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International Trade in Environmental Goods and Services: A Canada-U.S. Comparison

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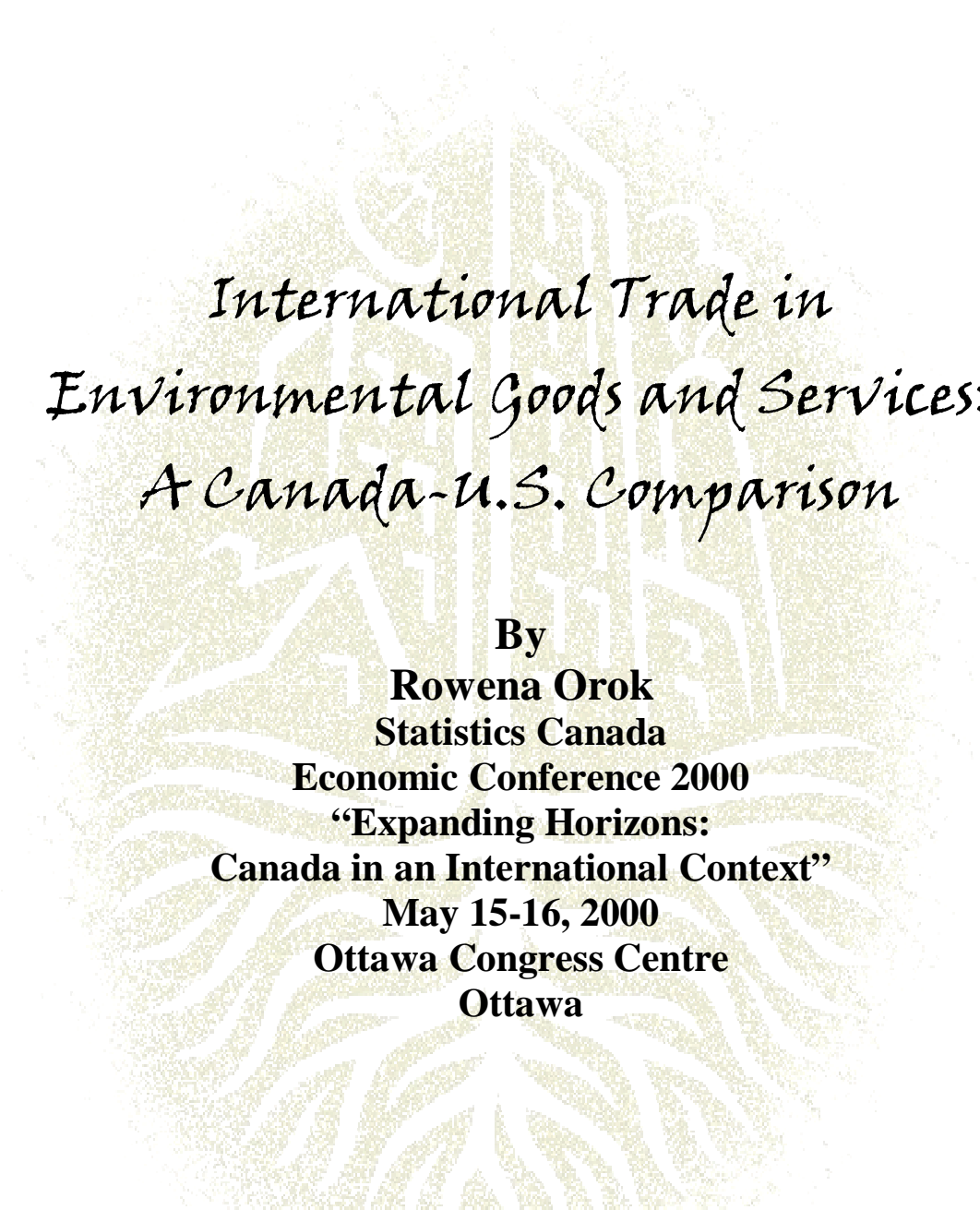
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*International Trade in
Environmental Goods and Services:
A Canada-U.S. Comparison*

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Statistics Canada
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Abstract

Often identified as an emerging sector, the environment industry continues to evolve into a complex industry that offers a wide range of technologies and services aimed at protecting the environment and improving environmental quality. The industry is no longer limited to providing traditional “end-of-pipe” solutions to businesses in order to comply with environmental regulations. The development of “integrated-process” technologies allows the environment industry to offer solutions that reduce environmental risk and minimise pollution, material and energy use within the production process. Fueled both by regulatory and voluntary actions, the industry’s economic activities are of considerable interest to policy-makers and businesses who look at the impacts of environmental efforts on trade opportunities, both domestic and international.

This paper analyses Canada’s trade in environmental goods and services and compares it with the trade profile of the world’s largest environmental market, the United States. What is Canada’s trade balance among the different segments of the environment industry? What are the market drivers for environmental goods and services? The relevance of this research is magnified by the current focus on environmental technologies and their key sub-sectors such as climate change technologies, water and wastewater systems and hazardous waste management. The government recently identified these sectors as targeted growth areas for Canada.

The existing literature lacks an integrated data set for inter-country comparisons. This research paper addresses the main challenge of developing coherent and comparable trade profiles of the Canadian and United States environment industries.

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Symbols

The following standard symbols are used in Statistics Canada publications:

- .. figures not available
- ... figures not appropriate or not applicable
- nil or zero
- amount too small to be expressed
- x confidential to meet secrecy requirements of the *Statistics Act*

1 Overview of Environmental Goods and Services

The improvement of environmental quality was a significant driving force behind the earliest environmental infrastructures such as basic waste collection systems and sewage treatment facilities. The first environmental goods and services (EGS) were directed towards reducing pollution that people could touch, see or smell. Today, there is a wider range of environmental goods and services. This includes products that minimise material and energy use, reduce environmental risk, and prevent pollution right from the source.

Several sets of criteria are used to define and delimit an environmental good or service. The environmental goods and services classification focuses on a product's environmental function or purpose. This is in contrast with traditional product classification systems that are based primarily on the physical attributes of goods and services.¹

The EGS categories covered in this research paper are shown in Text Box 1.1² with both the Canadian and U.S. classifications based on the Organisation for Economic Co-operation and Development (OECD) guidelines. This list integrates the Canada and U.S. classification schemes to maximise data comparability.

The range of products classified under environmental goods and services have undergone significant transformations from their modest beginnings. EGS products have not only increased in number but also in complexity and sophistication. Traditionally,

Text Box 1.1

Environmental Goods and Services

Goods

Water and wastewater equipment and chemicals – equipment, supplies, and maintenance systems in the delivery and treatment of water and wastewater.

Air pollution control – equipment and technologies to control air pollution, including vehicle controls.

Instruments and information systems – sampling systems, measuring and monitoring equipment, data acquisition equipment, environmental information systems and software.

Waste management equipment – equipment for handling, storing, or transporting solid, liquid and hazardous waste, including disposal, recycling and remediation equipment.

Services

Solid and hazardous waste management (including remediation/industrial services) – collect, process and dispose of solid waste; manage ongoing hazardous waste streams, medical waste, nuclear waste; physical cleanup of contaminated sites and buildings; provide environmental cleaning of operating facilities.

Environmental consulting and engineering – engineering, consulting, design, assessment, permitting, project management, operations and maintenance, monitoring.

Environmental testing and analytical services – testing of “environmental samples” (soil, water, air, biological tissues), measuring and monitoring, process and control, data acquisition.

Water and wastewater management – collect and treat residential, commercial and industrial wastewater; wastewater reuse systems; water and wastewater system assessment; water handling systems.

Resources

Alternative energy – renewable energy systems and equipment (solar, wind, tidal, geothermal); alternative fuel systems and equipment; energy efficient products.

Other

Other – all other goods and services not classified elsewhere.

Sources:

Environmental Business International Inc., California.
Statistics Canada, Environment Accounts and Statistics

environmental equipment were mostly “end-of-pipe” equipment used to treat pollutants that have been released in air, water, and soil. These types of equipment were also used to handle or store solid and hazardous waste materials.

The past decade, however, has seen the continued development of more “integrated process” technologies that prevent the release of pollutants and also reuse materials and energy during the production process.³ Current advancements in renewable energy and clean fuel systems also provide producers with better environmental technologies that can be used in order to carry out production process modifications.

Environmental services are no longer limited to waste management and wastewater treatment services. An extensive variety of engineering, analytical and design services are now available in the market to help businesses incorporate environmental considerations into their production processes.

2 *The Environment Industry*

Background

Historically, the demand for environmental goods and services (EGS) was driven by regulation and other policy initiatives.⁴ During the 1970s, governments mainly adopted a “command and control” approach to address environmental problems. Detailed regulations enforced compliance among industrial polluters. Technology-based standards accompanied the prescribed emission limits for each source of pollution in a particular plant.

In the 1980s, there was continued emphasis on pollution control. The focus was on ambient standards whereby limits were set based on the overall plant emissions. Various economic instruments such as taxes, charges and tradeable permits were used to improve environmental performance. Together, these two periods (1970s and 1980s) stimulated the demand for environmental goods, mostly “add-on” goods for pollution abatement and control purposes (filters, screens, strainers, etc.).

By the 1990s, environmental policy shifted its focus towards pollution prevention. There has been an increased recognition of the merit of eco-efficient environmental solutions that provide economic benefits at the individual business level. Hybrid approaches using regulation, economic instruments and voluntary agreements were aimed at increasing incentives for businesses to install cleaner production processes. Support for integrated process technologies accelerated the growth in

environmental services (consulting engineering, analytical services, etc.). In addition, a risk-based approach to environmental consulting and other environmental solutions started gaining credence in all parts of the world.⁵

Industry Definition

EGS producers became collectively known as the “environment industry.” In statistical terms, the environment industry is not classified as one specific industry under the existing classification systems.⁶ It consists of diverse producers which are involved (directly or indirectly) in the production of goods and services that are used or can potentially be used to protect the environment.

Environment-related activities include those that measure, prevent, limit or correct environmental damage to water, air, as well as problems related to waste, noise and ecosystems. Both governments and businesses produce goods and services related to these activities.⁷

Being relatively new, detailed statistics on the environment industry are limited. The United States has one of the longest aggregate data series available on the industry, some dating back to the 1970s. In Canada, extensive environment industry statistics are still in the early stages of development.⁸ Compiling a coherent data set for inter-country comparison is, therefore, an essential component of empirical work on the environment industry.

The years 1996 and 1997 provide a snapshot of the industry for Canada and the United States. The tables are based on the most recent comparable data available for the two countries. Text

Box 2.1 defines various terms used in the Canada-U.S. comparison of environment industry profiles.

Industry Snapshot

In 1997, total U.S. environment industry revenues reached \$259 billion, up 4% from the previous year (Table A.1). The bulk of these revenues originated from U.S. markets, as total domestic supply rose to \$233 billion in 1997.

Solid and hazardous waste management services combined with water and wastewater management services made up 56% of total U.S. environment industry revenues (Table A.2). The private sector was the dominant revenue earner in the solid and hazardous waste management services category. This sector, for example, generated more than two-thirds of solid waste management services revenues in 1997.⁹ During the period, the largest revenue growth was found in instruments and information systems and water and wastewater equipment.

Canada's environment industry, significantly less than one-tenth the size of the U.S. environment industry, grew to \$19 billion in 1997 (Table A.3). As was the case in the U.S., most of the revenues came from domestic markets. Solid and hazardous waste management services as well as water and wastewater management services were also the largest revenue sources for the industry (Table A.4). The "other" EGS category was also a significant revenue-earner in both years. Environmental services and construction activities that cannot be classified under the EGS equipment and

Text Box 2.1 Environment Industry Terms and Definitions

EGS = environmental goods and services

Total Environment Industry Revenues = total environmental revenues earned by businesses and governments from both domestic and international (export) markets.

Domestic Supply = total value of EGS produced by businesses and governments sold to domestic markets only (excludes exports).

Domestic Market = total value of EGS bought by domestic customers (includes imports).

Trade Balance = the difference between exports and imports. A positive trade balance (exports greater than imports) is also called a *trade surplus*. A negative trade balance (imports greater than exports) is also called a *trade deficit*.

Sources:

Environmental Business International Inc., California.
Statistics Canada, Environment Accounts and Statistics Division, Ottawa.

services classification accounted for majority of revenues in this category.

More noteworthy, however, is the growth potential of specific sub-sectors in the Canadian environment industry. Unlike in the U.S. where revenues in most EGS categories remained relatively flat between 1996 and 1997 (less than 10% increases), Canadian environmental firms posted a relatively strong growth in the areas of consulting and engineering (+21%), water and wastewater management services (+10%) and water and wastewater equipment and chemicals (+9%). For example, Canadian consulting and engineering firms continued to improve their expertise in designing environmental management systems for new projects as well as providing the required remedial solutions for existing sites.

3 *International Trade and the Environment Industry*

The growing importance of environmental issues generates a parallel interest in evaluating the opportunity for trade in environmental goods and services. Policymakers, business analysts and corporate planners look at the impacts of environmental regulations and conventions on trade opportunities. For example, the Montreal Protocol for controlling ozone-depletion fosters the market for ozone-friendly products.

A more recent example of market drivers is the Kyoto Protocol. The Kyoto Protocol is directed towards reducing greenhouse gas emissions that contribute to climate change. Potential government legislation, economic policy instruments (such as taxes and tradeable permits) and other market drivers will have a significant impact on the production and sales of environmental technologies, especially climate change technologies. Another important part of the Kyoto Protocol is the use of technology transfer to other countries as a tool to reduce greenhouse gas emissions. The corresponding measures that increase market access opportunities will also stimulate technology transfer between countries.

Sustainable development strategies worldwide further contribute to the overall growth of the global environment industry which is currently estimated at over \$650 billion. A growing number of businesses are incorporating environmental considerations into their corporate planning and decision-making processes. For example, companies in Canada (64% of establishments in the

primary, manufacturing and utility sectors) and around the world are using the ISO 14000 series to bring economic benefits (waste minimisation, energy savings, etc.) and at the same time to offset the costs of reducing environmental impacts.¹⁰ Together, such environmental initiatives and corporate environmental strategies serve as market signals that affect the demand and supply of environmental goods and services, both domestic and international.

Increased globalisation and wider free trade areas also intensify international trade prospects, despite the potential threats of foreign competition. The resulting trade opportunities are of considerable importance to open-market economies like Canada. Governments and businesses wish to determine export patterns to help evaluate general international competitiveness and to gain access to particular environment growth markets such as those in Asia.

Trade analysis also sheds light on how much of domestic demand is being met by imports; where these imports are coming from; and why these goods and services are not being produced domestically. Finally, do international trade activities also reflect the changing profile of environmental goods and services, as observed in the domestic markets?

The subsequent sections highlight the trade profiles of U.S. and Canadian environment industries. The analysis is based on the comparable EGS categories listed in Text Box 1.1.

4 Exports

Canada exported \$898 million in environmental goods and services in 1997, up 17% from the previous year. In the U.S., environmental exports also rose at a comparable rate, totaling \$25 billion in 1997 (Table A.5).

Between 4% and 5% of Canada's total environment industry revenues were derived from exports (Table A.6). Recently, the Canadian government, through the Export Development Corporation (EDC), expressed its commitment to support environmental exports. EDC's projections showed a 30% anticipated annual growth in environmental exports.¹¹

The U.S., on the other hand, had a comparatively higher proportion of its total environment industry revenues arising from exports (9% in 1996 and 10% in 1997). A new environmental export initiative was also launched in the U.S. Various representatives from the U.S. environment industry, non-profit organisations, and the federal government met to discuss the strategy to re-double environmental exports.¹²

Looking at the exports' share of total environment industry revenues in 1996 and 1997, Canada showed its strength in tapping into specific environmental export markets (Table A.6). For example, average shares for 1996 and 1997 showed that Canadian environmental firms exported a higher proportion of their production of air pollution control equipment, waste management equipment and water and wastewater equipment and chemicals compared to the U.S. The U.S., on the

other hand, had an established advantage in instruments and information systems,¹³ exporting about 50% of its total production during the period.

Largest Exports

In Canada, environmental equipment led exports in both years (Table A.5). Major exports were air pollution control equipment, water and wastewater equipment and chemicals, and waste management equipment. Likewise, the top two U.S. environmental exports were water and wastewater equipment and chemicals and air pollution control equipment.

Various national and international initiatives aimed at decreasing air pollution, reducing greenhouse gas emissions, minimising water contamination, and improving water quality enhanced the market opportunities abroad for these types of environmental goods.

Standard air pollution control equipment continued to dominate Canada's environmental export market. Approximately one-quarter of Canada's total environmental exports included wet and dry scrubbers, precipitators, separators, and catalytic converters. Some studies found that Canada has a competitive advantage in catalytic converters in many parts of the world.¹⁴ The 1997 export level for air pollution control equipment, however, stayed flat relative to other types of environmental equipment.

In the U.S., water and wastewater equipment and chemicals accounted for almost 25% (on average) of

environmental exports in 1996 and 1997. Traditional types of equipment most commonly sold abroad were separation equipment (ion exchange, membrane filtration, carbon absorption), delivery equipment, biosolids equipment, and destruction/disinfection equipment. Exports of water and wastewater treatment chemicals were mainly activated carbon and ion exchangers.

Export Growth

Canadian exports of environmental services showed a notable increase in 1997 (Table A.5). Export revenues from solid and hazardous waste management services nearly doubled (\$27 million in 1997) while those of environmental consulting and engineering services rose by 88% (\$72 million). Canadian businesses saw a surge in overseas contracts for both of these services categories in 1997. The growth in consulting and engineering services may be attributed to the increasing expertise in developing niche markets abroad for environmental management systems as well as environmental monitoring systems.

Canada's exports of water and wastewater management services experienced the only decline from 1996 to 1997 (-37%). Businesses in that year conducted fewer revenue-generating activities related to the operations of water treatment facilities, wastewater reuse systems and water handling systems. Because of volatility in this relatively small export category, a single transaction could cause a significant rise or drop in the total export level.

In the U.S., the largest increases in 1997 environmental export revenues were found in the traditional equipment markets, namely, water and wastewater equipment and chemicals (+41%) and air pollution control equipment (+33%).

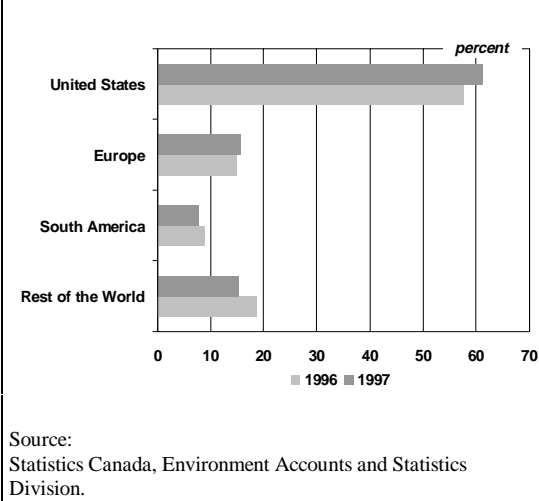
Equipment and services related to waste management as well as water and wastewater management services posted export declines in 1997. With mergers and acquisitions predominating the waste management industry in 1997, it was not surprising that waste management businesses concentrated mainly on domestic operations where they obtain majority of their revenues.

U.S. exports of water and wastewater management services also dropped from their 1996 levels. Providers of this environmental service were mostly municipally-owned facilities, also known as publicly-owned treatment works (POTWs), that served mainly the domestic market. Exports were relatively small and highly volatile, primarily in the form of design services and construction management for water projects in Asia and Latin America.

Foreign Markets Served

The U.S. was by far the biggest export market for Canada's environment industry, followed by Europe and South America (Figure 1). Total environmental exports to the U.S. (about 60% of the total) rose by 24%, to \$550 million, in 1997 (Table A.7). During the same period, environmental exports to Europe also grew at about the same rate (+23%) to \$140 million. Environmental exports to the Middle East/Africa showed the

Figure 1
Distribution of Canadian Environmental
Exports, by Destination, 1996 and 1997



highest increase (+30%) between 1996 and 1997.

In terms of the U.S. environment industry's export profile, the U.S. exported about 16% of its total EGS exports to Canada.¹⁵ The shares of U.S. environmental exports to Canada ranged from 5% in consulting engineering services to 19% for waste management equipment. There was no available breakdown of the U.S. environmental exports to the rest of the world. Most of the published data focussed only on specific EGS categories covering fragmented time periods.¹⁶

For example, the U.S. International Trade Commission (USITC) published two reports that looked at two specific categories of environmental products: water and wastewater equipment and air pollution control equipment.¹⁷ The report on water and wastewater equipment indicated that the major destinations of U.S. water and wastewater equipment exports were Canada, Mexico, Germany, United

Kingdom and France. Wastewater treatment chemicals were shipped primarily to Canada, Japan, Mexico and Australia. Equally important were the largest export markets for air pollution control equipment, namely, Western Europe, Canada, Mexico, Central America and South America.

5 Imports¹⁸

On average, imports satisfy about 13% of Canada's domestic environmental protection market, more than double the import share of the domestic environmental market in the U.S. (Tables A.1 and A.3). This result is not surprising, considering that the U.S. has a highly self-sufficient environmental market and a much larger base of industrial production from which to satisfy a wider range of client demand. Domestic demand was historically a major force behind the development of new environmental products in the U.S.¹⁹

The U.S. imported 36% more environmental goods and services in 1997, totaling \$13 billion (approximately 5% of total U.S. imports originated from Canada). Canada's environmental imports rose at the same rate, expanding to \$3 billion in 1997 (Table A.8). A closer look at the share of imports to total domestic market showed that in 1996 and 1997, a significant proportion Canada's demand for environmental goods and services were satisfied by imports (Table A.9).

Largest Imports

In both countries, the most prominent environmental goods exports were, at the same time, the most prevalent imports. The \$3 billion Canadian environmental imports in 1997 were mainly environmental equipment: water and wastewater equipment and chemicals, air pollution equipment and waste management equipment. In addition to water and wastewater management services, other top imports in the U.S. for that year were water equipment and

chemicals and air pollution control equipment (Table A.8).

Canada's largest imports of water equipment and chemicals were equipment used in filtration, biotreatment and aeration. Over half of these imports were purchases by governments and utilities. The rest was sold to clients in various industries like chemicals and pharmaceuticals, plastic, agriculture, food processing, and petroleum.²⁰

Imports of air pollution equipment, in comparison, were split between mobile source and stationary source equipment. Virtually all mobile source equipment were catalytic converters supplied to the motor vehicle industry. Imports of stationary source equipment were determined by the requirements of energy-intensive and highly-regulated industries. Among the industries were pulp and paper, cement, and electric utilities. These industries imported filters and baghouses, electrostatic precipitators and oxidation systems.²¹

Despite its self-sufficient environment industry, the U.S. continued to take advantage of technological advancements developed abroad. This was particularly true in the area of water and wastewater management services. Large imports were also reported in water and wastewater equipment and chemicals and air pollution control equipment.

The increased imports of water and wastewater management services were partly due to the need for upgrades and modifications to aging water infrastructures and sewage systems in the U.S. Most of these imports came from France and the United Kingdom. These

countries have developed some of the most advanced water and wastewater technologies in the world.²²

Water and wastewater equipment and chemicals were the second largest environmental imports in the U.S. Leading providers of process and delivery equipment for water and wastewater included Germany, Japan, United Kingdom, Italy and France. Likewise, specialty chemicals like activated carbon, used in water and wastewater treatment systems, were produced in Japan and Western European countries.

Air pollution control equipment also accounted for a significant proportion of imports in 1996 and 1997. Countries like Japan and Germany have become leaders in providing state-of-the-art air pollution control equipment.²³

Import Growth

Canada's import levels rose in all the categories of environmental goods and services, except waste management equipment. In 1997, industrial users and municipal governments reduced their imports of vehicles used in collecting and transporting solid and hazardous wastes and recyclable materials. This prompted a 23% decrease in import level for waste management equipment as a whole.

Imports of environmental services led the growth, especially in environmental consulting and engineering services, which tripled in 1997. Design and construction management along with operations and maintenance of environmental systems for the chemical

industry and the petroleum industry accounted for the bulk of these imports.

U.S. imports of water and wastewater management services almost doubled in 1997 (\$4.2 billion). Of all the environmental equipment categories, imports of waste management equipment saw the highest import increase (+69%). Unlike Canada, industries and municipal governments in the U.S. imported more compactors, shredders, drums, containers, landfill liners, incinerators and recycling equipment during the period.

6 Trade Balance²⁴

Canada

Canada had a total environmental goods and services trade deficit of \$1.5 billion in 1996, widening to \$2.2 billion in 1997 (Table A.10). Looking at the EGS categories, Canada's largest environmental exports were also its highest environmental imports – water and wastewater equipment and chemicals, waste management equipment and air pollution control equipment.

In both years, Canada's environment industry realized a trade surplus only in environmental testing and analytical services. Laboratory testing and geographic information systems (GIS), for example, have extensive applications in the areas of conservation and resource management, environmental risk assessment, land-use planning and emergency response planning. However, this category represented only a small portion of Canada's trade in environmental goods and services (5% of exports and significantly less than 1% of imports).

Most EGS categories experienced increased trade deficits in 1997. The largest trade deficits were in water equipment and chemicals, air pollution control equipment and environmental consulting engineering. On the other hand, a decrease in imports of waste management equipment helped improve the trade balance in that category by reducing the 1997 trade deficit to \$438 million.

A general pattern of deficits may be linked to the stage of development of

Canada's environment industry and limited size of overall industrial production capacity compared to such larger economies such as the U.S., Europe and Japan. For demand that could not be met by domestic suppliers, Canadian industrial users and governments turned to international providers of environmental goods and services. This may have been due more specifically to the unavailability of technological/service capacity or to more competitive international prices.

During this developmental period for EGS, niche markets were more likely determined by the requirements of domestic rather than international markets: Canadian environmental businesses, thus, concentrated on serving the local environment market and potential markets abroad may not have been fully exploited. The bulk of imports more than likely originated from other countries like the U.S., United Kingdom, Germany and Japan which have already established a technological advantage in areas such as water and wastewater equipment and services as well as air pollution control equipment. Direct country of origin data, however, remains to be developed.

U.S.

The U.S. environment industry showed trade surpluses in all the environmental goods and services categories except in water and wastewater management services. In 1997, a surge in imports widened the trade deficit in this category. In turn, this contributed to narrowing the overall trade surplus (equipment and services) by \$683 million between 1996 and 1997 (Table A.10).

Nevertheless, most EGS categories saw an improvement in their trade balance. There were increases in the trade surplus especially in water equipment and chemicals, environmental consulting and engineering, and air pollution control equipment.

Compared with Canada, the U.S. environment industry earned a higher proportion of its total revenues from exports. There was only a small proportion of EGS provided by imports, owing to a self-sufficient source of supply for the environmental market. Industry analysts have observed that the huge domestic market offered little incentive for EGS suppliers in the U.S. to pursue international business.²⁵

Highly-traded Goods and Services

A recent OECD report²⁶ on the environment industry concluded that:

- EGS activities are evolving in the direction of services;
- service sectors are perhaps the most dynamic and becoming increasingly internationalised; and
- environmental protection relies less on end-of-pipe solutions.

Can these same generalisations be applied to the international trade profiles of Canada and the U.S.?

The first two conclusions were supported, to a certain extent, by numerous case studies conducted in Canada and the U.S. Various studies commented on the growth in environmental services like consulting and engineering, analytical services and

management consulting services. The 1996 and 1997 international trade data for both Canada and the U.S. showed that, indeed, there was considerable growth in trade activity in environmental services, albeit at smaller levels compared with the overall trade in environmental goods.

The third conclusion, however, was not as evident, given the existing data sources. To establish whether an environmental good or service was used for pollution abatement purposes (end-of-pipe) or as part of pollution prevention strategies (integrated process), there was a need to further identify the specific purpose for which the good or service was used. An end-use distinction was not possible in many cases from available data. For example, the chemicals used in clarifying wastewater (end-of-pipe) and the revenues from sales chemicals used in wastewater reuse systems (integrated process) were all aggregated under the same EGS category. Therefore, the existing trade data cannot be used to verify claims by industry analysts that EGS are not being sold in isolation to the extent previously but rather are part of broader-based strategies for cleaner production.²⁷

7 Future Research

Data Gaps

Developing more comprehensive and comparable data sources continues to be the main challenge in evaluating the environment industry and the associated goods and services. This study is a step toward a more extensive trade analysis of environmental goods and services.

Presently, there is ongoing work on the development of the environment industry framework at the domestic and international levels. The harmonisation of EGS categories is critical for inter-country comparisons and in estimating the global environmental market. Continued data collection, particularly direct survey data, is also critical in addressing data gaps and in ensuring consistent time series data sets for the industry.

Detailed information on the following would improve the Canada-U.S. comparison of environmental trade:

Canada

- Environmental trade profiles of governments, including EGS exports by destination and EGS imports by country of origin; and
- Environmental imports by EGS categories and country of origin

U.S.

- Environmental export distribution by destination; and
- Environmental import distribution by country of origin.

Empirical Analysis

Empirical research on the environment industry substantiates the observations and conclusions drawn from case studies and business profiling exercises. A good example is in the analysis of a country's competitive advantage in environmental goods and services. Existing studies evaluate competitive advantage in a "qualitative" sense, based on the general profile of environmental businesses. Evaluating additional "quantitative" variables such as capital and labour intensities gives the researcher additional analytical tools and also helps to answer a significant question –Does a country which is known to have an advantage in the export of labour-intensive commodities also export labour-intensive environmental products or not? This sheds further light on the characteristics of environmental goods and services that a country produces and may specialise in.

More intensive research on the determinants of environmental exports and imports is another area for empirical analysis. Some studies indicated that tariff measures, investment restrictions/limitations, export credits, innovation policies and intellectual property regimes have diversely affected the trade in environmental goods and services. However, the literature still lacks quantitative research on the short-run and long-run factors that determine EGS trade.

Policy

Continued work in bridging the existing data gaps would help illuminate issues such as:

- evaluating environment regulatory framework and choice of policy instruments;
- trade liberalisation in environmental goods and services; and
- identifying potential target growth areas within the environment industry.

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Endnotes

¹ There are also inherent difficulties associated with the definition of an environmental good or service. Differences in definitions, framework and coverage vary among studies.

The OECD summarised these difficulties – *“Overall, there are a group of measurable goods and services which are widely agreed on as forming the “core” of the environment industry (i.e., goods and services that are used to clean up existing processes and production, control air and water pollution, minimise noise-related problems, reduce and re-use waste). But beyond this core, the boundaries of the industry are fluid and there are difficulties in measuring many environmental goods and services and activities with any precision. (OECD, 1992)”*

² See OECD and EuroStat, 1999. The EGS classification used in this research paper pertains to goods and services used for environmental protection. Environment-related activities are illustrated in Section 2 of this paper.

³ Integrated process technologies are one of the components of “pollution prevention.” Pollution prevention is the use of processes, practices, materials, products or energy that avoid or minimise the creation of pollutants and waste, and reduce overall risk to human health or the environment (Government of Canada, 1995).

⁴ See OECD, 1999 for a discussion of trends in environmental policy.

⁵ Hutton, 1998.

⁶ Industry classification systems arrange producing units into industries, i.e. groups of establishments whose production represents a homogeneous set of goods or services or groups of establishments engaged in the same or similar kind of economic activity. The Standard Industrial Classification System (SIC) is Canada’s oldest and most widely used of the existing standard classification. In 1996, the North American Industrial Classification System (NAICS) was finalised and became the common framework for the production of

comparable statistics by the statistical agencies of Canada, Mexico and the United States following the 1994 North American Free Trade Agreement (NAFTA).

⁷ Environment industry revenues earned by governments and businesses relate to **gross revenues**. Revenues will be double counted to the extent that goods and services produced by an establishment in the environment industry are purchased by another in the same industry. In addition, since there is no separate industrial classification for “environment industry,” EGS producers belong to various industries. For these reasons, it would be incorrect to compare the aggregate environmental revenues to gross domestic product (GDP) which is the sum of the unduplicated production of all industries. Thus, revenues presented in this report should not be expressed as a percentage of GDP.

⁸ Starting in 1995, the survey on the environment industry was conducted by Statistics Canada. Data from this survey were used to produce estimates of the economic activity of the environment industry. Before 1995, various data sources were used to compile data for the environment industry.

⁹ EBI, 1998, p. 4.

¹⁰ The ISO 14000 series was developed by the International Organisation for Standardisation (ISO). See Standards Council of Canada, 1998, <<http://www.scc.ca/iso14000>>, (accessed December 15, 1998).

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¹⁴ See CEIA, 2000 for details.

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¹⁶ Refer to EBI, 1998a for an example of available export market profile.

¹⁷ USITC, 1995 and USITC, 1996.

¹⁸ The analysis and Canada-U.S. comparison of environmental imports is restricted to the equipment and services categories only. There are currently no estimates of Canadian imports for the “Resources” and “Other” categories.

¹⁹ USDC, 1998.

²⁰ EBI, 1997.

²¹ EBI, 1997.

²² USITC, 1995.

²³ USITC, 1996.

²⁴ The analysis and Canada-U.S. comparison of environmental trade balance is restricted to the equipment and services categories only. There are currently no estimates of Canadian imports for the “Resources” and “Other” categories.

²⁵ USDC, 1998, pp. 37-43.

²⁶ OECD, 1999.

²⁷ OECD, 1999, p.27.

Annex A: Statistical Tables

Table A.1
U.S. Environment Industry Profile, 1996 and 1997

	1996	1997
	millions of Canadian dollars	
Total Environment Industry Revenues	248 082.0	258 500.0
Total Domestic Market	235 479.0	245 611.0
Total Domestic Supply	226 268.0	233 111.0
Trade:		
Trade Balance	12 602.7	12 888.9
Environmental Exports	21 813.7	25 388.9
Environmental Imports	9 211.0	12 500.0

Note:

Figures may not add up to totals due to rounding.

U.S. data were calculated based on published estimates by Environmental Business International, Inc.

The units of measurement used in the original data were U.S. dollars. In order to make inter-country comparison possible, the units of measurement were changed to Canadian dollars.

The exchange rates used for 1996 and 1997 were taken from CANSIM Matrix M2450, Exchange Rates (USA\$/CDN\$).

Sources:

Environmental Business International Inc., 1998.

Statistics Canada, Environment Accounts and Statistics Division.

Table A.2
**U.S. Environment Industry Profile
 By EGS Category, 1996 and 1997**

Category	1996	1997	% change
	millions of Canadian dollars		
Goods:			
Water and Wastewater Equipment and Chemicals	23 972.6	25 291.7	5.5
Air Pollution Control	20 958.9	21 847.2	4.2
Instruments and Information Systems	4 246.6	4 527.8	6.6
Waste Management Equipment	13 424.7	13 555.6	1.0
Services:			
Solid and Hazardous Waste Management ¹	69 863.0	72 013.9	3.1
Environmental Consulting and Engineering	20 821.9	21 263.9	2.1
Environmental Testing and Analytical Services	1 643.8	1 555.6	-5.4
Water and Wastewater Management	69 041.1	72 250.0	4.6
Sub-total: Goods and Services Categories	223 972.6	232 305.6	3.7
Resources:			
Alternative Energy	3 424.7	3 763.9	9.9
Other:	20 684.9	22 430.6	8.4
Total: All Categories	248 082.2	258 500.0	4.2

Notes:

Figures may not add up to total due to rounding.

U.S. data were calculated based on published estimates by Environmental Business International, Inc.

The units of measurement used in the original data were U.S. dollars. In order to make inter-country comparison possible, the units of measurement were changed to Canadian dollars.

The exchange rates used for 1996 and 1997 were taken from CANSIM Matrix M2450, Exchange Rates (USA\$/CDN\$).

1. This category includes remediation services.

Sources:

Environmental Business International Inc., 1998.

Statistics Canada, Environment Accounts and Statistics Division.

Table A.3
Canadian Environment Industry Profile, 1996 and 1997

	1996	1997
	millions of Canadian dollars	
Total Environment Industry Revenues	18 447.0	18 916.0
Total Domestic Market	19 821.0	20 927.0
Total Domestic Supply	17 679.0	18 018.0
Trade ¹		
Trade Balance	- 1 527.4	- 2 224.7
Environmental Exports	614.6	684.3
Environmental Imports	2 142.0	2 909.0

Note:

Figures may not add up to total due to rounding.

1. Trade data are based on totals for the equipment and services categories.

Source:

Statistics Canada, Environment Accounts and Statistics Division, *Environment Industry Survey 1996 and 1997*.

Table A.4
**Canadian Total Environment Industry Revenues
 By EGS Category, 1996 and 1997**

Category	1996	1997	% change
	millions of Canadian dollars		
Goods:			
Water and Wastewater Equipment and Chemicals	677.6	740.5	9.3
Air Pollution Control	519.1	521.2	0.4
Instruments and Information Systems	156.6	169.6	8.3
Waste Management Equipment	262.7	259.9	-1.1
Services:			
Solid and Hazardous Waste Management ¹	4 206.1	4 037.5	-4.0
Environmental Consulting and Engineering	817.9	992.7	21.4
Environmental Testing and Analytical Services	638.0	630.3	-1.2
Water and Wastewater Management	2 875.1	3 168.0	10.2
Sub-total: Goods and Services Categories	10 153.1	10 519.7	3.6
Resources:			
Alternative Energy	136.0	139.2	2.4
Other:	8 159.0	8 257.8	1.2
Total: All Categories	18 446.9	18 915.6	2.5

Notes:

Figures may not add up to total due to rounding.

1. This category includes remediation services.

Sources:

Statistics Canada, Environment Accounts and Statistics Division, *Environment Industry Survey 1996 and 1997*.

Table A.5
Exports of Environmental Goods and Services
Canada-U.S. Comparison, 1996 and 1997

Category	Canada			U.S.		
	1996	1997	% change	1996	1997	% change
	millions of Canadian dollars			millions of Canadian dollars		
Goods:						
Water and Wastewater Equipment and Chemicals	155.0	184.1	18.8	4 520.5	6 388.9	41.3
Air Pollution Control	204.2	207.3	1.5	2 191.8	2 916.7	33.1
Instruments and Information Systems	41.2	42.6	3.5	2 191.8	2 222.2	1.4
Waste Management Equipment	86.5	89.5	3.5	2 602.7	2 222.2	-14.6
Services:						
Solid and Hazardous Waste Management ¹	13.8	27.0	95.6	2 602.7	2 361.1	-9.3
Environmental Consulting and Engineering	38.5	72.4	88.3	1 780.8	2 361.1	32.6
Environmental Testing and Analytical Services	34.1	35.2	3.3	32.9	41.7	26.7
Water and Wastewater Management	41.4	26.1	-37.0	411.0	277.8	-32.4
Sub-total: Goods and Services Categories	614.6	684.3	11.3	16 334.2	18 791.7	14.2
Resources:						
Alternative Energy	26.7	32.0	19.6	1 506.8	1 944.4	29.0
Other:	127.0	182.0	43.3	3 972.6	4 652.8	17.1
Total: All Categories	768.3	898.3	16.9	21 813.7	25 388.9	16.4

Notes:

Figures may not add up to total due to rounding.

U.S. data were calculated based on published estimates by Environmental Business International, Inc.

The units of measurement used in the original data were U.S. dollars. In order to make inter-country comparison possible, the units of measurement were changed to Canadian dollars.

The exchange rates used for 1996 and 1997 were taken from CANSIM Matrix M2450, Exchange Rates (USA\$/CDN\$).

1. This category includes remediation services.

Sources:

U.S. Department of Commerce, 1998.

Environmental Business International, Inc., 1998.

Statistics Canada, Environment Accounts and Statistics Division, *Environment Industry Survey 1996 and 1997*.

Table A.6
Environmental Exports' Share of Total Environmental Revenues
Canada-U.S. Comparison, 1996 and 1997

Category	Canada		U.S.	
	1996	1997	1996	1997
	%		%	
Goods:				
Water and Wastewater Equipment and Chemicals	22.9	24.9	18.9	25.3
Air Pollution Control	39.3	39.8	10.5	13.4
Instruments and Information Systems	26.3	25.1	51.6	49.1
Waste Management Equipment	32.9	34.5	19.4	16.4
Services:				
Solid and Hazardous Waste Management ¹	0.3	0.7	3.7	3.3
Environmental Consulting and Engineering	4.7	7.3	8.6	11.1
Environmental Testing and Analytical Services	5.3	5.6	2.0	2.7
Water and Wastewater Management	1.4	0.8	0.6	0.4
Sub-total: Goods and Services Categories	6.1	6.5	7.3	8.0
Resources:				
Alternative Energy	19.7	23.0	44.0	51.7
Other:	1.6	2.2	19.2	20.7
Total: All Categories	4.2	4.7	8.8	9.8

Notes:

Figures may not add up to total due to rounding.

U.S. data were calculated based on published estimates by Environmental Business International, Inc.

The units of measurement used in the original data were U.S. dollars. In order to make inter-country comparison possible, the units of measurement were changed to Canadian dollars.

The exchange rates used for 1996 and 1997 were taken from CANSIM Matrix M2450, Exchange Rates (USA\$/CDN\$).

1. This category includes remediation services.

Sources:

U.S. Department of Commerce, 1998.

Environmental Business International, Inc., 1998.

Statistics Canada, Environment Accounts and Statistics Division, *Environment Industry Survey 1996 and 1997*.

Table A.7
Canadian Environmental Exports By Destination, 1996 and 1997

Destination	1996	1997
	millions of Canadian dollars	
United States	442.9	549.9
South America	68.2	70.3
Mexico	13.1	13.7
Other Central America	2.2	2.6
Europe	113.7	140.3
Middle East/Africa	30.8	40.2
Asia	62.3	56.9
All other	35.1	24.4
Total Exports¹	768.3	898.3

Notes:

Figures may not add up to total due to rounding.

1. Includes all EGS categories.

Source:

Statistics Canada, Environment Accounts and Statistics Division, *Environment Industry Survey 1996 and 1997*.

Table A.8
**Imports of Environmental Goods and Services
 Canada-U.S. Comparison, 1996 and 1997**

Category	Canada			U.S.		
	1996	1997	% change	1996	1997	% change
	millions of Canadian dollars			millions of Canadian dollars		
Goods:						
Water and Wastewater Equipment and Chemicals	504.3	790.6	56.8	2 465.8	3 055.6	23.9
Air Pollution Control	525.1	656.3	25.0	1 780.8	1 944.4	9.2
Instruments and Information Systems	161.6	250.0	54.7	411.0	416.7	1.4
Waste Management Equipment	682.9	527.8	-22.7	821.9	1 388.9	69.0
Services:						
Solid and Hazardous Waste Management ¹	72.5	147.6	103.5	411.0	277.8	-32.4
Environmental Consulting and Engineering	134.0	442.7	230.3	411.0	277.8	-32.4
Environmental Testing and Analytical Services	4.1	6.3	52.0	32.9	0.0	-100.0
Water and Wastewater Management	57.5	87.8	52.9	2 191.8	4 166.7	90.1
Sub-total: Goods and Services Categories	2 142.0	2 909.0	35.8	8 526.0	11 527.8	35.2
Resources:						
Alternative Energy	..	..	..	274.0	416.7	52.1
Other:	..	..	..	411.0	555.6	35.2
Total: All Categories	..	..	..	9 211.0	12 500.0	35.7

Notes:

Figures may not add up to total due to rounding.

U.S. data were calculated based on published estimates by Environmental Business International, Inc.

The units of measurement used in the original data were U.S. dollars. In order to make inter-country comparison possible, the units of measurement were changed to Canadian dollars.

The exchange rates used for 1996 and 1997 were taken from CANSIM Matrix M2450, Exchange Rates (USA\$/CDN\$).

1. This category includes remediation services.

Sources:

U.S. Department of Commerce, 1998.

Environmental Business International, Inc., 1998.

Statistics Canada, Environment Accounts and Statistics Division, *Environment Industry Survey 1996 and 1997*.

Table A.9
Environmental Imports' Share of Total Domestic Market
Canada-U.S. Comparison, 1996 and 1997

Category	Canada		U.S.	
	1996	1997	1996	1997
	%		%	
Goods:				
Water and Wastewater Equipment and Chemicals	49.1	58.7	11.3	13.9
Air Pollution Control	62.5	67.6	8.7	9.3
Instruments and Information Systems	58.3	66.3	16.7	15.3
Waste Management Equipment	79.5	75.6	7.1	10.9
Services:				
Solid and Hazardous Waste Management ¹	1.7	3.5	0.6	0.4
Environmental Consulting and Engineering	14.7	32.5	2.1	1.4
Environmental Testing and Analytical Services	0.7	1.0	2.0	0.0
Water and Wastewater Management	2.0	2.7	3.1	5.5
Sub-total: Goods and Services Categories	18.3	22.8	3.9	5.1
Resources:				
Alternative Energy	..	..	12.5	18.6
Other:	..	..	2.4	3.0
Total: All Categories	..	..	3.9	5.1

Notes:

Figures may not add up to total due to rounding.

U.S. data were calculated based on published estimates by Environmental Business International, Inc.

The units of measurement used in the original data were U.S. dollars. In order to make inter-country comparison possible, the units of measurement were changed to Canadian dollars.

The exchange rates used for 1996 and 1997 were taken from CANSIM Matrix M2450, Exchange Rates (USA\$/CDN\$).

1. This category includes remediation services.

Sources:

U.S. Department of Commerce, 1998.

Environmental Business International, Inc., 1998.

Statistics Canada, Environment Accounts and Statistics Division, *Environment Industry Survey 1996 and 1997*.

Table A.10
Trade Balances in Environmental Goods and Services
Canada-U.S. Comparison, 1996 and 1997

Category	Canada			U.S.		
	1996	1997	% change	1996	1997	% change
	millions of Canadian dollars			millions of Canadian dollars		
Goods:						
Water and Wastewater Equipment and Chemicals	- 349.3	- 606.5	-257.2	2 054.8	3 333.3	1 278.5
Air Pollution Control	- 320.9	- 448.9	-128.0	411.0	972.2	561.3
Instruments and Information Systems	- 120.4	- 207.4	-87.0	1 780.8	1 805.6	24.7
Waste Management Equipment	- 596.5	- 438.2	158.2	1 780.8	833.3	-947.5
Services:						
Solid and Hazardous Waste Management ¹	- 58.7	- 120.5	-61.8	2 191.8	2 083.3	-108.4
Environmental Consulting and Engineering	- 95.6	- 370.3	-274.7	1 369.9	2 083.3	713.5
Environmental Testing and Analytical Services	29.9	28.9	-1.0	0.0	41.7	41.7
Water and Wastewater Management	- 16.1	- 61.8	-45.7	- 1 780.8	- 3 888.9	-2 108.1
Sub-total: Goods and Services Categories	- 1 527.4	- 2 224.7	-697.3	7 808.2	7 263.9	-683.2
Resources:						
Alternative Energy	..	..	..	1 232.9	1 527.8	294.9
Other:	..	..	..	3 561.6	4 097.2	535.6
Total: All Categories	..	..	..	12 602.7	12 888.9	286.1

Notes:

Figures may not add up to total due to rounding.

U.S. data were calculated based on published estimates by Environmental Business International, Inc.

The units of measurement used in the original data were U.S. dollars. In order to make inter-country comparison possible, the units of measurement were changed to Canadian dollars.

The exchange rates used for 1996 and 1997 were taken from CANSIM Matrix M2450, Exchange Rates (USA\$/CDN\$).

1. This category includes remediation services.

Sources:

U.S. Department of Commerce, 1998.

Environmental Business International, Inc., 1998.

Statistics Canada, Environment Accounts and Statistics Division, *Environment Industry Survey 1996 and 1997*.

