental sector and within sub-sectors.
- (5) Identify the recent historical growth of the environmental sector and sub-sectors
- (6) Identify drivers of the environmental sector and sub-sectors.

The goal was to identify areas of the environmental sector that were likely to experience significant changes in labour demand in the near-term or long-term as a result of economic, political, consumer market, or other forces.

The RDA Team completed the following tasks in the initial preliminary literature review:

- (1) Collection and review of an international body of labour market and demand research on the environmental sector and sub-sectors.
- (2) Collection and review of available statistics on the environmental labour force in Canada (from Statistics Canada)

SECONDARY DATA SOURCES REVIEWED IN PRELIMINARY RESEARCH

Environment and Labour Force Skills: Overview of the links between the skills profile of the labour force and environmental factors

European Union, December 2008

The Environmental Goods and Services Sector (Statistical Framework)

EU, September 2009

Links between the Environment, Economy and Jobs

GHK, 2007

Facts and Figures of the Links between EU's Economy and the Environment

EU, 2009

The Potential for Market Pull Instruments for Promoting Innovation in Environmental Characteristics

EU Directorate General Environment, February 2009

Optimizing Markets for Recycling

EU/Arcadis, November 2008

ECO-Industry, Its Size, Employment, Perspectives, and Barriers to Growth in an Enlarged EU

EU Directorate General Environment/E&Y, 2007

Scenarios and Models for Exploring Future Trends of Biodiversity and Ecosystem Services Changes

Institute for European Environmental Policy, September 2009

Bridging the Valley of Death: Public Support for Commercialization of Eco-Innovation

EU Directorate General Environment, May 2009

Umweltwirtschaftsbericht 2009 (Environmental Economic Report)

Umwelt Bundes Amt (Federal Environmental Office), Germany 2009

Beschäftigungswirkungen des Umweltschutzes in Deutschland: Methodische Grundlagen und Schätzung für das Jahr 2006 (Employment effects of Environmental issues Germany: Methodological Foundations and values 2006)

Umwelt Bundes Amt (Federal Environmental Office), Germany 2006

The Austrian Environmental Technologies industry – development and determinants of employment

Kletzan and Koppl

The Impact of Innovation Activities on Employment in the environmental sector

Empirical Results for Germany at the Firm Level

IAB-Discussion Paper, 2008

GreenTech: Made in Germany

Verlag Vahlen Munchen, 2009

Environmental Protection Expenditure in Specified Industries

UK Environment, 2008

Clean Technology and the Green Economy: Growing Products, Services, businesses, and Jobs in California's Value Network

California Economic Strategy Panel, March 2008

Understanding Green Jobs

Centers for Excellence (California, USA), 2009

Current and Potential Green Jobs in the U.S. Economy

US Conference of Mayors/ Global Insight (USA), October 2008

Growing Green Jobs

Council for Adult and Experimental Learning (USA)

Energy Efficiency Jobs

Centers for Excellence (California, USA), 2009

Go Green at Work; Handbook for Union-Led Responses

TUC Green Workplaces (USA), March 2008

Green Economy Workforce Study

Centers for Excellence (California, USA), December 2008

Growing the Green Collar Economy: Skills and labour challenges in reducing our greenhouse emissions and national environmental footprint

CSIRO (Australia), June 2008

Green Jobs Soar in Germany (in German)

Forschungsvorhaben des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit, (2004-2007), April 2008

Green Jobs: Towards decent work in a sustainable, low-carbon world

UNEP, 2008

Renewable Energy and Energy Efficient Economic Drivers for the 21st Century

American Solar Energy Society, 2007

Jobs in LA's Green Technology Sector

Department of Water and Power and the Workforce Investment Board of the City of Los Angeles, 2006

OUTCOMES FROM PHASE I

In the first phase of research, the research team identified a set of key growth trends that are impacting environmental employment in Canada. These were identified through the key expert interviews and through an extensive secondary literature review.

In addition, during the first phase, the team developed a classification system for defining environmental employment in Canada into a set of measurable categories: the Canadian Environmental Goods and Services Sector Model (CEGSS). The model is well-aligned with future data sources that will become available from Statistics Canada in 2010 from the Survey of Environmental Goods and Services (currently in the field). Data collection will be further supported by the implementation of the North American Product Classification System (NAPCS) reporting structure which will be in place by 2012. Statistics Canada will begin to produce statistics by the type of products and services that firms sell, which will provide insight into environmental products and services sales in Canada.

PHASE II RESEARCH

In the second phase, the research team developed a report and database of trend data that explores the key environmental employment trends identified in Phase I, using the CEGSS as a framework for defining, measuring, and exploring the sector.

The report was developed to compile data on the macro drivers affecting environmental spending and environmental employment, discuss the major players in the environmental sector, discuss factors that are impacting growth in the sector, and identify major emerging trends. At a micro level--within each subsector--a separate report was designed to identify the drivers that are affecting growth in the subsector, on a global scale and in Canada.

Where available, the research team collected employment measurements and proxy data that describe the size and growth of environmental employment. Because of the lack of data on many of the subsectors, it was decided that the research team should stop short of deriving indirect estimates for environmental employment where no direct measurements exist. The report gives context to the dynamics that are influencing the environmental sector and environmental employment, describing the size and growth of subsectors, highlighting the high-growth areas, and discussing emerging trends and their potential impact on environmental employment.

METHODOLOGY FOR DEVELOPMENT OF THE REPORT

The composition of the report involved the following methodologies:

- (1) Secondary Literature Review: Observations made in related primary and secondary research were summarized to provide context, analysis, commentary, and key findings of related research. The literature review includes information reviewed in Phase I and additional review on sub-topics as necessary.
- (2) Secondary Data Collection: Secondary time series data was collected that illustrates certain trends or further supports and explains the subject.
- (3) Secondary Data Analysis: The analysis of secondary data typically involved identifying causal relationships using mathematic, statistical, or econometric techniques.
- (4) Key Expert Interviews: The text of the interviews completed in Phase I was referenced.
- (5) As-Needed Interviews: Domain experts were contacted to collect specific information or data as required.

| REPORT CHAPTER | RESEARCH METHODS |
|--|---|
| Executive summary | (Summarization from the Body of the Report) |
| Defining environmental employment | Secondary literature review |
| Key emerging trends | Key expert interviews, As-needed interviews, Secondary data collection, Secondary data analysis |
| Drivers of employment in environmental sub-sectors | Secondary data collection, Secondary data analysis, As-needed interviews, Key expert interviews |
| Drivers of growth in Canada's environmental sector | Secondary literature review, Secondary data collection, Secondary data analysis |
| Constraints to growth of the Canadian environmental sector | Secondary literature review, Key expert interviews |
| Global trends | Secondary literature review, Secondary data collection, Secondary data analysis |

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