

Assessing Latin American Markets for North American Environmental Goods and Services

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Commission for Environmental Cooperation

Three nations working together to protect the Environment.

A North American approach to environmental concerns.

The **Commission for Environmental Cooperation (CEC)** was established by Canada, Mexico and the United States in 1994 to address transboundary environmental concerns in North America. While the idea to create such a commission originated during the negotiations of the North American Free Trade Agreement (NAFTA), it derives its formal mandate from the North American Agreement for Environmental Cooperation (NAAEC).

The NAAEC builds upon and complements the environmental provisions established in the NAFTA. It creates a North American framework whereby goals related to trade and the environment can be pursued in an open and cooperative way.

In broad terms, the NAAEC sets out to protect, conserve and improve the environment for present and future generations. How? The parties to the Agreement set out the following objectives:

- to protect the environment through increased cooperation;
- to promote sustainable development based on mutually supportive environmental and economic policies;
- to support the environmental goals of NAFTA and avoid creating trade distortions or new trade barriers;
- to strengthen cooperation on the development of environmental laws and enhance their enforcement; and
- to promote transparency and public participation.

In signing the NAAEC, the governments of Canada, Mexico and the United States committed themselves to a core set of actions, including:

- reporting on the state of the environment;
- striving for improvement of environmental laws and regulations;
- effective enforcement of environmental law; and
- publication and promotion of information.

Mission Statement

The CEC facilitates cooperation and public participation to foster conservation, protection and enhancement of the North American environment for the benefit of present and future generations, in the context of increasing economic, trade and social links between Canada, Mexico and the United States.

Introduction and Acknowledgements

Competitiveness and market access in the twenty-first century are irrevocably tied to the use of, and export of, modern, efficient and clean technologies. Indeed, trade presents enormous opportunities and potential for the promotion and development of new clean technologies and creates opportunities for investment and innovation. In North America, the opportunities for investment in environmental technology have been tremendous. Above all, the inclusion of Mexico in the North American market will provide lessons that will be of interest to Latin America. Trade liberalisation and NAFTA has enabled Canadian, Mexican, and US environmental service and technology providers to develop, partner and conduct their collective environmental problem-solving and expertise both together as a new community and beyond North America's borders.

The Commission for Environmental Cooperation's (CEC) report *Assessing Latin American Markets for North American Environmental Goods and Services* features such critical information as what makes multinational or North American partnerships successful, where markets are expanding, and where Mexico has been successful in developing clean technologies and adapting proven technologies from the US and Canada for use in its domestic market. The report also highlights how these, and other technologies might expand into new markets with similar needs.

The principal authors of this report are Sarah England of ESSA Technologies Ltd., Richard Kiy, of SAIC de México S.A. de C.V., John Bildner of CG/LA Infrastructure and Johnathan Rhone of the GLOBE Foundation. The CEC would like to acknowledge the tremendous effort made by these individuals and their respective organizations in compiling this report.

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July, 1996

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Acronyms

ACUBA	Association of Buenos Aires Tanneries (Argentina)
ADEGA	Asociación para el Desarrollo de la Gestión Ambiental (Argentina)
ADI	Association of Designers and Inspectors
ADIMRA	Association of Metallurgical Industries of Argentina
ADTP	Tietê-Paraná Development Agency (Brazil)
AGOSBA	Buenos Aires Water and Sanitation (Argentina)
AMPICH	Association of Small and Medium Industries of Chile
ASL	Analytical Service Laboratories
ASOQUIM	<i>Asociación Venezolana de la Industria Química y Petroquímica</i> Chemical Manufacturers Association of Venezuela
Bancomext	<i>Banco Nacional de Comercio Exterior</i> Mexican Foreign Trade Commission
BECC	Border Environmental Cooperation Commission
BFI	Browning Ferris International
BNDS	Brazilian National Development Bank
BOT	build-operate-transfer
BTU	measuring unit for energy
CACM	Central American Common Market
CAD	Canadian dollars
CARICOM	Caribbean Economic Community
CARs	Regional Autonomous Corporations (Colombia)
CCC	Canadian Commercial Corporation
CEAMSE	Metropolitan Area Ecological Coordination Agency (Argentina)
CECODES	<i>Consejo Empresarial Colombiano para el Desarrollo Sostenible</i> Business Council for Sustainable Development (Colombia)
CEDRM	Special Decontamination Commission for the Metropolitan Region (CEDRM is a part of CONAMA) (Chile)
CEL	Criminal Environmental Law (Venezuela)
CEMEX	<i>Cementos Mexicanos</i> Mexican Cement Association
CEPA	Canadian Environmental Protection Act
CETESB	Environmental Sanitation Technology Company (Brazil)
CETESB	São Paulo Environmental Protection Agency (Brazil)
CIDA	Canadian International Development Agency
CNA	<i>Comisión Nacional del Agua</i> National Water Commission (Mexico)
CODELCO	National Copper Corporation (Chile)
CoFAPYS	Federal Council of Potable Water and Sanitation (Argentina)

COFEMA	Federal Commission on the Environment (Argentina)
CONAMA	<i>Conselho Nacional do Meio Ambiente</i> National Environment Commission (Brazil)
Conieco	<i>Consejo Nacional de Industriales Ecológicas</i> National Chamber of Environmental Manufacturers (Mexico)
COREMAs	<i>Comisión Regionales del Medio Ambiente</i> Regional Environmental Commissions (Chile)
CORFO	Production Development Corporation (Chile)
CPDS	Capital Project Detailed Study
CPPS	Capital Project Preliminary Study
CVG	Corporation Venezolana de Guyana
DFAIT	Department of Foreign Affairs and International Trade (Canada)
DIPOS	Provincial Department of Sanitary Works (Argentina)
DIPOS	Provincial Water and Sewage Agency of Tucumán
DNP	National Department of Planning (Colombia)
ECOPETROL	<i>Empresa Colombiana de Petróleos</i> , National Oil Company (Colombia)
EDC	Export Development Corporation (Canada)
EEC	Environment Export Council
EGS	environmental goods and services
EIS	environmental impact study
EMAU	Defunct arm of the Venezuelan Ministry of the Environment
EMOS	Municipal Sanitation Company (Santiago, Chile)
ENAMI	state-owned smelting company (Chile)
EPA	Environmental Protection Agency (US)
EPAS	Provincial Agency for Water and Sanitation (Mendoza, Argentina)
ESSAL	Los Lagos Sanitary Services (Chile)
ESVAL	Valparaiso Sanitation Company (Chile)
Eximbank	US Export-Import Bank
FEEMA	State Environmental Engineering Foundation (Brazil)
FIESP	Sao Paulo Federation of Industries (Brazil)
FTAA	Free Trade Agreement for the Americas
G3	Trade Agreement between Mexico, Colombia and Venezuela
GETE	Global Environment Technology Enterprise (US)
GDP	Gross Domestic Product
GLIN	Great Lakes Information Network
HEBC	Hemispheric Environmental Business Council — formerly US Environmental Business Council
IBAMA	<i>Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis</i> Institute of Environment and Renewable Natural Resources (Brazil)

IBGE	Institute of Geography and Statistics (Brazil)
ICA	<i>Ingenieros Civiles Asociados, S.A. de C.V.</i> Mexican construction firm
IADB	Inter-American Development Bank
IMAC	<i>Ingenieria y Medio Ambiente de Coahuila</i>
IMP	Buenos Aires Provincial Institute of the Environment (Argentina)
IMP	<i>Instituto Mexicano del Petróleo</i> Mexican Petroleum Institute (Mexico)
INDERNA	National Institute for Renewable Natural Resources (Colombia)
INE	<i>Instituto Nacional de Ecología</i> National Institute of Ecology (Mexico)
IPMA	Buenos Aires Provincial Institute of the Environment (Argentina)
IPT	Institute of Technological Research (Brazil)
ISO	International Standards Organization
ITESM	Technological Institute of Monterrey, Center for Sustainable Development
JV	joint venture
LAC	Latin American Countries
MARNR	Ministry of Environment and Renewable Natural Resources (Venezuela)
MDB	Multilateral Development Bank (Brazil)
MERCOSUR	South American Common Market
Minambiente	Ministry of the Environment (Colombia)
NAAEC	North American Agreement on Environmental Cooperation
NADBANK	North American Development Bank
NAEF	North American Environment Fund
Nafin	<i>Nacional Financiera</i> , Mexico's National Development Bank
NAFTA	North American Free Trade Agreement
NIMBY	"not in my back yard"
NIST	National Institute of Standards and Technology (US)
Ocensa	<i>Oleoducto Central</i> Colombian oil company.
OECD	Organization for Economic Cooperation and Development
OECF	Overseas Economic Cooperation Fund (Brazil)
OLIFI	Office for Liaison with International Financial Institutions (Canada)
OPIC	Overseas Private Investment Corporation
OSM	Mendoza Sanitary Works (Argentina)
PCB	Polychlorinated biphenyl
PIES	Pollution Prevention Information Exchange System (US)
PDVSA	<i>Petroleos de Venezuela</i> , Venezuela Petroleum Company
PM-10	measuring unit for particulate matter in the air
PRE	AID's Bureau of Private Enterprise

Profepa	<i>Procuraduría Federal para la Protección del Ambiente</i> Federal Environmental Attorney General (Mexico)
PRONOPAC	National Water and Sewage Program (Argentina)
R&D	research and development
RIMSA	<i>Residuos Industriales Multiquim, S.A. de C.V.</i> a subsidiary of Chemical Waste Management de México
SABESP	São Paulo Basic Sanitation Company
SAG	Organic Law of Agricultural and Ranching Services (Chile)
SAIC	Science Applications International Corporation
Semarnap	<i>Secretaría del Medio Ambiente, Recursos Naturales y Pesca</i> Secretariat for the Environment, Natural Resources and Fisheries (Mexico)
SFA	<i>Sistema Federale Ambiente</i> National Environmental System
SIMA	National Environment System (Colombia)
SISNAMA	<i>Sistema Nacional do Meio Ambiente</i> National Environmental System (Brazil)
SRNAH	<i>Secretaría de Recursos Naturales y Ambiente Humano</i> Secretariat for Natural Resources and Human Environment (Argentina)
TELIPA	Avellaneda Industrial Liquid Effluent Treatment Plant (Argentina)
TVA	Tennessee Valley Authority
UIA	Argentina Industrial Union
UNAM	<i>Universidad Autonoma de México</i> National Autonomous University of Mexico
USAID	US Agency for International Development
USDOC	US Department of Commerce
USTDA	US Trade Development Agency
USTDA	US Trade and Development Agency (Argentina)
WMX	Waste Management (Argentina)
YPF	Government Oil Wells (Argentina)

Preface

Latin America is an expanding market for North American environmental goods and services. This market growth is the result of several factors. These include: the clear need for more and better environmental management; inadequate environmental infrastructure throughout the region; significant advances in environmental laws and regulations; increased democratization coupled with growing environmental activism; a trend toward privatizing government-owned facilities, together with a growing demand for environmental remediation of sites before sale; a trend toward increased decentralization of fiscal authority, environmental enforcement and the provision of public services; and international pressure to promote environmental compliance and upward harmonization of environmental standards.

Furthermore, the passage of the North American Free Trade Agreement (NAFTA), particularly its chapters on services and investment, has created new market opportunities for environmental technology and service firms in the region. Mexican, American and Canadian firms have also begun to use their respective comparative advantages to secure environmental market opportunities in countries throughout the rest of Latin America.

Despite the expanding nature of the environmental business sector in Latin America, rates of growth will vary from country to country. On the whole, economic demand for consumer products in Latin America is high although productivity is generally low. The need to improve production capacity and productivity may affect an individual country's ability to purchase environmental goods and services.

This guide is intended to provide information to facilitate access to this growing market; to promote the sale of North American environmental technologies and services to Latin American clients; and to increase the capacity for environmental protection throughout the hemisphere. The intended audience is North American environmental firms considering expansion into Latin America's largest emerging environmental markets: Chile, Argentina, Brazil, Colombia and Venezuela.

The concept of accessing the Latin American market for environmental goods and services is too broad a topic for a single document. Therefore, this report is confined to those topics of most immediate use and of most limited access to firms that do not currently have the know-how to compete in the Latin American market, but are contemplating expansion into that region. It is designed both to encourage potential exporters and to help them find additional information.

Latin America is fertile ground for business development by North American environmental firms. It should be emphasized, however, that there are appreciable risks inherent in doing business in Latin America, as the 1995 economic crisis in Mexico illustrates. Exchange rate, re-payment and other economic risks, as well as political and personal safety risks, are real. Any firm planning to do business in the region should pay attention to the elements of the case studies that indicate what works. Financing, full service packages and patience are typical of the essential ingredients for success.

Overall, the top environmental priorities are sewage networks and water supply. Businesses targetting these areas will find a large and growing need for their technologies and services. The marketing of technologies that are not only tailored to the local problem, but are also cost-effective, is essential. The needs and capabilities of each setting, as well as ability to pay, must be matched to the technology.

This report analyzes target markets within Latin America; reviews environmental regulatory reform in the target countries; reviews market conditions in the target subsectors; identifies specific project opportunities; analyzes North American export strengths; analyzes the comparative advantage of the three NAFTA partners *à vis* exports to Latin America; appraises market access strategies; provides information on sources of financing; and lists ongoing and contemplated projects throughout the region.

Target Market

Although Latin American countries are very different in ecology, climate, level of development and gross domestic product (GDP) per capita, they tend to share the environmental problems of severe air pollution, water pollution, lack of hazardous waste treatment and disposal, inadequate solid waste disposal, deforestation, and destruction of natural habitats. There is a pressing need for environmental goods and services that are appropriate to local economic, environmental and infrastructural conditions. However, regulatory drivers and economic forces vary within the region, and these variations have formed the basis for the selection of the target markets analyzed in this study. Though important opportunities exist for environmental work in Mexico, especially in the area of emission

control, hazardous waste treatment and disposal, and water delivery systems, the primary target markets identified here are Argentina, Brazil, Chile, Colombia and Venezuela.

The reasons for examining these markets extend well beyond trade liberalization. The factors that foster expanded market opportunities for North American firms in Latin America include: inadequate municipal environmental infrastructure; advances in environmental regulations; democratization coupled with environmental activism; privatization of heavy industry and accompanying requirements for environmental investments; decentralization, which may facilitate financing municipal environmental projects; increasing international pressure to comply with international environmental management standards such as International Standards Organization (ISO) 14000; the beginnings of a shift of responsibility for environmental infrastructure from the public to the private sector; and plant and equipment modernization to improve production, which often includes modern pollution control.

Environmental Regulatory Reform and Regional Trade Agreements

Chapter 2 reviews environmental regulatory reform in target countries, and regional cooperation and trade agreements beyond the NAFTA and the proposed Free Trade Agreement for the Americas (FTAA). Mexico's recently negotiated bilateral and regional free trade agreements with Chile (1994), Costa Rica (1995) and Colombia and Venezuela (1995) uniquely position Mexican companies to have better access to market opportunities in these countries. This can also facilitate partnerships with American and Canadian firms wishing to do business in these markets, as well as increasing opportunities for Mexican initiatives. Other agreements examined include the South American Common Market (*MERCOSUR*), the Caribbean Economic Community (CARICOM), the Andean Pact and the Central American Common Market (CACM).

Market Overview and Analysis of Target Subsectors

The market overview in Chapter 3 is intended as a quick reference guide, providing a brief overview of each of the target countries of Argentina, Brazil, Chile, Colombia and Venezuela. Each section has been designed to stand alone as a summary of the business opportunities and conditions in that country. For each section, the principal environmental market opportunities have been identified, critical statistics have been provided and an explanation of key business issues has been laid out.

The findings indicate that in Argentina, key opportunities are in the areas of water pollution and hazardous waste control. In Brazil, the key opportunities are diverse, and focus on municipal sanitation, although industrial and hazardous waste are also important. In Chile, the mining sector represents the biggest opportunity for sales of environmental equipment. Other key sectors requiring inputs of environmental goods and services include fish processing and the southern timber industry. Colombia's environmental market includes a need for wastewater treatment facilities for major metropolitan areas, solid and hazardous waste management services, and air pollution control equipment. Significant opportunities are also to be anticipated in connection with Colombia's booming oil industry. In Venezuela, the petroleum sector presents environmental market opportunities. Environmental services and technologies for *Petróleos de Venezuela*, the Venezuela Petroleum Company, are projected to represent a market worth US\$612.4 million between 1996 and the year 2000. Investment will centre on effluent treatment, atmospheric emissions, industrial waste management and soil conservation.

American, Canadian and Mexican Export Strengths

American, Canadian and Mexican environmental goods and service companies are uniquely positioned to take advantage of growing opportunities in Latin America's emerging environmental market. Chapter 4 outlines the relative strengths in supply of each of the NAFTA partner nations in the provision of environmental goods and services to Latin America. American and Canadian companies offer state-of-the-art technologies, skilled labour and extensive experience in responding to the opportunities created by regulatory requirements. Mexican companies command some of the most competitive labour rates in the world for skilled professionals in the environmental service sector and have a good track record of working with American and Canadian companies. A growing number of Mexican companies also have experience throughout Latin America. Recent initiatives have increased the number of Mexican environmental professionals and Mexican environmental service companies with specific expertise in the areas of environmental auditing, air pollution monitoring, air emissions reduction and

wastewater treatment. This section also provides an indication of what kinds of technologies and services have been successfully exported from North America to Latin America.

Market Access Strategies

Chapter 5 provides an overview of market access strategies with a focus on process and partnering options. Detailed case studies are used to illustrate how partnerships are created and what makes them work in Latin America. Since the passage of the NAFTA, there has been a marked increase in the number of partnerships between Mexican, American and Canadian firms in a host of environmental projects throughout Mexico. The 1995 economic crisis has, for the time being, slowed growth in that country's environmental service and technology sector for domestic and foreign firms alike. This section examines the extent to which existing and new NAFTA partnerships can be leveraged to ease access to Latin American markets.

Financing

Chapter 6 examines export financing strategies, sources and constraints. With limited access to internal capital and limits on international funding, project financing is a major constraint in developing the Latin American market. This chapter provides a guide to the principal multilateral and bilateral financiers of development projects, as well as an introduction to the import/export banks and investment corporations of the US, Canada and Mexico. The potential for funding environmental projects in Latin America from these sources is examined.

1.0 Introduction

With the passage of the North American Free Trade Agreement (NAFTA) and the possibility of joining this historic trade accord, countries throughout Latin America have embraced the notion of hemispheric economic integration. In fact, this proved to be the underlying theme of the Summit of the Americas held in Miami during early December 1994. Leaders of 34 nations jointly committed to the establishment of a Free Trade Agreement for the Americas (FTAA) by the year 2005. The “Spirit of Miami” was reinforced by the recent hemispheric trade ministerial meeting held in March 1996 in Cartagena, Colombia.

Yet, the path toward a hemispheric trade pact stretching from the Yukon to Tierra del Fuego has met with some difficulty. Just weeks after the Miami Summit, Mexico experienced an economic crisis that damaged investor confidence in Latin America. Investor fears were reinforced by political opposition in the United States to an economic rescue package for Mexico and, most recently, the government’s inability to secure “fast track” negotiating authority for Chile’s accession to the NAFTA, even though Chile had been invited to join the NAFTA during the Summit.

1.1 Why Latin America?

Given the real and perceived economic challenges that countries in Latin America face, why should North American environmental companies actively consider entering this market? The reason is simple. In spite of the short-term repercussions of the collapse of the Mexican peso (the “tequila effect”), the region has undertaken some very fundamental institutional and economic reforms that have positioned it to take advantage of long-term economic growth, projected to exceed 6 percent between 1998 and 2005. Also, countries throughout the region are now making environmental protection a legislative priority.

Despite current uncertainty over the timing of the NAFTA accession, nations throughout the region remain committed to adhering to the “Miami deadline” of 2005 to have a fully enacted FTAA with not just some, but all of the rules in place, including those specific to the environment. In fact, Latin American countries are already working to promote inter-regional trade by dropping existing trade barriers and establishing both bilateral and multilateral trade agreements as exhibited by the South American Common Market (*MERCOSUR*), made up of Argentina, Brazil, Uruguay and Paraguay. In the spring of 1996, Chile entered into negotiations to become an associate member of *MERCOSUR*. Likewise, similar agreements are currently being negotiated between *MERCOSUR* and both Venezuela and Bolivia. In fact, as a means of establishing a counter-balance to the NAFTA, Brazil has recently proposed the establishment of *MERCONORTE*, to serve as a *MERCOSUR*’s northern counterpart in South America to include member countries of the Andean Pact (Bolivia, Colombia, Ecuador, Peru, and Venezuela).

Besides trade activity between Brazil and the rest of Latin America, Mexico, Venezuela and Colombia (commonly known as the G3) have formed their own regional trade accord. Bilaterally, Mexico and Chile signed a free trade agreement which came into effect in 1992.

Table 1-1: Latin American countries (LAC) environmental market overview 1995

Country	Market (US \$ billions)	GDP (US \$ billions)	Population (millions)	Market Growth (percentage)
Brazil	2.4	369	157	10-14
Mexico	2.0	328	90	10-14
Argentina	0.7	112	34	8-12
Chile	0.3	35	14	15-20
Colombia	0.3	51	35	8-10
Peru	0.3	25	23	8-10

Venezuela	0.3	58	20	9-11
Rest of LAC	0.3	144	413	6-8
Total LAC	6.6	1,122	786	12%

Source: Environmental Business International Inc.

1.2 Why These Target Markets?

In this survey, five key target markets with particular promise for North American environmental technology and service companies have been identified in Latin America. They are: Argentina, Brazil, Chile, Venezuela and Colombia.

Though various other countries in Latin America, such as Peru and Ecuador, are taking positive strides to improve their environment, the five target countries represent the markets with the greatest short-term potential for companies interested in expanding into Latin America. Of these, the countries demonstrating the most promise are Brazil and Chile. Both have made significant progress in streamlining their regulatory processes, tightening pollution regulations and strengthening enforcement. Argentina has not moved as far in these areas, but is making substantial progress in instituting viable environmental programs. In 1992, Argentina established the new *Secretaría de Recursos Naturales y Ambiente Humano* (SRNAH) Secretariat for Natural Resources and Human Environment, and enacted a law governing the generation, transport, handling, treatment and disposal of hazardous waste in areas under national jurisdiction.

Given recent political and economic uncertainties in both Venezuela and Colombia, these countries may not seem like obvious priority environmental markets. However, environmental expenditures for their respective oil and gas industries are very real. In Colombia, the state-owned oil company *Empresa Colombiana de Petróleos* (ECOPETROL), will commit US\$160 million in environmental expenditures during 1996. Similarly, the Venezuela Petroleum Company (PDVSA) is slated to spend upwards of US\$612 million on the environment between now and the year 2000.

According to a report by the US Agency for International Development (USAID), the combined six-country region consisting of Argentina, Brazil, Chile, Colombia, Mexico and Venezuela was expected to generate a demand for environmental goods and services totalling US\$2.45 billion in 1992. Approximately 70 percent of the spending in these markets was expected to come from the construction of municipal and industrial wastewater treatment projects. Air pollution control markets were estimated to account for 21 percent of market share, while solid and hazardous waste markets were to have accounted for 9 percent of total spending. Recent studies undertaken by the US Department of Commerce (USDOC), Office of Environment Export Technologies, and private market research companies support the earlier projections by USAID and demonstrate that the environmental market continues to grow in each of these six countries.

1.3 Economic & Political Climate in Latin America

For much of the 1980s and early part of the 1990s, in what has been dubbed the “lost decade,” the economies of Latin America stagnated as a result of hyperinflation, import substitution policies and political instability. Infrastructure investment during this period was largely nonexistent. However, during the last few years significant changes have taken place, including democratization and economic reform. These reforms have included the privatization of major government-owned enterprises and the opening of national economies through import liberalization and deregulation. These reforms had begun to generate positive results as exports expanded, inflation declined and productivity and personal income increased.

This progress was interrupted in some countries by the Mexican economic crisis of 1994-1995, which shook investor confidence in emerging markets throughout the world including many of those in Latin America. During the first quarter of 1995, countries across the region (with the exception of Colombia, Peru and Chile) faced significant downward pressure on their currencies and their respective stock markets.

Yet, by the third quarter of 1995, countries throughout the hemisphere had largely stabilized. In fact, the Mexican crisis gave Latin American leaders another reason to reaffirm their commitment to reform, including: raising domestic savings rates; encouraging private investment in infrastructure (energy, environment, transportation and

telecommunications); reforming labour codes and education systems; and deregulating and de-bureaucratizing lower levels of government. Other reforms being undertaken throughout the region include:

- accelerating the pace of decentralization by reforming the federal state/provincial division of authority and revenues, to assure long-term fiscal stability
- creating independent central banks to assure long-term monetary stability
- launching banking and pension reform to facilitate higher savings and investment and deepen capital markets
- putting greater emphasis on sustainable development

Once put in place, these reforms can help create an economic structure in the region that mirrors that in East Asia, where annual growth rates are predicted to be in excess of 6 percent between 1998 and 2005. Such growth would present tremendous opportunities for North American companies, including strategic partnerships between North American firms positioned to take advantage of rising expenditures on environmental goods and services.

The Mexican crisis prompted the implementation of policies with unavoidable short-term recessionary effects during the first quarter of 1995. However, the institution of these reforms has increased the capacity of countries such as Argentina, Brazil, Chile, and Colombia for positive economic growth for the rest of the decade. The notable exception is Venezuela.

Unlike other countries in Latin America, Venezuela had already entered a deep economic crisis even before the recent Mexican developments. As a result of isolating itself from international capital markets by introducing stern controls on capital flows, Venezuela had not been as severely affected as some other Latin American countries (LAC) by events in Mexico. Yet, in spite of Venezuela's economic troubles, there are some signs of hope for recovery in the medium to long term. On April 5, 1996, President Caldera announced the lifting of foreign exchange controls. The net effect has been a devaluation of the Venezuelan currency of over 50 percent against the American dollar. These measures were accompanied by an over 600 percent increase in gasoline prices and inflation rates that are expected to go into triple digits by the end of 1996.

Still, in spite of Venezuela's current economic challenges, the country is making substantial progress in privatizing state-owned industries and instituting other important institutional reforms. This is particularly true in the area of the environment. Already the Venezuelan Environment and Renewable Nature Resources Ministry (MARNR) has put the state-owned Venezuelan Petroleum Company (PDVSA) on notice that it will soon start strictly enforcing a wide range of environmental norms applicable to the oil and gas industry. Similarly, the country's mining and steel producing sector may also begin to feel MARNR's regulatory squeeze.

Efforts at economic reform in Latin America are being complemented by the movement towards regional economic integration. Latin American countries are dropping existing trade barriers and establishing both bilateral and multilateral trade agreements. Regional trade agreements are exemplified by the South American Common Market (MERCOSUR), a customs union made up of Argentina, Brazil, Uruguay, Paraguay and, most recently, Bolivia, although Bolivia's terms are somewhat different. Chile is expected to join as an associate member by July 1996, and Mexico has had initial discussions with Brazil to become a member or associate. Similarly, Mexico, Venezuela and Colombia (the G3) have formed their own regional trade accord. Mexico and Chile signed a free trade agreement that came into effect in 1994. This agreement is now being expanded to include trade in services. Bolivia, Colombia, Ecuador and Venezuela have already formed a customs union with partial coverage, and Peru was expected to join towards the end of 1995. In November 1994, all five countries reached agreement on a common external tariff, to be implemented later this year. Intra-regional trade doubled between 1990–1994 in the Central American Common Market (CACM), recovering from the stagnation of the 1980s. In the case of the Caribbean Economic Community (CARICOM), implementation problems and the more heterogeneous composition of the group resulted in the virtual stagnation of regional trade at the low levels of the late 1980s. The volume of intra-regional trade in LACs has increased dramatically since the beginning of the 1990s. Intra-regional exports rose from US\$16 billion in 1990 to more than US\$32 billion in 1994, or from 3 percent of total exports to almost 22 percent. MERCOSUR is the most dynamic group, with a total of US\$11.4 billion in intra-regional exports in 1994. This represents a three-fold increase in five years. Simultaneously, exports to the rest of the world grew by 28 percent. Trade within the Andean Pact countries also increased, with exports reaching US \$3.5 billion in 1994.

Given the myriad trade agreements between various countries in the Americas and the significance of MERCOSUR, it is clear that as the countries of the Americas move towards a Free Trade Agreement for the Americas (FTAA), the North American Free Trade Agreement (NAFTA) will not be the only blueprint. The next

few years will see the evolution of relations as various countries seek to position themselves for expanded trade opportunities.

Table 1-2: Intra-regional exports in Latin American countries (percent of total exports)

	Average 1980–85	Average 1985–90	1990	1991	1992	1993
Argentina	19.0	22.7	26.1	29.3	32.9	41.4
Bolivia	49.1	52.9	44.8	48.4	38.7	37.3
Brazil	NA	12.5	11.6	16.7	22.0	25.2
Chile	NA	14.6	12.6	14.8	17.0	20.0
Colombia	15.7	14.2	16.1	21.6	23.8	25.3
Ecuador	17.0	13.6	17.7	17.1	17.9	21.0
Mexico	NA	6.7	6.0	6.7	5.0	4.9
Nicaragua	NA	14.8	21.9	26.2	28.5	27.3
Paraguay	NA	49.3	52.4	46.7	50.2	49.0
Peru	15.8	14.9	14.6	18.5	18.0	18.7
Uruguay	NA	33.5	39.5	40.7	41.8	51.2
Venezuela	11.4	10.0	11.9	12.6	17.1	20.0

not available

Source: ComTrade, United Nations International Trade Database.

Country and Political Risk

Latin America is a region with tremendous potential for market expansion for North American environmental firms with a medium- to long-term vision. Growing pressures created by the urbanization are causing countries throughout the region to give environmental protection more serious attention. All the countries surveyed in this report (Colombia, Venezuela, Chile, Brazil and Argentina) have strengthened their environmental laws in recent years. Accordingly, more resources are being expended on environmental goods and services than ever before. While the opportunities for export sales exist, there are nevertheless risks which any North American environmental firm should consider. These include:

- *Exchange Rate Risk*
One way to minimize exchange rate exposure is to maximize costs in local currency, particularly in the area of labour, thereby minimizing the company's exposure in dollars. If the majority of costs are in local currency the risk associated with currency fluctuations is reduced and competitiveness in the local marketplace is increased.
- *Re-Payment Risk*
There are inherent risks associated with payment for goods and services, particularly when a transaction is trans-border. To minimize risk, it is useful to secure a standby letter of credit from the customer or secure other forms of payment guarantees such as those provided by the US Export-Import Bank (Eximbank), the Canadian Export Development Corporation (EDC) or *Banco Nacional de Comercio Exterior (Bancomext)*, the Mexican Foreign Trade Commission.
Judicial and administrative recourse in Argentina, Brazil, Colombia and Venezuela is not always a reliable vehicle for prosecuting claims against non-paying customers.
- *Political and Economic Risk*
Since the 1980s, Latin America has experienced considerable economic growth and political stabilization as governments throughout the hemisphere move towards democracy. Nevertheless, political and economic risks

still exist across Latin America from economic volatility in Mexico and Venezuela to the political uncertainty in Colombia (brought about by suggestions that President Samper's recent election campaign was financed, in part, by the Cali drug cartel). It pays to learn more about the political and economic climate for the country in question before doing business in Latin America. Information is available from Embassies (see Appendix B), the US Department of Commerce (USDOC), the Canadian Department of Foreign Affairs and International Trade (DFAIT), Industry Associations and Chambers of Commerce. Another good resource is the CIA Fact Book, available through the Internet at <http://www.odci.gov/cia/publications/pubs.html>

- *Security Risk*

As in any major metropolitan area in North America, issues of physical security have become a concern throughout Latin America. This is particularly true in Mexico and Venezuela, which have experienced significant economic hardships over the past two years. In Colombia, increased guerrilla activities and narcotics-related violence pose a threat to expatriates doing business in the country. Finally, assaults and even kidnappings are becoming commonplace in cities such as São Paulo, Rio de Janeiro and Buenos Aires. In order to better assess potential security risks in Latin America, consult the US State Department Travel Advisory by phone or fax, or on the Internet at <http://dosfan.lib.uic.edu/dosfan.html>.

1.4 Environmental Issues Facing the Region

Environmental degradation is a serious problem in Latin America. Less than 10 percent of the region's population has access to safe water. Air pollution in most of the major cities is a very serious concern, as are hazardous waste management practices. In order to fully appreciate the expected demand for environmental goods and services in Latin America, it is important to gain a better understanding of these environmental challenges and the economic and demographic forces that have brought them about. Most of the environmental problems faced by Latin America today stem from rapid industrialization; the modernization of agriculture and the associated increase in agro-chemical use; major state-owned mining and petroleum operations; fast-paced urbanization; and continuing poverty.

Top Five Environmental Priorities

Colombia

1. **Sewage treatment** especially at Rio Bogota. Untreated sewage results in a high incidence of infectious diseases.
2. **Hazardous waste handling and treatment** At present the country has limited capacity to treat the waste being generated.
3. **Air pollution mitigation** particularly in Bogota where there are over 330,000 vehicles with an average fleet age of ten years. One out of every 23 Colombians owns a car and there are 1 million vehicles countrywide.
4. **Environmentally-friendly technologies for Colombian industries, which generally use outdated technologies.** Tax incentives and value-added tax exemptions for imported products are being considered to promote investment in new technologies.
5. **Mitigation of environmental damage caused by the mining and oil sectors** *Empresa Colombiana de Petróleos (ECOPETROD)*, the Colombian National Oil Company, in particular, is spending significant resources to reduce air pollution in its refining facilities such as the one at Barrancabermeja, as well as to reduce hazardous waste generated and waste discharged into waterways.

Venezuela

1. **Sewage treatment** Lack of proper treatment is a major source of infectious diseases countrywide.
2. **Air pollution and traffic management** particularly in Caracas.
3. **Pollution control and remediation in the oil and mining sectors** particularly in Lake Maracaibo, a centre for Venezuelan oil activity.
4. **Hazardous waste treatment and disposal** Currently most hazardous waste is deposited in municipal waste dumps.
5. **Solid waste management** Due to the growth of urban areas and individual consumption levels, municipal waste has reached quantities that have started to threaten the environment and public health.

Brazil

1. **Municipal wastewater treatment.** Only 10 percent of wastewater receives any form of treatment. Public funding is not keeping pace with the need for municipal water infrastructure. A long-term private concession model has not been successfully established yet.
2. **Clean-up of industrial hazardous waste** There is a lack of hazardous waste storage and disposal facilities in São Paulo and Rio.
3. **Sewage collection.** Much of the peripheral areas of Brazil's major cities are not connected to the municipal sewage network.
4. **Municipal solid waste.** Only a small percentage of solid waste is disposed of in environmentally safe landfills.
5. **Air pollution control.** This is particularly acute in industrial parks such as Cubatão, located near Santo. Automobile emissions are a growing problem in São Paulo.

Chile

1. **Full implementation of the Basic Environmental Law** Chile has not yet fully regulated its 1994 environmental law. Until the standards are defined, many industries will continue to put off badly needed environmental investments.
2. **Pollution control and water reuse in the mining sector** Air pollution from copper smelters and sulphuric acid plants is severe. Water conservation and reuse is a priority in the rapidly expanding mining operations in the arid regions of the North.
3. **Air pollution control in Santiago** Air pollution, both automobile and industrial, is trapped by the mountain ranges that surround the Santiago Metropolitan Area, where 40 percent of Chileans live. In spite of the catalytic converter program, auto emissions are still a problem.
4. **Municipal water treatment** Throughout the country, public water utilities are not treating wastewater discharged into rivers and bays.
5. **Industrial wastewater treatment.** Untreated discharges from pulp and paper, fish processing, and other industries in the South are a priority.

Argentina

1. **Industrial hazardous waste treatment and disposal** Incomplete regulatory frameworks and political opposition have prevented municipalities from licensing hazardous waste landfills and treatment facilities, particularly in the Buenos Aires Metropolitan Area.
2. **Hazardous waste remediation** Flowing through the heavily industrialized suburbs of Buenos Aires, the Matanzas-Riachuelo and the Reconquista rivers are among the most contaminated in Latin America. Dock Sud, the petroleum terminal and chemical complex in Buenos Aires, is also severely contaminated.
3. **Municipal water treatment.** Only 40 percent of all wastewater in the country is treated. The need is particularly acute in the provinces, such as Buenos Aires Province, which have not yet privatized their municipal water supplies.
4. **Pollution control in the oil sector** Newly-privatized oil giant, Government Oil Wells (YPF) is putting an end to years of neglect in the area of emissions control, wastewater treatment and remediation at its refineries.
5. **Industrial wastewater treatment.** Industry, particularly small- and medium-sized local companies, will have to comply with newly enacted hazardous waste regulations in Buenos Aires Province, and increasingly strict enforcement of regulations in Córdoba and other provinces.

The Latin American countries (LAC) surveyed in this study share similar environmental problems. These problems include:

- **Water pollution:** Rivers and freshwater bodies such as the Paraíba River in Brazil, Rio Bogota in Colombia and Lake Maracaibo in Venezuela bear the brunt of untreated wastewater and industrial discharges. Other badly affected waters in Latin America include the Tiete River, which runs through São Paulo; the Riachuelo in Buenos Aires; and the harbour at Guanabara Bay in Rio de Janeiro.
- **Severe air pollution:** This pollution, comprising sulphur dioxide, ozone, carbon monoxide, and PM₁₀, is a growing problem in major urban centres such as Santiago, São Paulo and Caracas. It arises from traffic congestion, unpaved roads and unregulated industrial emissions.
- **Hazardous waste:** Proper hazardous waste treatment and disposal remains a problem throughout the region, particularly in the chemical, petroleum and mining sectors. The large number of very small industrial enterprises pose a problem for the dissemination of environmental information and for the enforcement of regulations.

- **Solid waste:** Rapid urban growth in the absence of infrastructure development has resulted in an inability to manage the growing volume of solid waste.
- **Deforestation:** Although not listed as one of the top five environmental priorities, deforestation is a serious issue. In the rainforests and savannas of Brazil, Colombia and Venezuela, deforestation remains an ongoing concern as urban development, agricultural production and mining operations disrupt the forest ecosystems.
- **Gold mining:** In Brazil and Colombia, artisanal gold mining is carried out using mercury to dissolve the gold from the ore. The mercury is a source of serious pollution.

The environmental problems faced by the LACs profiled are not unlike those of other fast-growing economies and their “mega-cities” throughout world. Over 75 percent of the LAC population currently lives in urban areas, with nearly 20 percent living in seven major urban industrial centres: Mexico City, Buenos Aires, Santiago, São Paulo, Rio de Janeiro, Caracas and Bogota. Unfortunately, few municipal governments in Latin America have the resources, authority or trained staff to provide their rapidly growing populations with the services and facilities they need for an acceptable quality of life: clean water, sanitation, appropriate housing, schools and transport. The problems of Latin America’s urban centres are compounded by the neglect of infrastructure development that occurred during most of the 1980s and the first half of the 1990s. This policy has left the region overburdened with severe environmental and health problems. According to the World Bank, providing the region with the infrastructure stock consistent with an export-led growth strategy will require approximately US\$60 billion in investment through to the year 2005 (see table below). The underlying demand for infrastructure improvements is already leading to a number of opportunities for exports of North American environmental technology and expertise.

Table 1-3: Infrastructure investment needs in Latin America during the 1990s

Sector	US \$ billion (1993 prices)	Percent of Regional GDP
Electricity	24	1.8
Transportation	14	1.0
Telecommunication	10	.07
Water and sanitation	12	0.9
Total	60	4.4

Source: World Bank, Regional Infrastructure Initiative.

According to the World Bank, the volume of infrastructure investment required for the next decade is substantial, representing approximately 4.5 percent of regional gross domestic product (GDP). This figure is much larger than the combined commitments of the World Bank and the Inter-American Development Bank (IADB). The bulk of the increase will have to come from private sector investment brought about through privatization and new greenfield investments in a number of important sectors throughout the survey region. These levels of private investment are only possible if the region can:

- maintain economic and political stability;
- ensure currency convertibility; and
- promote a business climate and conditions akin to those of developed nations.

1.5 Methodology

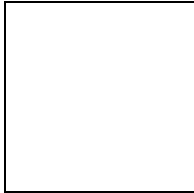
A number of methods were used in compiling the material presented here. Firstly, the authors drew on their own knowledge and experience as active providers of consulting services in Latin America. Secondly, interview data was used extensively, in order to provide the most up-to-the-moment information possible on environmental business in Latin America. Thirdly, embassies, trade offices, and other governmental and institutional sources were solicited to provide data for the report. Finally, published and unpublished reports and documents were accessed. Published sources are noted in the Bibliography. Interviewees are listed in Appendix F.

The interviewees were chosen for a variety of reasons. The authors sought to represent companies of varying size and resources. Companies were identified that were particularly successful in penetrating the Latin American

market, and special attention was given to companies whose capacities matched either the most pressing environmental issues in the target countries, or the most attractive environmental business opportunities in those countries as identified in Chapter 3. Interviews were conducted in the field, by telephone and fax, and at the GLOBE 96 environmental trade fair in Vancouver, Canada. Interviewees were given the opportunity to edit the material presented regarding their firm's activities.

The target countries of Argentina, Brazil, Chile, Colombia and Venezuela were chosen because together they represent the fastest growing, biggest and most accessible environmental goods and services markets in the region. According to the US Agency for International Development, this group, together with Mexico, was estimated to have had an environmental market of US\$2.45 billion in 1992, and this market is growing appreciably faster than the American and Canadian markets. Growth rates are indicated in Figure 1-1 below.

Figure 1-1: Environmental market growth in the Americas, 1993-1994



1.6 The Opportunities

At present the greatest environmental opportunities lie in the area of water treatment. On the average only 5 to 25 percent of all municipal and industrial wastewater in Latin America is treated. Both in Argentina and Chile, state water companies are being privatized. In the Brazilian states of Sao Paulo and Rio Grande Sur, the private sector is increasingly being encouraged to construct, finance and operate new sewer treatment plants. Wastewater treatment is also a priority in Venezuela.

Hazardous waste storage, treatment and recycling facilities is another growth area in Latin America, where on-site storage and illegal dumping of hazardous waste is common practice.

In Argentina, Colombia and Venezuela, environmental opportunities also exist in the area of oil and mining. Government Oil Wells (YPF), Argentina's recently privatized oil company, has promised to devote greater attention to emissions controls, wastewater treatment and remediation at its refineries. Similarly, *Petróleos de Venezuela (PDVSA)*, the Venezuelan Petroleum Company, plans to invest US\$130 million for environmental assessment, remediation and air emission control projects in 1996. Likewise, the Colombian National Oil Company (ECOPETROL), will invest US\$160 million in the environment in 1996 alone. Remediation is also needed in the Venezuelan and Chilean mining sectors. CODELCO, Chile's public mining company has set 2005 as the target date for full compliance with International Standards Organization (ISO) 14000 environmental standards and plans to invest US\$100 million in new equipment and remediation.

Air pollution equipment and services in Chile and Colombia will also be needed in the near future. With 85 percent of the Latin American population living in urban areas, solid waste management is another area where North American expertise can be utilized. In Argentina, the Buenos Aires Metropolitan Area recently contracted out the operation of four of its landfills to private consortia. In Sao Paulo, Brazil, a new composting, recycling and waste-to-energy facility was recently built, entirely with private funds. Although many citizens in Latin America are still not accustomed or able to pay the true cost of proper solid waste management, opportunities, particularly in large urban areas, are bound to increase.

2.0 Environmental Regulations and Regional Trade Agreements

2.1 Introduction

As Latin American countries move toward regional economic integration, both through binational trade agreements as well as larger regional agreements, they have begun to re-evaluate many of their laws and regulations. Re-evaluation of laws relating to environmental protection has also been driven by international pressure, privatization of state-run companies, and a general desire to streamline bureaucracies. Indeed, several countries including Brazil and Colombia have begun developing national environmental commissions to coordinate federal environmental projects and policies. Inspired in large part by the 1992 Rio de Janeiro Earth Summit, these commissions have been gaining ground over the last year with the support of the Earth Council based in San José, Costa Rica, a non governmental organization dedicated to implementing sustainable development concepts worldwide. One of the most important developments has been the efforts of some Latin American countries (LAC) to integrate environmental protection and traditional command and control regulations with those of natural resource protection and management. The largest LAC have developed and implemented their own environmental policies. This chapter will evaluate briefly the overall environmental policies and institutional structures of Argentina, Brazil, Chile, Colombia and Venezuela.

2.2 Argentina's Environmental Legislation

Like many of its Latin American neighbours, Argentina lacks an overall environmental framework law that specifically outlines mechanisms for environmental protection. However, environmental protection jurisdiction is spread almost evenly across several ministries as well as several secretariats that report either to ministries or directly to the President.

As a result, national coordination for environmental protection and conservation of natural resources has thus far been difficult. Up until 1995, the federal government still had not adopted comprehensive legislation, leaving environmental issues to be handled by sector laws, which are often outdated. And, while some of the provinces have passed comprehensive environmental legislation, such as Ordinance MCBA No.39,025 in the Province of Buenos Aires, these laws have often complicated enforcement by adding confusion over federal versus provincial jurisdictions.

Nevertheless, efforts are underway to clarify the responsibilities and jurisdictions of federal and provincial agencies and departments. In May 1995, the *Secretaría de Recursos Naturales y Ambiente Humano (SRNAH)* Secretariat for Natural Resources and Human Environment, approved a law to create *Sistema Federale Ambiente (SFA)*, National Environmental System, to provide a legal framework for improved coordination between federal, provincial and municipal authorities on environmental policies and regulations.

The law would provide support for the Federal Commission on the Environment (*COFEMA*), an organization of provincial environmental authorities, which for several years has been attempting to unite provincial authorities. Although efforts so far have been largely unsuccessful and disorganized — mainly because *SRNAH*'s near complete lack of support — now that *COFEMA* has been specifically recognized in a 1994 redraft of the Constitution, the provincial association should begin to gain ground.

Another initiative to promote cooperation between federal and provincial environmental protection efforts came in July 1993 when the various environmental agencies signed the Federal Environmental Pact. This was intended to help provincial governments harmonize their environmental policies and regulations in accordance with federal policies and regulations. The Pact was dissolved, however, by the National Environmental System, largely because it made little progress toward its objectives.

Because of its economic importance, the province of Buenos Aires has been forced to take a proactive role in developing its own environmental policies. The Buenos Aires Provincial Institute of the Environment (*IPMA*) has worked closely with *SRNAH* to take on more and more responsibility for environmental protection. In the most recent example, in July 1995, *IPMA* published Decree 1,601, which regulates the Industrial Establishments Law of

1993. The decree makes the law enforceable and adds specific requirements for environmental impact studies and reporting for issues that fall within the province's jurisdiction.

However, while the Buenos Aires provincial environmental laws have been set up as models for other provinces, those provinces have met with limited success in implementing their own legislation.

As a result of the confusion over jurisdictions, which has been compounded by the lack of a single overall environmental law, environmentalists and others have often turned to the country's Constitution for legal backing in protecting the environment and natural resources. In 1994, Argentina's Congress approved reforms to the Constitution providing a fairly specific set of Constitutional guarantees. The charter's main environmental section detailed in Article 41 covers protection of the environment, conservation of natural resources, the right to a healthy environment, and liability for environmental harm.

In addition, Article 41 sets forth the general responsibilities for environmental management and divides those responsibilities between the federal and provincial governments. Thus, the federal government must establish minimum environmental standards while the provinces are responsible for enforcing the standards. The Constitution also states in Article 124 that the provinces have original ownership of all the natural resources located within their territory. The federal government has dominion over rivers and interprovincial commerce. The first paragraph of Article 41 states that, "Argentinean citizens have the right to and the duty to protect a healthy, balanced environment in order to allow for development of society and productive activities that satisfy present needs without compromising those of future generations."

In 1991, Argentina created the *Secretaría de Recursos Naturales y Ambiente Humano (SRNAH)* Secretariat for Natural Resources and Human Environment, within the Office of the President of the Republic. *SRNAH* is to assist the President in the development, protection, recuperation and control of the environment, and to act as the authority in charge of applying the standards in the areas of its jurisdiction at the national level and in the Municipality of Buenos Aires. In the provinces *SRNAH* coordinates its activities in cooperation with the provincial governments.

Since *SRNAH* was created, María Julia Alsogaray has been its president and has worked closely with Argentina's President Carlos Menem, who in mid-1995 was re-elected for a second term in office. Although María Julia Alsogaray has frequently been criticized by environmentalists for alleged ties to some of Argentina's largest enterprises, others have praised her efforts to streamline the country's environmental bureaucracy.

There have also been recent initiatives at the federal and provincial levels to promote both the adoption of a new environmental framework law as well as change *SRNAH* from a department within the President's Office into a full-fledged cabinet-level ministry. Although both of these initiatives are moving slowly, there appears to be genuine support for them among both elected officials and environmental authorities.

In April 1995, the Federal Commission on the Environment (*COFEMA*), the Chamber of Deputies' Natural Resources and Human Environment Committee, and *SRNAH* established a commission to evaluate proposals for a much discussed federal environmental framework law, or national environmental code as legislators have previously referred to the initiative.

The new law would be similar in structure to Mexico's General Law for Environmental Protection and Chile's more-recent Environmental Framework Law. It would be broad in focus and cover issues ranging from air and water pollution to environmental impact assessment and environmental education. The Legislative Review Commission has placed special emphasis on resolving conflicts between federal and provincial agencies as well as on developing a more integrated approach to managing natural resources. It is not known when such a framework law will be approved, although the President's reelection is expected to bolster the project.

Little has been said on the creation of a cabinet-level environment ministry. However, President Menem has made it clear that such a ministry is high on his agenda and the groundwork has already been completed. President Menem and a group of legislators were able to include reforms to the Constitution in 1994 that allowed for the creation of several new ministries. Prior to the reforms new ministries were explicitly prohibited. Budget questions related to a new ministry would still have to be clarified.

Perhaps Argentina's most difficult issue continues to be how to handle hazardous waste, especially in the country's industrial centres, which currently do not have the necessary infrastructure to transport, store and otherwise treat or dispose of the wastes. The 1992 Hazardous Waste Law No. 24,051 went a long way toward establishing effective regulation of hazardous waste. However, many problems remain, in particular the complete lack of disposal sites. The Registry of Generators and Operators of Hazardous Wastes, which was created by Resolution No. 413 in 1993, has received little support. Although *SRNAH* has granted repeated deadline extensions to encourage companies to

register the types and quantities of waste they are generating, only a small number of large companies have registered.

Likewise, efforts by *SRNAH* to mandate the installation of hazardous waste treatment and disposal sites, especially around the city of Buenos Aires, have failed since municipal governments and other groups have fiercely opposed allowing such facilities in their communities. While a series of environmental service company proposals have received initial federal approval, none of these projects has yet been implemented. This situation has forced many major companies to treat and store their waste at temporary locations, such as parking lots, at their plants.

The major government entities dealing with the environment in Argentina are:

- a) *Presidencia de la Nación*, Office of the President of the Nation
 - *Secretaría de Recursos Naturales y Ambiente Humano (SRNAH)* Secretariat for Natural Resources and Human Environment
 - *Subsecretaría de Relaciones Institucionales*, Subsecretariat of Institutional Relations
 - *Subsecretaría de Recursos Naturales*, Subsecretariat of Natural Resources
 - *Subsecretaría de Ambiente Humano*, Subsecretariat of Human Environment
 - *Dirección Nacional de Control de la Contaminación Hídrica*, National Directorate for Control of Water Contamination
 - *Dirección de Recursos Forestales Nativos*, Directorate of Native Forest Resources
 - *Administración de Parques Nacionales*, National Parks Administration
 - *Instituto Nacional de Ciencia y Técnicas Hídricas*, National Institute of Water Science and Technology
 - *Oficina de Contaminación Ambiental Industrial*, Office of Industrial Environmental Pollution
 - *Secretaría de Planeación*, Planning Secretariat
- b) *Ministerio de Salud y Acción Social*, Ministry of Health and Social Action
 - *Secretaría de Vivienda y Calidad Ambiental*, Secretariat of Housing and Environmental Quality
 - *Secretaría de Salud*, Secretariat of Health
- c) *Ministerio de Economía y Obras y Servicios*, Ministry of Economy and Works and Services
 - *Secretaría de Agricultura, Ganadería y Pesca*, Agriculture, Livestock and Fisheries Secretariat
 - *Servicio Nacional de Salud Animal*, National Service for Animal Health
 - *Instituto Argentino de Salud y Calidad Vegetal*, Argentinean Institute for Vegetable Health and Quality
 - *Subsecretaría de Pesca*, Subsecretariat of Fisheries
 - *Instituto Forestal Nacional*, National Forests Institute
 - *Subsecretaría de Agricultura*, Subsecretariat of Agriculture
 - *Dirección de Producción Forestal*, Directorate of Forest Production
 - *Secretaría de Industria y Comercio*, Industry and Trade Secretariat
 - *Secretaría de Minería*, Mining Secretariat
 - *Secretaría de Recursos Hídricos*, Water Resources Secretariat
 - *Secretaría de Transporte*, Transportation Secretariat
 - *Secretaría de Energía*, Energy Secretariat
 - *Instituto Forestal Nacional*, National Forests Institute
 - *Administración General de Puertos*, General Harbours Administration
- d) *Ministerio de Relaciones Exteriores, Comercio Internacional y Cultura*, Ministry of Foreign Relations, International Commerce, and Culture

2.3 Brazil's Environmental Legislation

Under Brazil's Constitution, states are granted significant rights to develop and enforce environmental laws and regulations, so long as they are considered by federal agencies to be at least as strict as federal laws and regulations. As a result of this decentralization and the lack of a comprehensive national environmental code, many Brazilian states, especially São Paulo and Rio Grande do Sul, have pushed through policies considered to be much more advanced and practical than those of the federal government.

In addition to developing its own laws, São Paulo State environmental authorities have become leaders in proposing a new national environmental code that observers believe will eventually be adopted by Brazil's Congress. While details on the proposed code are sketchy, São Paulo legislators have said that it will serve as a useful framework within which states will be able to develop specific regulations according to their own needs.

São Paulo has also taken the lead in developing a voluntary auditing system for companies, which was actually originally designed to be mandatory. While the program still lacks serious participation by industry, much as has been the problem with Mexico's voluntary audit program, state officials are confident that the system will contribute significantly to elevating the level of compliance in the state.

As in all Latin American countries (LAC), enforcement has been one of the most difficult issues to resolve in Brazil. But significant efforts are underway to improve the country's record on enforcing its environmental regulations and standards. Initially, much of this activity has again come from state environmental agencies. A recent example occurred in August 1995, when a fine of more than US\$1 million was imposed on the Usina Santa Bárbara, a sugar and alcohol factory located near Campinas, by the São Paulo Environmental Protection Agency (CETESB).

The federal government in Brazil has also become more aggressive. In August 1995, the *Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA)* Brazilian Institute of Environment and Renewable Resources, a division of the environment ministry, launched "operation penalty" to collect US\$76 million in overdue fines from companies and individuals across Brazil. The total in overdue fines is more than four times IBAMA's budget for 1995.

Like many other countries in Latin America, Brazil does not have a general all-encompassing environment law. Rather, Brazil has a law outlining general national environmental goals and policies (Law No. 6.938, 1981) and laws that regulate specific environmental aspects such as air, water, renewable natural resources, hazardous wastes, environmental zoning, planning, environmental impact and civil actions.

Nevertheless, in 1981 Brazil did implement a *Sistema Nacional do Meio Ambiente (SISNAMA)* National Environmental System, that consists of different institutions at the federal, state and municipal level to implement and enforce environmental policies. The system has played an important role in promoting what cooperation has existed so far.

Under the SISNAMA there are three main federal governmental bodies responsible for the environment: 1) the *Conselho Nacional do Meio Ambiente (CONAMA)* National Environment Council; 2) the *Ministerio do Meio Ambiente, Recursos Hidricos e da Amazonia Legal* Ministry for the Environment, Water Resources and the Amazon; and 3) the *Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA)*, Brazilian Institute of Environment and Renewable Natural Resources

CONAMA is primarily responsible for developing environmental and natural resource policies and also has the authority to adopt technical standards on its own. The environment ministry, which assumed the responsibilities of the old Presidential Environment Secretariat, executes the policies through three Secretariats; one on environment, one on water resources and a third on the Amazon region.

The third government organization, IBAMA, is an independent executive agency under the environment ministry that is responsible for implementing environmental and natural resource policies and programs, issuing federal permits, and enforcing the nation's environmental laws and regulations. IBAMA has offices called Superintendencies in each Brazilian state. In July 1995 IBAMA president, Paul Jungmann proposed making IBAMA a "self-sustainable administration" by privatizing some of its functions, decentralizing its structure, and providing greater authority to the 28 local Superintendencies. Jungmann hopes that his new administrative model will speed up the decision-making process and the granting of financial resources.

The major government entities dealing with the environment in Brazil are:

- a) *Conselho Nacional do Meio Ambiente (CONAMA)* National Environment Council
- b) *Conselho Nacional da Amazonia Legal* National Council for the Amazon
- c) *Ministerio do Meio Ambiente, Recursos Hidricos e da Amazonia Legal* Ministry of Environment, Water Resources and the Amazon
- *Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA)* Brazilian Institute of Environment and Renewable Natural Resources
- d) *Ministério da Ciencia e Tecnologia*, Ministry of Science and Technology
- *Instituto Nacional de Pesquisas da Amazonia* National Institute of Amazonia Research
- e) *Ministério de Justiça* Ministry of Justice
- *Conselho Nacional de Transitq* National Transit Council
- *Conselho Nacional de Desenvolvimento Urbano* National Council on Urban Development
- f) *Ministério de Agricultura*, Agriculture Ministry
- *Instituto Brasileiro de Desenvolvimento Foresta* Brazilian Institute of Forest Development

- *Secretaría Nacional de Produção Agropecuária*National Secretary of Agricultural and Ranching Production
- *Secretaría Nacional de Defesa Agropecuária*National Secretary for the Defense of Agriculture and Ranching
- g) *Ministério de Reforma e do Desenvolvimento Agrário*Agrarian Reform and Development Ministry
 - *Empresa Brasileira de Pesquisas Agropecuarias*Brazilian Enterprise for Research on Agriculture and Cattle Ranching
- h) *Ministério da Marinha*,Marine Ministry
 - *Comissão Interministerial para os Recursos do Mar, Interministeria*Commission for Ocean Resources
 - *Comissão Marítima Nacional*National Maritime Commission
- i) *Ministério da Saúde*,Health Ministry
 - *Secretaría Nacional de Vigilancia Sanitária*National Secretary of Sanitary Enforcement
- j) *Ministério das Minas e Energias*,Mining and Energy Ministry
 - *Comissão Nacional de Energia Nuclear*National Nuclear Energy Commission
 - *Instituto de Energia Atômica* Atomic Energy Institute
 - *Departamento de Águas e Energia Elétrica*National Department of Water and Electric Energy
- *Departamento Nacional de Produção Mineral*National Department of Mineral Production
- k) *Conselho Nacional do Petróleo*,National Petroleum Council

2.4 Chile's Environmental Legislation

Chile's environmental framework has gained recent attention because of negotiations over the country's possible entrance into the North American Free Trade Agreement (NAFTA). While the outcome of negotiations remains uncertain, at least part of the debate has focussed on whether or not Chile's environmental regulatory framework lives up to the conditions outlined in the NAFTA side agreement on environmental protection, the North American Agreement on Environmental Cooperation (NAAEC).

Yet Chile is in the process of negotiating a bilateral trade accord with Canada, with an environmental side agreement which parallels the NAAEC. The Chilean government has argued that its 1994 Environmental Framework Law is sophisticated and comprehensive enough to match similar laws in the US, Canada, and Mexico. Nevertheless, Chile's federal authorities, and especially the National Environment Commission (CONAMA), have so far failed to complete a series of environmental regulations, including a regulation on procedures for developing and approving environmental impact studies, that are vital to the legal implementation of the Environmental Framework Law. At this point, the law provides few specifics on issues such as contaminant emissions levels. As a result, lawyers and non governmental organizations alike have looked to other legal documents for support. Likewise, state and federal environmental officials have had to turn to a host of laws and regulations handled by other state and federal institutions. Chile's Constitution of 1980 guarantees the right of all people to an "environment free from contamination." The Constitution entrusts the government with preserving the natural environment and assuring that this right is not compromised.

Chile's present environmental legal structure dates back to 1990 when Patricio Aylwin Azócar assumed the Presidency in the nation's first democratic elections since the Pinochet coup in 1972. At the time that Aylwin took office, Chile had no environmental policy or administration and environmental legislation was "dispersed and confusing." In June 1990, CONAMA was formed under the auspices of the Office of the President. The creation of CONAMA did not establish a new environmental authority, but rather an integrated coordinating body made up of representatives from eight different ministries and the Office of the President, to help develop and implement national environmental policies and programs.

CONAMA's creators sought to work gradually within Chile's existing government structure, avoiding the creation of a new bureaucracy. Apart from a central office in the city of Santiago, CONAMA also has Regional Environmental Commissions (COREMAs) located throughout Chile. Together, CONAMA and the COREMAs work in conjunction with the different Environmental Departments (*Unidades Ambientales*) of the various ministries that have environmental functions.

In its first four years, CONAMA worked to strengthen the *Sistema de Areas Silvestres Protegidas del Estado*, System of Wild Protected Areas of the State, and develop environmental institutions and methodologies for conducting environmental impact assessments with the assistance of the World Bank; created a System of Environmental Legal Information and a *Centro Nacional del Medio Ambiente*, National Centre for the

Environment; and conducted a wide range of studies and inventories related to environmental contamination, soils and natural resources.

Beginning in 1991, changes and new additions were made in the area of environmental legislation. For example, the Organic Law of Agricultural and Ranching Services (SAG), the Forestry Law, and the Water Code were all modified. Ministries also issued new environmental decrees, including Decree Number 185 in 1991 by the Mining Ministry regulating, *emisiones de anhídido sulphurosos de las fuentes fijas* sulphur oxide emissions from a fixed source; Decree Number 4 in 1992 by the Health Ministry on particulate emissions from fixed sources in the Metropolitan Region; and Decree Number 1 in 1992 by the Defence Ministry regarding aquatic contamination, to name a few. In September 1992, the President submitted environmental legislation to Congress, which, after extended negotiations received final approval in January 1994.

Perhaps the single largest issue to be resolved is that of airborne contaminant emissions. In Chile's mining industry, in particular, companies have been advised repeatedly that they are releasing excessive amounts of sulphur dioxide and particulates. Most of the state-run mining operations are now being forced to develop and implement specific, and costly, emissions reduction plans. Unfortunately, without a specific regulation granting CONAMA authority to set and enforce emissions limits, mining companies have been subject to widely varied requirements developed both by Chile's Health Ministry and various local and regional health and agriculture departments. Those local and regional agencies are authorized to develop their own standards according to surrounding geography and land use patterns.

The major government entities dealing with the environment in Chile are:

- a) *Comisión Nacional del Medio Ambiente*, National Environment Commission
 - *Consejo Directivo*, Directive Counsel
 - *Dirección Ejecutiva*, Executive Department
 - *Consejo Consultivo*, Consultative Counsel
- b) *Comisiones Regionales del Medio Ambiente (COREMAS)* Regional Environmental Commissions
- c) *Ministerio de Agricultura*, Agricultural Ministry
- d) *Ministerio de Minería*, Mining Ministry
- e) *Ministerio de la Vivienda y Urbanismo*, Housing and Urban Ministry
- f) *Ministerio de Economía, Fomento y Reconstrucción*, Ministry of the Economy and Development
 - *Subsecretaría de Pesca*, Fisheries Subsecretariat
 - *Consejo Nacional de Pesca*, National Fisheries Council
 - *Consejo Consultivo de Pesca y Caza*, Fishing and Hunting Advisory Council
- g) *Ministerio de Relaciones Exteriores*, Foreign Relations Ministry
- h) *Ministerio del Interior*, Interior Ministry
 - *Oficina Nacional de Emergencia*, National Emergencies Office
- i) *Ministerio de Salud*, Health Ministry
- j) *Ministerio de Bienes Nacionales*, National Goods Ministry
- k) *Ministerio de Planificación y Cooperación*, Planning and Cooperation Ministry
 - *Comisión Nacional de Energía*, National Energy Commission
- l) *Ministerio de Obras Públicas*, Ministry of Public Works

2.5 Colombia's Environmental Legislation

With the creation of Colombia's new Environment Ministry (*Minambiente*) in late 1993, Colombia has become one of Latin America's most advanced nations in terms of environmental policy and institutions. The new ministry oversees a wide variety of departments and institutes related to environmental protection, industrial regulation, and natural resources.

The country's environmental law (Law No. 99), which established the new ministry, allows for broad federal authority on environmental issues and creates a system for decentralized, regional enforcement and the granting of permits.

Colombia's federal government is currently facing difficult budget issues that have directly affected the work of the new environment ministry, leaving the new Regional Autonomous Corporations, among other agencies and institutes, largely without funding. However, progress continues on the task of developing a sound environmental protection infrastructure.

Most recently, *Minambiente* published the Regulation for the Protection and Control of Air Quality. While specific emissions limits will still have to be set through new environmental standards, the regulation does outline requirements for the monitoring and enforcement of contaminant levels and noise emissions from a variety of stationary and mobile sources.

The Regulation also established specific new reporting requirements for industry and other generators of emissions, including the creation of a categorized index system to allow *Minambiente* to classify generators according to the nature and quantity of their emissions.

Another important area addressed by Law 99 has been that of environmental licenses for industry. While the environmental licensing system supervised by *Minambiente* has been criticized by a variety of companies, mainly due to delays caused by the bureaucracy, observers have noted that the licenses have finally allowed the Colombian government to establish a mandatory system for keeping track of activities across various industries.

Colombia's Constitution, reformed in 1991, is by far the most environmentally advanced constitution in all of Latin America. Not only does the Constitution spell out the responsibilities of the federal government regarding the environment, it also sets out the responsibilities of citizens as well. For example Article 8 states that "it is the obligation of the state and its people to protect the cultural and natural riches of the nation."

The Constitution also requires the government to prevent and control factors that lead to the deterioration of the environment and to impose legal sanctions and require the reparation of damages caused to the environment.

Citizens under the Constitution are guaranteed the right to a "safe environment" and are allowed to legally challenge the actions or inaction of public authorities that threaten their constitutional rights. Article 79 of the Constitution also requires laws to guarantee the participation of communities in decisions that affect them.

In order to implement the National Environmental System (NEMA) at the local level, Law 99 provides for 26 Regional Autonomous Corporations and eight special Autonomous Sustainable Development Corporations with additional management authority over biodiversity. Each Regional Autonomous Corporation is granted the authority to adopt environmental and natural resource regulations (provided they are not less stringent than federal standards), issue environmental and natural resource permits, conduct inspections, and issue fines for violations of environmental laws and regulations. Law 99 also requires local governments to develop comprehensive urban development plans with specific goals, projects and systems to control atmospheric as well as other forms of pollution.

One of the principal changes brought about by Law 99 is that the Environment Ministry, Regional Corporations and local governments are empowered to enforce environmental laws. Under the 1974 Natural Resources Code, maximum environmental fines amounted to only US\$700. Law 99 increased that amount to approximately US\$350,000. Environmental enforcement has been aimed primarily at Colombia's timber, petroleum and agriculture sectors.

The Director of *Minambiente* has promised to focus efforts on clean production, environmental improvement in urban centres, population policies, environmental education, protection of important ecosystems and water cleanup. While enforcement efforts have substantially increased since the law's passage, the new Environment Ministry has, nevertheless, had difficulty implementing other areas of the National Environmental System set out in Law 99.

While virtually all the Regional Autonomous Corporations (local environmental agencies) that were created under Law 99 have been formally established, lack of funding has rendered the local offices virtually nonexistent, leaving local environmental matters unattended to. Regional Autonomous Corporations are funded from an array of sources that include taxes, environmental fines, royalties from oil, coal, and other minerals and grants from the electricity sector.

The major government entities dealing with the environment in Colombia are:

a) *Minambiente*, Environment Ministry

- *Dirección General de Asentamientos Humanos y Población* General Department of Human Settlements and Population
- *Dirección General de Medio Ambiente Físico* General Department of Physical Environment
- *Dirección General de Forestal y de Vida Silvestre* General Department of Forests and Wildlife
- *Dirección General de Planeación y Ordenamiento Ambiental del Territorio* General Planning and Environmental Territorial Zoning Department
- *Dirección General Ambiental Sectorial* General Sectoral Environmental Department

- b) *Ministerio de Desarrollo Económico*, Economic Development Ministry
- c) *Ministerio de Agricultura*, Agricultural Ministry
- d) *Instituto Nacional de Pesca y Acuicultura*, National Fisheries and Aquaculture Institute
- e) *Ministry of Mining and Energy*
 - *Instituto de Investigaciones en Geociencias, Minería y Química* Institute of Geoscience, Mineral, Chemical and Mine Investigations
- f) *Ministerio de Salud Pública*, Ministry of Public Health

2.6 Venezuela’s Environmental Legislation

Venezuela was one of the first countries in Latin America (along with Colombia and Ecuador) to adopt an environmental framework law. Venezuela’s Organic Environmental Law, which dates back to 1976, establishes general environmental policies and criteria for environmental planning, and lists 13 activities deemed liable to degrade the environment that fall under the control and regulation of the executive branch. The Organic Environmental Law also creates a National Environmental Council and National Environmental Office both under the auspices of the President of the Republic, and an Environmental Attorney General’s Office under the Interior Ministry to handle environmental enforcement matters.

Article 106 of Venezuela’s 1961 Constitution entrusts the federal government with defending and conserving the nation’s natural resources and assuring that their exploitation be for the collective benefit of Venezuelans. Several months after adopting the Organic Environmental Law in 1976, Venezuela created a new all-inclusive Environment and Renewable Natural Resources Ministry (MARNR) responsible for implementing national environmental and renewable natural resource policies. MARNR is divided into five areas: Administrative Services; Investigation and Basic Information; Environmental Planning and Zoning; Administration of the Environment; and Infrastructure. MARNR has offices in fourteen different regions of the country established according to their “ecological and socioeconomic homogeneous criteria.” The functions and responsibilities MARNR include everything from the conservation, preservation and regulation of renewable natural resources, including land, fauna and flora, forests, water and fisheries, to the regulation of chemical and hazardous substances and the physical and spatial planning and zoning of the national territory.

Although MARNR’s responsibilities are extensive, other Ministries share in the administration, control, and management of the environment and renewable natural resources. There are also three decentralized organizations under MARNR: the National Institute of Sanitary Works, the National Institute of Parks and the Institute of Urban Sanitation for the Metropolitan Area of Caracas. Beginning in 1991 MARNR was reorganized in order to reduce the size of its main office and to provide more control to regional offices. This reorganization coincided with the passage of the Organic Law of Municipal Power and the Organic Law of Decentralization in 1989, which give state and local authorities greater autonomy and authority over government revenues.

Apart from the Organic Environment Law, the other principal piece of environmental legislation in Venezuela is the *Ley Organica para la Ordenación del Territorio* Organic Law of Land Planning, adopted in 1983, which established a long-term planning process that seeks to balance human economic and social needs, the use and exploitation of natural resources, and the protection of the environment. The law establishes a hierarchical planning system that includes national and regional land use plans, and sectoral plans that pertain to the development of agriculture, industry, transportation and construction, and the use of water and natural resources. The Land Planning Law also includes more specific urban plans as well as land use plans for areas under special administrative control such as national parks, protected zones, forests, and wild life reserves, refuges and sanctuaries, natural monuments, security and defence areas, and zones that are of interest to tourists. The sectoral, urban and special land use plans must conform to the national and regional plans. The law creates a National Territorial Land Use Commission as well as a Regional Territorial Land Use Commission responsible for developing their respective plans.

Table 2-1: Summary of key environmental legislation in Venezuela: dates of first passage

1976	Environmental Law Creation of Ministry of Environment
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1978	Water Classification Regulations
1979	Liquid Effluent Regulations
1983	Territorial Planning Law
1987	Hazardous Waste Management Regulations
1989	Air Pollution Regulations
1991	Environmental Impact Study Regulations
1992	Criminal Environmental Law

Venezuela is rich in biological diversity and is home to one of the largest tropical forests and wilderness areas in all of Latin America. More than 54 percent of Venezuelan territory is under some form of protected status, including 39 national parks, 17 national monuments, 48 buffer zones, 10 forest reserves, 8 logging reserves, 2 wildlife reserves, 7 wildlife refuges, and 9 national water reserves, as well as 15 other protected areas (155 in all). Part of the problem with having such large amounts of protected area is the lack of human capacity to police or administer them.

Environmental enforcement continues to lag despite the adoption in 1992 of the *ley Penal del Ambiente*, Criminal Environmental Law, designed to enforce more vigorously the 1976 Organic Environment Law. Under the Environmental Penal Law, 36 specific crimes against the environment are provided for, with penalties that include fines up to 3,000 times the minimum wage, arrest, prison sentences, community service, environmental cleanup and the publication of sentences in national newspapers. The Environment Attorney General handles all civil and administrative environmental actions, while *Fiscales* in the Justice Ministry handle criminal actions. The law includes provisions relating to companies as well as individuals.

Originally, industry and business were given a two-year grace period to comply with the 1992 Criminal Environmental Law. Due in part to poor compliance, in 1994 MARNR set a new deadline for wastewater emissions and extended the grace period for other sources of pollution indefinitely. According to a 1994 MARNR report, only 1,528 of the 2,426 firms registered in Venezuela had submitted an "environmental impact portfolio" indicating the measures being taken to comply with environmental standards. Although the Environmental Penal Law has forced industry and business to begin to take environmental matters more seriously, MARNR has failed to actively enforce it. This reluctance has been due in part to the economic crisis in Venezuela which caused the Bolivar to drop from 118 to 180 per American dollar in June of 1994. This poor exchange rate has particularly inhibited the purchase of pollution control technology, almost entirely imported from the United States or Europe. This should change, however, as Venezuela initiates major economic reforms, including the lifting of foreign exchange controls. Increasingly, state and municipal governments are assuming greater responsibility for environmental enforcement. The major government entities dealing with the environment in Venezuela are:

- a) *Ministerio del Ambiente y de los Recursos Naturales Renovables* Ministry of Environment and Renewable Natural Resources
 - *Despacho del Ministro*, Office of the Minister
 - *Dirección General del Ministro*, General Department of the Ministry
 - *Dirección General Sectorial de Administración y Servicios* General Sectorial Department of Administration and Services
 - *Dirección General Sectorial de Información e Investigación del Ambiente* General Sectorial Department of Environmental Information and Investigation
 - *Dirección General de Planificación y Ordenación del Ambiente* General Department of Environmental Planning and Zoning
 - *Dirección General Sectorial de Administración del Ambiente* General Sectorial Department of Environmental Administration
 - *Dirección General Sectorial de Infraestructura* General Sectorial Department of Infrastructure

- b) *Ministerio de Sanidad y Asistencia Social*,Ministry of Health and Social Assistance
- c) *Ministerio de Trabajo*,Labour Ministry
- d) *Ministerio de Agricultura y Cría*,Ministry of Agriculture and Livestock
- e) *Ministerio de Energía y Minas*,Ministry of Energy and Mines
- f) *Ministerio del Desarrollo Urbano*,Urban Development Ministry
- g) *Ministerio de Transporte y Comunicaciones*Ministry of Transportation and Communications
- h) *Comisión Nacional de Normas Técnicas para la Conservación, Defensa y Mejoramiento del Ambiente*,
National Technical Standards Commission for the Conservation, Defense and Improvement of the
Environment
- i) *Procuraduría del Ambiente, auxiliar del Ministerio Público*Environmental Attorney General

3.0 Opportunities

3.1 Introduction

This chapter is intended as a quick reference guide, providing a brief overview of each of the target countries of Argentina, Brazil, Chile, Colombia and Venezuela. Each section has been designed to stand alone as a summary of the business opportunities and conditions in that country. For each section, the principal environmental market opportunities have been identified, critical statistics have been provided and an explanation of key business issues has been laid out. For example, the text describes the degree to which environmental regulations are enforced, the key environmental subsectors and the key industry subsectors, where applicable. A list of contacts is provided and examples of projects in the environment sector are given in text box form. Embassy contacts are provided in Appendix B.

The findings of this study indicate that in Argentina, key opportunities are in the areas of water pollution and hazardous waste control. A lack of wastewater treatment and clean water supply is a serious problem. Privatization of water systems in the provinces is attracting environmental service providers.

In Brazil, the key opportunities are diverse, and focus on municipal sanitation, although industrial and hazardous wastes are also important. Municipal solid waste disposal is another concern. Environmental services are expected to grow by 10 to 15 percent per year.

Chile differs from Argentina in that its economy is growing rapidly, at about 6.5 percent. The mining sector represents the biggest opportunity for sales of environmental equipment. Other key sectors requiring inputs of environmental goods and services include fish processing and the southern timber industry.

Colombia's environmental market to the year 2000 includes a need for wastewater treatment facilities for major metropolitan areas, solid and hazardous waste management services, and air pollution control equipment.

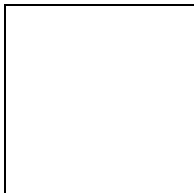
Significant opportunities are also to be anticipated in connection with Colombia's booming oil industry, centred on the Llanos Basin in the east. Institutional capacity building in the new Ministry of the Environment (*Minambiente*) is another potential market for consulting services, as this ministry is receiving substantial World Bank support.

Throughout Venezuela's past economic crisis and foreign exchange limitations, the petroleum sector enjoyed relatively few controls. Environmental services and technologies for the Venezuela Petroleum Company (VPSA) represent a market of US\$612 million between now and the year 2000. Investment will centre on effluent treatment, atmospheric emissions, industrial waste management and soil conservation. With exchange rate controls having been lifted on April 15, 1996, Venezuela's mining sector, petrochemical industry, food processing and solid waste management markets will be areas of potential expansion for North American environmental technology and service firms.

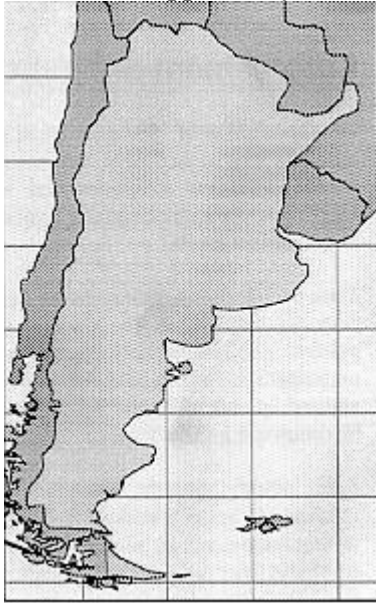
Details of these opportunities and information on the market drivers are provided in the following five market overviews.

3.2 Argentina

Figure 3-1: Argentina — real GDP growth



What is the Opportunity?



Water pollution and hazardous waste are Argentina’s two most severe environmental problems. Public and political awareness of the problem is growing as industry, and therefore, the generation of hazardous waste is concentrated in the areas around the Federal Capital and the Province of Buenos Aires.

It must be noted that while hazardous waste generation is concentrated in the Buenos Aires Metropolitan Area and near some of the provincial capitals, the lack of wastewater treatment, and in some cases potable water supplies, spans the whole country. With the successful privatization by *Agua Argentina* of potable water and wastewater services in the Buenos Aires Metropolitan Area, the focus of important business opportunities is shifting to the provinces, which are quickly privatizing their water systems.

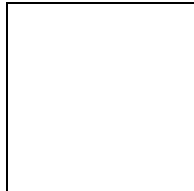
Table 3-1: Argentina at a glance	
Population	33 million
Economy (1995)	GDP: US \$271 billion Annual growth rate: -4.4 percent Per capita GDP: US \$8,065
Natural resources	Fertile plains (pampas) Minerals: lead, zinc, tin, copper, iron, manganese, oil, uranium
Agriculture	Accounts for 70 percent of GDP, about 70 percent of exports by value. Products: grains, oilseeds and by-products, livestock products
Industry	Accounts for 21 percent of GDP. Types: food processing, motor vehicles, consumer durables, textiles, metallurgy, chemicals
Trade	
Exports	US \$13 billion (10 percent to the US): grains, meats, oilseeds
Imports	US \$16.8 billion (23 percent from the US): machinery, fuel and lubricating oils, iron and steel products, wood and lumber, automotive equipment and parts, chemicals
Exchange rate	US \$1=1 peso

Source: US State Department

Enforcement of Environmental Regulations

The Constitution of 1994 gave broad environmental authority to the provinces. At the same time many of the newly written provincial constitutions delegated authority to the municipalities. A sort of “legal chaos” ensued. Argentinean companies find few legal precedents to help them interpret the implications of regulations. Decentralization is creating competing environmental jurisdictions at the federal, provincial and municipal levels. Since the regulatory institutions are new, there is considerable confusion in Argentinean industry about which body is most relevant. The Matanzas-Riachuelo Basin Plan, for example, has made little progress due to political disputes between the Province of Buenos Aires, the federal government, and the various municipalities on both banks of the river. The federal government has dominion over the rivers, and thus will control the Riachuelo clean-up. However, the project has been needlessly held back by competing jurisdictional conflicts. Both industry and the regulatory agencies themselves agree that regulatory agencies, particularly at the provincial level, lack proper funding for the necessary monitoring and enforcement of regulations and sufficient technically qualified staff capable of reviewing an EIS, etc. Furthermore, provincial laws are typically less stringent than those of the federal capital. Anecdotal evidence suggests that only three or four provinces have enacted laws that measure up to the federal Hazardous Waste Law of 1992.

Figure 3-2: Argentina pollution control equipment market (total vs. imports)



Key Environmental Subsectors

Municipal Water

The Federal Council of Potable Water and Sanitation (CoFAPYS), recognizes that inadequate sewer network coverage, potable water loss and wastewater treatment are critical problems in Argentina. According CoFAPYS, less than 40 percent of homes have sewer service. In certain regions, like the over-populated suburbs of Buenos Aires, the percentage of sewer service is only 26.5 percent. Even more stunning is the average water loss rate for Argentinean water companies, estimated at 40 percent.

The concession for the provision of water and wastewater service in the Buenos Aires Metropolitan Area is the country’s largest privatization to date in the environmental sector. The creation of the regulatory entity and the transfer of the concession to Aguas Argentinas took place at the same time in January, 1999. Aguas Argentinas, a French-Spanish-Argentinean consortium, has succeeded in improving water service in the Metropolitan Area. The total investment to be undertaken by Aguas Argentinas during its 30-year concession is on the order of US\$3 billion. In the next three years alone, Aguas Argentinas will invest over US\$1 billion, principally in wastewater treatment and improved metering. Aguas Argentinas is now installing water metres and consumption-based billing, new concepts in a culture historically accustomed to flat fees and unlimited consumption. It will soon begin work on a new wastewater treatment facility. The San Fernando Treatment Plant will treat the domestic and industrial wastewater dumped into the city’s sewer network, which currently pollutes the Riachuelo, Reconquista, and Rio de la Plata rivers.

The water sector in the Argentinean provinces is in the process of a full transformation. Consistent with national policy, many of the provinces are now promoting privatization of their principal water utilities. Many have taken the form of 30-year concessions. However, each one has chosen its own path in regards to dividing up service areas, establishing tariff structures and subsidy policies, etc. Six of the 22 provincial water companies have been privatized, and nine more are in the process of being so.

Table 3-2: Provincial water companies

Privatized	In process of privatization	Little or no privatization activity
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Corrientes Entre Ríos La Pampa San Luis Santa Fe Tucumán	Buenos Aires Province Córdoba Formosa Jujuy Mendoza Neuquén Río Negro San Juan Santiago del Estero	Catamarca Chubut La Rioja Salta Santa Cruz Tierra del Fuego
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One of the best business opportunities may be a privatization in the Province of Buenos Aires: Buenos Aires Province is planning to privatize its principal water and wastewater utility, Buenos Aires Water and Sanitation (AGOSBA). AGOSBA's service area is located outside of the Buenos Aires Metropolitan Area and covers 47 municipalities with a population of 3.74 million. The Province of Buenos Aires comprises an area about the size of New England and includes both Argentina's richest agricultural lands as well as the country's highest concentration of industries. Despite its relative wealth, basic sanitation services in the province are often lacking. Statistics from the Secretariat of Environmental Policy indicate that only 37 percent of homes are connected to sewer systems and only 62 percent have running water. The secretariat estimates that the province as a whole needs 2.2 million residential hookups to public sewer systems and 1.4 million connections for potable water supply. The AGOSBA privatization law is now being debated by the provincial legislature and is expected to be approved by the end of April 1996. Although the details are not finalized, privatization will be for no less than 20 years, and will be open to international, competitive bidding.

The Argentinean experience with water privatization has been uneven. Without an established and viable model, each water utility has taken a different approach. Like Buenos Aires, many water regulatory agencies are created at the same time that the new concessionaire takes control of the operations, a situation that causes considerable confusion. At present there are only eight water and sewer regulatory agencies in the country. As a result, the rules for the new private operators, not to mention the small private water providers and cooperatives found throughout rural Argentina, are seldom clear. A good example is the case of the Province of Tucumán. On the other hand, the Province of Mendoza has taken a more gradual approach to creating its regulatory agency prior to involving the private sector.

Financing Sources for Water Projects

While no multilateral funds for hazardous waste have been made available for projects to date, the Inter-American Development Bank (IADB) and the World Bank have provided lines of credit for some municipal water projects. The Federal Council of Potable Water and Sanitation (CoFAPYS) is the entity charged with channelling multilateral funds to both state and private water projects. It is administering two major programs: a US\$250 million program for water systems in towns with fewer than 5000 inhabitants; and a US\$300 million program sponsored by the IADB. CoFAPYS imposes certain requirements on borrowing entities, such as full metering of water and sewage service.

A US \$250 million line of credit supplied by the National Water and Sewage Program (PRONOPAC) for towns with populations larger than 15,000 has now been disbursed. CoFAPYS is negotiating a new line of credit with the IADB that will be dedicated exclusively to helping private companies pre-treat their wastes.

Municipal Solid Waste

The Buenos Aires Metropolitan Area generates approximately 350,000 tons of domestic solid waste per month, half of which is organic in nature. Regulated sanitary landfills in the Buenos Aires Metropolitan area contain 30 million tons of solid waste. Little recycling is currently done due to lack of proper incentives. However, a significant amount of recyclable waste is generated, including 9,756 tons per month of paper, 7,840 tons per month of plastic, 3,360 tons per month of glass and 1,764 tons per month of metal in the metropolitan area alone. The management of landfills poses a serious environmental threat in Argentina. To avoid paying dumping fees, some municipalities dispose of their waste in unregulated landfills. These unregulated dumps often receive hazardous waste as well. In addition, a substantial amount of domestic waste, almost three million cubic metres, has been disposed of in open landfills. Runoff from these contributes to the metropolitan area's severe water pollution problem.

The Metropolitan Area Ecological Coordination Agency (*CEAMSE*), the solid waste regulatory agency for the Buenos Aires Metropolitan Area, has contracted the operation of four landfills to private consortia: Conyca-Thol, Benito Roggio-Ormas, Cyusa-Brown & Caldwell, and Aseo.

In addition, *CEAMSE* has contracted out most of the collection of municipal solid waste in the metropolitan area. Municipal solid waste concessions in Buenos Aires, held by private companies since 1979, have recently expired and will soon be resubmitted for competition. Bidding was expected to take place after the Buenos Aires mayoral elections on June 30, 1996.

Currently, two consortia operate solid waste services in Buenos Aires. Manliba's concession area covers approximately 80 percent of the city; Cliba's covers 20 percent. The city government pays the concessionaires US \$17 million per month.

Under the new concession plan, the city will be divided into five concession areas. A company can win control of no more than two of the five areas. Under the new plan, monthly revenues for the concessionaires could reach US \$2 million. A number of companies have already indicated interest in competing for the contracts including: Benito Roggio, which forms part of the Manliba consortium; and WMX International and Macri, which form part of the Cliba group. Also in the competition are Argentinean construction giant Techint and its American partner Brown & Caldwell.

Hazardous Waste

Hazardous waste treatment and remediation is one of the most important environmental needs in Argentina. The lack of licensed hazardous waste treatment or disposal facilities is among the most critical problems to be addressed. Without the enforcement of hazardous waste regulations, unauthorized waste dumps, uncovered sulphur pits and oil ponds have become common. According to the study by the *Asociación para el Desarrollo de la Gestión Ambiental (ADEGA)*, only 14 percent of Argentinean companies could confirm that there is an authorized hazardous waste facility located in proximity to their plant. The principal waste-generating industries in Argentina include oil, leather tanning, steel, automotive and meat packing. Other sizeable waste producers include: chemical factories, hospitals, pulp and paper mills, textile mills, and food processing plants.

Chase Manhattan Bank is pioneering an innovative hazardous waste incinerator project.

Currently, the only available alternative for hazardous waste disposal is incineration, a very costly option. Small- and medium-sized firms, the bulk of Argentinean industry, cannot afford the high costs. While incineration may be one solution to hazardous waste disposal, there should be opportunities for developing less expensive alternatives. Hazardous waste disposal facilities have become a contentious issue in Argentina, as no mayor wants to permit a facility in his own city. Waste Management and SIDECO, a large Argentinean company, tried to open a hazardous waste facility in the Buenos Aires Metropolitan Area, but were stopped by pressure from the municipality.

Although the issue was politicized, the "not in my back yard" (NIMBY) mentality has also been a factor in the failure of the Secretariat for Natural Resources and Human Environment (*SRNAH*) to solicit bids for hazardous waste facilities.

A collective project organized by the Association of Buenos Aires Tanneries (*ACUBA*), suffered a number of setbacks, but supporters are now trying to restructure the project to get it back on track.

The lack of treatment and land-disposal facilities forces even the most responsible industries to store waste onsite as a temporary measure. These sites consist of paved and unpaved areas on which are stored, in many cases, tens of thousands of drums. These accumulations pose explosive, fire and uncontrolled discharge hazards.

Industrial Wastewater

Discharges of untreated wastewater and uncontrolled spills in rivers that run through population centres are two of the country's most pressing health and environmental problems. Years of unmonitored wastewater discharges have turned the Riachuelo, a river that runs through greater Buenos Aires, into a river of chemicals. Over 5,000 waste-producing industries are located in the Matanzas-Riachuelo river basin, the site of the most acute industrial contamination in Argentina. With 70 percent of all industry located in the Province of Buenos Aires, the concentration of hazardous discharges is particularly severe. Estimates are that 80 percent of all Argentinean industries in the Buenos Aires Metropolitan Area do not pre-treat wastewater.

The most colossal wastewater disaster is the Dock Sud oil terminal in Buenos Aires. Lack of controls and monitoring at the Dock Sud oil terminal have resulted in severe oil contamination of the port.

Air Pollution

Air pollution control is not a priority in Argentina. The flat geography of the city of Buenos Aires and the surrounding plains and the Rio de la Plata are favourable for the dispersal of air contaminants. Other cities such as Córdoba, the second largest in Argentina, located in the mountainous Northwest, suffer from air pollution trapped

by the surrounding mountains much like Santiago, Chile, or Mexico City. In most of the country, monitoring equipment, either mobile or fixed, is scarce and industries do not use pollution control equipment. Until two years ago, Argentina did not use unleaded gasoline. The Secretariat for Natural Resources and Human Environment (*SRNAH*) still does not require the use of catalytic converters. There does not seem to be a movement, either public or political, to change this situation.

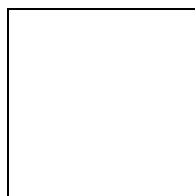
Argentina: Multi-Sector Projects

Argentina has two massive projects that are seeking financing from multilateral and international sources. Once the feasibility studies are complete, these programs will recommend comprehensive effluent treatment and remediation projects with municipal and industrial components.

Matanzas-Riachuelo Basin Management Project

The river basin contains about 20 percent of the population in the Buenos Aires Metropolitan Area and over 5,000 industrial plants. The acute industrial pollution problem is compounded by untreated domestic wastewater discharges and a geography that is prone to flooding. This comprehensive project will have municipal as well as industrial components.

Figure 3-1: Argentina’s pollution control equipment market share



First proposed by the Menem Government and redefined in the recently completed Master Plan, the project will cost over US\$1 billion. If full funding is approved (as of May 1996 the IADB had still not received an official federal government request), the project could provide opportunities in both industrial and municipal wastewater treatment systems. Private industry will undoubtedly receive some of the financing in order to install treatment systems required for the clean up component. The Plan calls for treatment of industrial effluents before their discharge into the river. The municipalities will also be a key part of this project. The Province of Buenos Aires is allowing them, as required by provincial law, to take the initiative in designing their own parts of the project. Municipalities upstream may also receive funds for wastewater treatment plants and systems.

Dock Sud

Located in the province of Buenos Aires at the mouth of the Matanzas-Riachuelo River Basin that empties into the Rio de la Plata, Dock Sud is a complex of oil loading terminals and storage facilities. Dock Sud is a heavily industrialized area which is home to many of Argentina’s petrochemical and petroleum facilities. It also contains some chemical and paint facilities with unprotected mounds of sulphur. Consequently, the area is plagued by very high levels of oil contamination in the water, groundwater and soil. Dredging the canal to keep it operational will be difficult because of the question of where to dispose of the oil-contaminated sediment.

Since Dock Sud has generated considerable bad press, all the oil companies except Shell are joining to form an environmental committee to assess the situation.

The US Trade and Development Agency (USTDA) is funding a US\$700,000 feasibility study for a comprehensive solution, which will likely contain remediation, waste disposal and waste recycling and reuse components.

Financing for the implementation of the plan has yet to be found.

Key Industry Subsectors

The principal waste-generating industries in Argentina include oil, leather tanning, steel, automotive and meat packing. Other sizable waste producers include chemical factories, hospitals, pulp and paper mills, textile mills, and food processing plants.

Oil

The privatization of Argentina’s oil industry in 1993 created a dynamic new force in an old industry. The privatization of Government Oil Wells (*YPF*) promised urgently-needed new investment in production as well as environmental undertakings. Years of neglect has resulted in critical levels of water contamination, oil sediments in the canal, oil waste contamination of subsoil, and open oil pits. Environmental investments were also neglected in upstream production in southern Argentina and in refineries throughout country. Upon privatization *YPF*,

S.A.'s foreign investors initiated a series of environmental measures aimed at redressing and preventing environmental degradation resulting from upstream and downstream activities.

Leather Tanning

Chromium pollution of soil and water is one of Argentina's most serious problems. The tanning sector is dominated by small- and medium-sized operations that find it difficult to obtain resources for investment in environmental management or pollution prevention. With both successes and failures, associations of leather tanners have grouped together to build collective plants, such as the Association of Buenos Aires Tanneries (*ACUBA*) facility.

Steel

The steel industry is in need of environmental technologies to treat its wastewater and industrial waste and to reduce its air emissions. As in other local industries, steel is feeling the effects of the Argentinean recession and is encountering flat domestic markets. Consequently Argentinean steel companies are trying to boost exports. Of all steel exports, 45 percent go to Brazil and 40 percent to Europe and the standards imposed by the export markets may actually drive Argentinean companies to control, treat and reduce pollution. The Association of Metallurgical Industries of Argentina (*ADIMRA*), the country's largest steel and metal industry association, claims that Brazil will impose International Standards Organization (ISO) 14000 certification starting in the first half of 1996. Europe may soon require ISO certification for steel imports as well.

Automotive

Multinational auto producers in Argentina are already treating their effluents and conducting environmental impact assessments under corporate policies. General Motor's new plant will include state-of-the-art facilities for the treatment and disposal of effluents. The auto producers (General Motors, Chrysler, and Fiat, among others) are located across the country in various provinces of Argentina: Córdoba, Buenos Aires and Santa Fe. Auto producers have in place recycling and reuse programs, but access to hazardous waste disposal sites is needed.

Projects

GM and Chrysler Assembly Plants

Perhaps the most comprehensive and technologically advanced environmental systems will be installed in the two new factories planned by General Motors (GM) and Chrysler. Although Argentina is in a recession, auto makers see Argentina as a good base for exporting into the growing *MERCOSUR* market, particularly Brazil.

GM's \$400 million plant in Santa Fe Province is scheduled to begin production in 1997. At the outset, the plant will produce 80,000 engines and 100,000 cars per year. The plant will comply with international standards with respect to the treatment and disposal of wastes.

Chrysler is planning a US\$100 million state-of-the-art assembly plant to manufacture Jeep Cherokees. When the plant begins operations in 1997, Chrysler expects it to produce 4,000 vehicles per year, increasing to 6,000 by the end of the decade. Chrysler has not determined the site of the new plant.

TELIPA

The Avellaneda Industrial Liquid Effluent Treatment Plant (*TELIPA*) Association has long-range plans for comprehensive treatment of liquid and solid wastes. Phase I of the project consists of a chrome-recovery facility, located on 2.5 hectares of land in Avellaneda, an industrial suburb of Buenos Aires. As it goes online in December 1995, the plant has a capacity to treat 200 cubic metres per day of chrome waste. The plant's capacity is more than enough for the association's 16 members, and can be expanded by adding a third shift if the plant wants to out-source its treatment services. Italprogetti, an Italian firm with extensive experience in treating tannery wastes, was contracted for plant design, equipment installation, and technical assistance. Phase I of the project has a total cost of US\$5 million, funded through the internal resources of the member firms.

Phase II will treat the sludge remaining after the removal of the chrome from the wastewater. The project will be constructed on the existing site at an estimated cost of US\$3 to \$4 million. New bids will be called, but no date has been set. *TELIPA* expects that the winner of the bid will have to arrange outside financing.

Phase III will treat the remaining organic materials in the wastewater. This project, also requiring financing, will cost US\$12 million, and will be conducted again under international competitive bidding. Due to space constrictions, however, a new site must be found. Under one scenario, the tanneries would relocate to an industrial park, to avoid having to build a complex system of ducts to carry the wastewater to the plant. Each company would cover its own costs for the relocation. *TELIPA* estimates that the total cost for relocation would be US\$40 to 50 million, significantly less than the cost of building the piping infrastructure.

Government Oil Wells (YPF) Environmental Investment Program

In an effort to upgrade its image, the new multinational investors required an extensive program of environmental measures in both upstream and downstream operations. With its US\$300 million four-year program, YPF will be the single largest opportunity for environmental service providers. YPF will contract firms for substantial remediation, emissions control and wastewater projects. Services needed will include environmental impact assessments, contingency plans and monitoring plans. The company's refineries and exploration and production operations will require services of all types. YPF has elected to adhere to international norms well above those required by the federal government or the Province of Buenos Aires, and thus expects to employ environmental technologies uncommon for the Argentinean market: tertiary wastewater treatment, recycling of wastes and water usage reduction.

Mendoza: Putting Institutional Reform Ahead of Privatization

The province of Mendoza has undertaken the difficult task of institutional reorganization. If successful, it will lay the groundwork for incorporating the private sector into the provision of water services and provide for a smooth transition.

In 1993, Mendoza began separating the regulatory and control functions from that of the operation of its sanitary services. First, it created an independent regulatory agency, Provincial Agency for Water and Sanitation (EPAS), which was given supervisory authority over the province's water providers. The largest is the Mendoza Sanitary Works, S.A. (OSM), which serves over 75 percent of the population in the province and maintains service areas located in and around the capital. The remainder of the population is served by a number of municipally-owned water and sewer companies (12 percent) and more than 200 smaller private water providers and cooperatives (12 percent).

EPAS is charged with protecting the rights of water users by assuring service quality; exercising control and regulating service through its enforcement unit, the Sanitary Police; guaranteeing efficient service by operators; and promoting new services in accordance with demand. By early 1995, EPAS was a fully functioning regulatory agency.

Mendoza then reconstituted its water utility as a corporation with the majority of the shares held by the provincial government. Rather than privatize outright, Mendoza began a plan to incorporate private capital and expertise into the water utility. The concept was to incorporate private capital through the sale of a packet of shares. Like the Bolivian Capitalization Program, Mendoza planned to sell 50 percent of the shares in the company and award management control to the winning bidder. Three major consortia presented bids at the end of 1995: Alfa, composed of Aguas de Barcelona of Spain, Canal Isabel II of Spain, and Lyonnaise des Eaux of France; a consortium made up of Générale des Eaux of France and Thames of the United Kingdom; and the Northumbria Water Group of the United Kingdom. Mendoza is now in the process of evaluating the bids.

Tucumán

The transfer of Tucumán's water utility from state to private control, has been problematic. Not only did the privatization process prove controversial, but the new concessionaire's operation of the water and sewage system has come under scrutiny and criticism.

The Province of Tucumán, faced with severe financial difficulties, was eager to privatize its water utility. The provincial legislature approved the privatization of the Provincial Water and Sewage Agency (DIPOS) in May 1993. After two years of discussions, the concession was awarded to Aconquija, S.A., a consortium of Compagnie Générale des Eaux, a French water company; Benito Roggio e Hijos, an Argentinean construction company; and Dycasa, a Spanish firm. Aconquija and the provincial government came to an agreement on labour: of the 2,300 DIPOS employees, the new concessionaire would keep only 900. Aconquija signed the 30-year concession contract with the government in May 1995, after a series of objections submitted by the provincial courts.

A regulatory framework was approved early in the process, but the regulatory agency was not set up until after the bidding had begun. After awarding the concession, the legislature still had not officially constituted the regulatory agency. The new agency was set up with a board of five directors and sufficient staff to fulfill its obligations.

However, it will receive financial support, in part, through a fee paid by the concessionaire.

In addition, the privatization of DIPOS has been criticized by the public for establishing a concession area in the capital and surrounding towns, the wealthiest areas of the province, and leaving the poorer rural areas to fend for themselves. Without the cross subsidies from the capital, rates in the rural areas have risen 80 percent, outraging Tucumán residents.

The controversy, however, did not stop once DIPOS was privatized. The government of Tucumán, unsatisfied with the service provided by Aconquija, is considering rescinding the concession contract. According to Tucumán,

Aconquija is in noncompliance with contractual obligations and is supplying substandard water. Although Aconquija has admitted that the water contains a high sedimentary content, it asserts that it is not the health risk that the government portrays. Tucumán also charges the consortium with not keeping with the timetable for the expansion of the water and sewer system, despite drastic rate increases. Many of the residents of Tucumán, upset at the doubling of rates, have refused to pay their water bills. If the contract is nullified, the concession could be rendered by the end of 1996.

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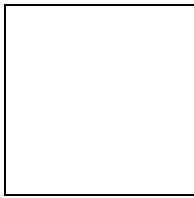
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3.3 Brazil

Figure 3-4: Brazil — real GDG growth



What is the Opportunity?



Brazil presents significant opportunities in many environmental submarkets such as mining remediation and pollution prevention. However, these opportunities are significantly different from what might be expected. While industrial and hazardous waste is a key issue, the most pressing environmental problem facing Brazil is municipal sanitation: potable water and sewage and wastewater treatment. In addition, municipal solid waste disposal is an important concern.

The future for environmental technologies looks bright, as major cleanup projects are underway or are expected to start shortly. A consensus on growth projections over the next five years ranges from 5 to 10 percent annually for equipment and from 10 to 15 percent for environmental services, including consulting. Already, monthly sales increases for wastewater equipment manufacturers for the period May through August 1995 averaged an annual equivalent rate of about 10 percent.

It is important to point out that the sheer size of Brazil makes country-wide generalizations difficult. Most environmental business opportunities lie in southern Brazil. While northeastern Brazil has the more serious public health problems and a lack of basic sanitation services, opportunities there will lie almost exclusively with multilateral bank-financed projects. Industrialization in northeastern Brazil is largely limited to urban centres such as Salvador, Bahia state, and Recife, Pernambuco state, and occurs on a much smaller scale than in southern Brazil.

Brazil has a significant local environmental technologies industry of its own. Given its state of development relative to the rest of Latin America, companies in Brazil provide for many of the country's environmental needs. The São Paulo Federation of Industries (FIESP), Brazil's largest industrial organization, reports that Brazil has about 200 environmental equipment manufacturers, engineering firms and providers of consulting services. For international firms, FIESP sees the best business opportunities in a number of specific technologies and services:

- monitoring software;
- environmental auditing;
- medical waste solutions;
- recycling technologies;
- laboratory services;
- clean technologies;

- control equipment;
- soil remediation technologies;
- instrumentation; and
- tire recycling equipment.

Table 3-3: Brazil at a glance	
Population	155 million
Economy (1995)	GDP: US \$456 billion. Annual real growth rate: 5 percent Per capita GDP: US \$3,000
Natural resources	Iron ore, manganese, bauxite, nickel, uranium, gemstones, oil
Agriculture	Accounts for 11 percent of GDP Products: coffee, soybeans, sugarcane, cocoa, rice, beef, corn, oranges, cotton, wheat
Industry	Types: steel, chemicals, petrochemicals, machinery, motor vehicles, consumer durables, cement, lumber, shipbuilding
Trade	
Exports	US \$38.7 billion. Major markets (percentage): US, 21, Argentina, 9, Japan, 6, Netherlands, 6, Germany, 5, France, 4, Italy, 4
Imports	US \$25.7 billion. Major suppliers (percentage): US, 24, Argentina, 9, Germany, 9, Japan, 8, France, 4
Exchange rate	US \$1 = 0.92 Reals (Rate stable)

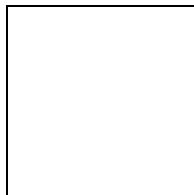
Source: US State Department

Enforcement of Environmental Regulations

To understand the major environmental policy and enforcement bodies, it is useful to examine state agencies such as the São Paulo Environmental Protection Agency (*CETESB*). São Paulo's environmental law of 1976 formed the basis for much of the legislation at the federal level. In addition, as states like São Paulo and Rio de Janeiro have the largest concentration of industry and population, the environmental problems there have pressed their governments into action. Consequently *CETESB* of São Paulo and the State Environmental Engineering Foundation (*FEEMA*) of Rio de Janeiro are leaders in establishing permitting powers, regulation setting authority and enforcement authority.

Moreover, their enforcement records are improving steadily. The capacity of the Brazilian Institute of Environment and Renewable Natural Resources (*IBAMA*) has also improved. *IBAMA*'s high profile campaign "Operation Penalty" has identified 112,000 environmental infractions all over the country, for which it plans to seek fines totalling approximately US\$87 million. In the space of four months, notifications have already been made for close to 40,000 violations. The largest single fine of US\$2.3 million was served on a timber company.

Figure 3-5: Brazil pollution control equipment market (total vs. imports)



Key Environmental Subsectors

Municipal Water

Potable water, municipal sanitation services (sewer systems and wastewater treatment plants) and industrial wastewater treatment offer very strong opportunities for North American firms. Potable water and sanitation services in Brazil have historically been municipal responsibilities, with the actual service frequently contracted out to state-owned water and sanitation companies. Drinking water supplies have been made available to a large percentage of the population: over 90 percent in the principal cities of São Paulo state; 67 percent in Brazil overall; and 50 percent in the Northeast. The figures for sewer connections are lower, however, and the figures for wastewater treatment lower still. Even in São Paulo state, the percentage of wastewater treated does not exceed 25 percent, while it is practically unknown in the poverty-stricken Northeast. There are two approaches being used to address these deficits. One is the traditional approach of massive infrastructure investment utilizing the financial resources of multilateral development banks (MDBs); the other is the privately financed concession approach.

Multilateral Development Bank (MDB)-Funded Projects

In terms of absolute dollar amounts, there is a huge volume of projects either underway or about to commence in 1996–1997. Most of these projects are multiphase and therefore present multiple bidding opportunities. These projects are massive public sector undertakings in which the private sector will be involved on a contract basis for design, engineering, other technical support and construction work. As of May 1996, there were no announced plans for private sector ownership and/or operation of the works in question.

The Concession or Build-Operate-Transfer (BOT) Approach

State and municipal officials in São Paulo and southern Brazil are very interested in having the private sector assume responsibility for the construction, financing and operation of new wastewater treatment plants. Indeed, a group of 30 Brazilian public and private sector officials toured the US in late September 1995 under the auspices of the US Agency for International Development (USAID). Their purpose was to inspect wastewater treatment facilities, talk with plant operators and hold discussions with financial experts on the best way to structure concession projects so as to enhance their financeability. Lack of available government revenues in the states of São Paulo and Rio de Janeiro is the basic reason for turning to the private sector.

Details on the financing are not yet available, although it is known that both the Brazilian National Development Bank (BNDS), and the International Finance Corporation of the World Bank, will be participating. The Global Environment Fund based in Washington, DC participated in the Ribeirão Preto project. In addition, the municipal government of Ribeirão Preto may subsidize payment of a portion of the service fees to be borne by city residents. It is very difficult to estimate the pace of forthcoming municipal wastewater concessions. While there is a tremendous demand for these projects, the question remains how to finance them. Many Brazilian municipalities are looking to the Ribeirão Preto and Limeira projects to see how they are financed and to learn whether a model will be developed that can be applied to their municipalities. If a practical financing model can be developed, there could be dozens of such projects in the next several years. It should be kept in mind that São Paulo state has 97 municipalities each with a population of over 50,000. Relatively few of these treat more than 10 percent of their wastewater, and many do no treatment at all.

Industrial Wastewater Treatment

The startup of river basin cleanup projects funded by MDBs typically triggers obligations by industrial facilities located in those basins to treat their wastewater before discharge to municipal sewer systems or other receiving bodies. Since the major planned river basin cleanups geographically cover heavily industrialized areas, this translates into a significant amount of industrial pretreatment activity.

São Paulo’s Environmental and Sanitation Technology Company (CETESB), the environmental regulatory agency of the State of São Paulo, reports that industries have made excellent progress in decreasing their wastewater discharges. Of the 1,250 heaviest polluters of the Tietê River, representing some 80 percent of the total, 89 percent have already achieved compliance with CETESB’s effluent pretreatment specifications. The São Paulo Federation of Industries (FIESP) has reported that companies have invested US\$200 million in upgrading their pretreatment capabilities. The São Paulo state government has provided US\$70 million to assist those companies.

While most of the industrial pretreatment work has already been accomplished in metropolitan São Paulo, there will be significant opportunities among companies affected by the Guanabara Bay and Guaíba River cleanups. Approximately 6,000 industries discharge into Guanabara Bay. However, 52 large facilities are responsible for 80 percent of the total discharge. Many of these companies, among them chemical plants, shipyards and refineries, have already initiated their cleanup projects, but many others have not. The State Environmental Engineering Foundation (FEEMA), the enforcement agency for the state of Rio de Janeiro, has stated that it plans to publish the pollution figures from the discharging industries every six months. To initiate this phase of the project FEEMA is receiving US\$4.5 million from the Inter-American Development Bank (IADB) to modernize its laboratories. Similarly, there will be substantial opportunities among industries that discharge into the Guaíba River in the state of Rio Grande do Sul.

Hazardous Waste

Hazardous Waste Treatment, Storage and Disposal

Hazardous and industrial waste management presents a confusing picture. It is clear that Brazilian industry generates a substantial amount of “hazardous waste” as defined in the Brazilian Federal Resource Conservation and Recovery Act. Industries in metropolitan São Paulo alone are estimated by CETESB to generate approximately 160,000 tons of hazardous waste per year.

Only about 10 percent of this waste stream is currently being incinerated. A major incineration project is expected to come on stream soon. Nevertheless, it is unclear whether a commercially viable market for additional incineration and/or treatment capacity exists.

There are seven industrial incinerators owned and operated by chemical and pharmaceutical companies providing incineration services to third-party generators. The chart below provides the relevant details for six of them. In the aggregate, these facilities have excess capacity.

Table 3-4: Brazil’s industrial incinerators available for third-party waste incineration

Company	State	Nominal Capacity	
Cinal	Alagoas	11,500 tons/year	1989
BASF	São Paulo	2,700 tons/year	1994
Hoechst	São Paulo	2,700 tons/year	1988
Ciba-Geigy	São Paulo	2,000 tons/year	1993
Bayer	Rio de Janeiro	3,000 tons/year	1989
Cetrel		10,000 tons/year	1991

- Brazil does not have a single commercial hazardous waste incinerator exclusively dedicated to incinerating the hazardous waste of third-party generators.
- “Co-processing,” or burning, hazardous waste in cement and lime kilns is a common practice in Brazil. It is currently being carried out in the states of Rio de Janeiro, Paraná, Minas Gerais and Rio Grande do Sul. It has not been allowed in São Paulo, but a new facility being developed by a consortium including Chase Manhattan Bank, the Brazilian firm Resicontrol and the Canadian firm Nortru, in the city of Sorocaba is in the final stages of obtaining a permit. This facility is a fuel-blending facility and expects to handle some 30,000 tons per year at the outset, with a final capacity of 60,000 tons per year.
- Brazil has a single licensed hazardous waste landfill at São Jose dos Campos, approximately two hours from São Paulo. The landfill, operated by Enterpa Engenharia, is small but designed to high standards. Little expansion opportunity exists at this site. Additional land disposal capacity is badly needed in the states of São Paulo and Rio de Janeiro.

- Given that there are only three available incinerators in the state of São Paulo, it appears that there has been insufficient capacity in the state. Once the Sorocaba facility becomes operational, this lack of capacity will diminish, and may even be eliminated.
- The shortfall in hazardous waste treatment capacity has meant that the primary method of hazardous waste management has been onsite storage. This practice, which is common throughout Latin America, presents the obvious dangers of accidental discharge, fire and explosion.

Another project being developed in São Paulo state has been 100 percent Brazilian to date. It involves treating solvents using plasma technology generated by the São Paulo electroplaters.

Hazardous Waste Remediation

Brazil does not have a “superfund statute” as does the US, and so while there is hazardous waste remediation work going on, there is no systematic, widespread remediation program in place.

The chemical firm Rhodia will be undertaking remediation projects in São Paulo state. Other potential sources of remediation work are Petrobras and other large industrial firms. Since there is a shortage of treatment capacity, any solution offered for a remediation project may require onsite treatment or destruction of the wastes.

Municipal Solid Waste

Brazil has a great need for the handling and disposal of municipal solid waste. While up to 95 percent of municipal solid waste is collected pursuant to municipal contracts, a very small percentage is disposed of in environmentally safe landfills. The unanswered question is whether Brazilian municipalities will devote the resources needed to address this situation and its related public health issues.

The Brazilian Institute of Geography and Statistics (IBGE) estimates that each Brazilian citizen generates an average of 0.6 kilograms of solid waste per day. With a population of about 150 million, Brazil therefore generates on the order of 90 thousand metric tons of solid waste or garbage per day. The following are the IBGE’s conclusions on how municipal solid waste is handled on a national basis.

Table 3-5: IBGE’s conclusions on municipal solid waste

Final destination	Metric tons per day	Percentage
Recycling or composting plants	1,800	2
Controlled landfills	9,000	10
Open dumps or other uncontrolled sites	79,000	88
Total:	90,000	100

Source: Brazilian Institute of Geography and Statistics

Of course, the situation varies considerably from region to region, state to state and even from city to city. But even in São Paulo state the situation is serious, since only seven landfills are designed and/or operated in an environmentally acceptable manner. The remaining 487 city dumps have few or no controls in terms of placement of daily cover, leachate collection systems, liners, etc.

It is also of interest that Brazilian municipal solid waste contains a higher percentage of organic material than is found in North American trash. The following table illustrates the composition of garbage from three representative Brazilian cities.

Table 3-6: Composition of municipal solid waste from three Brazilian cities

Components	Percentage (by weight)		
	São Paulo (1991)	Curitiba (1993)	Campo Grande (1985)

Plastics	13	6	6
Paper and cardboard	14	3	19
Metals	3	2	3
Glass	2	2	3
Organic	61	66	62
Other	7	21	7

Source: CEMPRE

On a national scale, the absence of strict regulations enforced by aggressive environmental agencies will cause the market for the design, construction and operation of sanitary landfills and other methods of waste management to be smaller than it otherwise might be. However, even in the absence of an enforcement-driven market, there are many developing opportunities. Many major Brazilian cities, all across the country, have already upgraded their landfills, utilizing lined cellular technology, or are making plans to do so. The list includes the following.

Table 3-7: Cities with upgraded landfills

City	Population	State
Belo Horizonte	2,017,000	Minas Gerais
Americana	154,000	São Paulo
Campinas	893,000	São Paulo
Caxias do Sul	291,000	Rio Grande do Sul
Porto Alegre	1,263,000	Rio Grande do Sul
Salvador	2,072,000	Bahia
Recife	1,297,000	Pernambuco
Petrolina	176,000	Pernambuco
Manaus	1,011,000	Amazonas

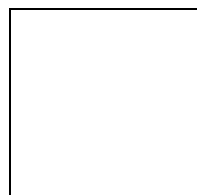
The geographic diversity of the list indicates a growing national awareness of the need to modernize solid waste disposal.

Another indication of the changing nature of the market is the plan of the city of São Paulo to ask the private sector to bid on a long-term concession for the construction and operation of three large composting and recycling plants and three waste-to-energy facilities. The city has already awarded contracts for two of the waste-to-energy facilities and opened competition for the third in late 1995. The composting and recycling facilities will handle 4,000 tons per day. The total system will process 7,500 tons per day.

Campinas, located 100 kilometres northwest of the city of São Paulo, is following São Paulo's example and is seeking to have a private company build and operate a joint garbage recycling and waste-to-energy facility. Technical bid specifications were available in March 1995 and the bidding period closed on May 15, 1995. Three major consortia, a Swiss/Brazilian, an American/Brazilian and an Italian/Brazilian, submitted bids. The city is currently studying the bids before deciding on the next step.

Sludge Management

Figure 3-6: Brazil's pollution control equipment market share



A promising new growth area lies in the management and beneficial reuse of sludge generated by municipal wastewater treatment plants. As additional plants come online across the country, both publicly-owned and operated and plants under concession regimes, significant volumes of sludge will be produced.

Only about 10 percent of the current volume of sewage in metropolitan São Paulo currently receives treatment, yet approximately 55,000 tons per year of domestic sewage sludge is already available. As treatment capacity is expanded, the generation of sludge will increase dramatically. For example, the Barueri treatment plant in western metropolitan São Paulo has an installed capacity of 7.0 cubic metres per second, but currently operates at 3.5 cubic metres per second. The ABC treatment plant under construction in São Caetano do Sul (southeast metropolitan São Paulo) will have a capacity of 3.0 cubic metres per second and should be operational in the second quarter of 1996. Presently, much of the sludge produced is landfilled, but government officials are aware that this is not an optimal disposal practice, since the landfills in question are not specifically designed to handle wastewater treatment sludge.

The São Paulo state water supply and sanitation company (SABESP), whose jurisdiction includes metropolitan São Paulo, is willing to entertain proposals from North American firms with experience in this area. Ideally, the first proposal would be part of a water reuse program connected with the Barueri wastewater plant. Composting, pelletizing and other beneficial reuse methods will receive serious attention.

Looking at the market as a whole, there are many business and financial questions to be answered, but Brazil's extensive agricultural expanses, starting with the state of São Paulo's massive citrus production, present intriguing possibilities. The use of treated sludge in conjunction with reforestation programs has also been mentioned.

Air Pollution

Compared with water quality and water pollution issues, air pollution control is not as significant a national problem. That is not to say that serious local and regional air pollution problems do not exist. Rather, such problems plague a few major urban centres and are primarily caused by vehicular traffic, not industry. In short, while metropolitan São Paulo and Belo Horizonte (state of Minas Gerais) suffer episodic smog problems, most of the country enjoys relatively good air quality.

The state of São Paulo, through its Environmental Protection Agency (CETESB), operates the most extensive air monitoring system in Brazil. It consists of both an automatic and a manual system. The automatic system, first established in 1981, now consists of 25 fixed stations (22 in metropolitan São Paulo and three in Cubatão) and two mobile laboratories. It measures fine particulates, sulphur dioxide, nitrogen oxides, ozone, carbon monoxide, hydrocarbons, wind direction and velocity, humidity, and temperature.

The manual system consists of seven stations in metropolitan São Paulo and Cubatão and a total of 17 other stations in cities in the interior of the state and the city of Santos on the coast. The manual system in metropolitan São Paulo and Cubatão measures total suspended particulates. The system in the interior and for Santos measures sulphur dioxide and smoke.

In metropolitan São Paulo, the most serious air pollution problem is ozone, particularly in the dry winter months. Vehicular traffic is responsible for approximately 90 percent of this problem. Fine particulates and carbon monoxide are also above accepted standards on an episodic basis.

In response to this vehicle-induced smog problem, the government has tried two approaches. The São Paulo municipal government planned a mandatory vehicle inspection program to be run by the private sector. And for a five-day period CETESB promoted a voluntary program in which car owners were urged to leave their car at home for one day during the work week. Given the fact that the program was voluntary and that no fines could be levied, the response was fairly encouraging. The first two days of the program saw a 45 percent participation rate, which dropped to 35 percent on the next two days. However, the state Secretary for the Environment, Fabio Feldmann, was encouraged and is proposing a three-month program for June, July and August of 1996.

Pollution Prevention & ISO 14000

The concept of pollution prevention is just becoming recognized in Brazil. The preferred method of dealing with environmental problems has been the classic "end of the pipe" approach. However, a number of large Brazilian companies and Brazilian subsidiaries of certain multinational corporations are seriously investigating ways in which they might reduce their wastewater discharges, air emissions and waste generation by changing their production processes.

Reinforcing the growing interest in pollution prevention is the advent of the International Standards Organization for Environmental Management Systems, known as ISO 14001. Now undergoing review and expected to be finalized in 1996, ISO 14001 is intended to encourage businesses around the world to establish voluntarily effective environmental management systems to help companies achieve environmental and economic goals.

Brazilian companies have already shown great interest in ISO 9000, which deals with establishing a quality control management system. In fact, with about 480 companies holding some 800 individual certifications and an additional 1,000 to 1,500 companies in different stages of implementation of their quality control systems, Brazil is by far the leader in Latin America. Given the large Brazilian export market and the number of multinationals established in Brazil, it is not surprising that a considerable amount of training and planning is already underway. According to the São Paulo Federation of Industries (*FIESP*), many British and French firms have already formed working relationships with Brazilian consulting firms to establish themselves in this growing market. A specific example of activity in this area is the major conference held in November 1995 in São Paulo dealing with ISO 9000 and ISO 14000. This conference was the third annual event dealing with ISO standards and was well attended by Brazilian industrialists.

Although it is too early to judge the effect of ISO 14001 on pollution prevention, it is clear that it will be a spur to further efforts to minimize pollution simply because certification in ISO 14001 requires a company to consider ways to reduce its overall pollution.

Projects

Tietê River Cleanup (São Paulo)

The Tietê River Cleanup in São Paulo consists of the construction and expansion of five conventional sewage treatment facilities; expansion of the sewage collection system; drainage projects; and installation of pretreatment equipment in industries previously dumping raw effluent into the river or sewage system. The project will be financed by the Inter-American Development Bank (IADB) with US\$2.6 billion over the next five years, with additional funding from the state government of São Paulo and the Japanese Overseas Economic Cooperation Fund.

The project has been subject to bidding irregularities and an inability on the part of the state government of São Paulo to arrange for its counterpart funding. After a large group of companies attempted to raise their prices after being awarded contracts, the state water company *SABESP*, cancelled the contracts in March 1995. Three contracts have been rebid and the rest will be rebid in the future. While the completion of the first phase of the project is scheduled for the end of 1998 (a two-year delay), many independent parties have expressed concern that the state will not be able to contribute its counterpart funding. This could put the entire future of the project in jeopardy. On the other hand, the part of the project calling for the installation of industrial pretreatment systems has largely achieved its goals.

Guanabara Bay Cleanup (Rio de Janeiro)

The Guanabara Bay Cleanup Project will require a total investment projected at US\$793 million. Of the total, US\$250 million will be financed by the Japanese Overseas Economic Cooperation Fund (*OECD*), followed by US\$350 million from the IADB, and US\$93 million from the state of Rio de Janeiro. The project will build four sewage treatment plants of 4 cubic meters per second, 1 cubic metre per second and 1 cubic metre per second and 0.8 cubic metre per second, respectively. It will also expand the existing sewer system; expand potable water supplies; improve river drainage; improve garbage collection; build recycling and composting facilities; and reconstruct and expand existing landfills. Industrial wastewater discharges will be controlled through required pretreatment.

Work on various components of the project has already begun. The State Environmental Engineering Foundation (*FEEMA*) estimates that the project will provide new or enhanced environmental services for five million people.

Bahia de Todos os Santos (Bahia)

The Bahia de Todos os Santos Sanitation Project in the state of Bahia consists of detailed monitoring of Todos os Santos Bay, expansion of the sewer network from the present 26 percent coverage to 80 percent coverage, control of industrial discharges, control of solid waste disposal from cities adjacent to the city of Salvador, environmental education and certain civil works. This is a US\$600 million project to be financed with US\$40 million from the IADB and the rest from the state government of Bahia.

São Paulo Thermal Plasma Hazardous Waste Project

As the industrial centre of Brazil, the state of São Paulo is home to a large number of electroplating companies. These firms, many of them in the small- to medium-sized category, use electroplating solutions containing heavy metals, such as chromium, cadmium and others. Until about two years ago, these companies were allowed to discharge their wastewater without treatment. However, new environmental legislation and regulations now require pretreatment of wastewater prior to discharge. Electroplating companies have installed pretreatment systems and now generate sludge which contains heavy metals, flocculant agents and other compounds. Since the

sludge is considered a "Class I" sludge and would need to be disposed of in a special landfill, a very expensive proposition, an association named Central Super was formed to investigate an alternate solution. The Plasma Group of the Institute of Technological Research (IPT) has been working independently on the treatment of industrial residues. After discussions with Central Super, successful laboratory-scale tests were run on the electroplating sludge using plasma technology. Central Super and a government agency then provided funds for construction and operation of a pilot plant unit with a 150 kg per hour capacity. If the tests are successful, a number of commercial facilities, each with a capacity of between 500 and 1,000 kilograms per hour, will be built. It is estimated that São Paulo electroplating companies generate 1,000 tons per month of sludge.

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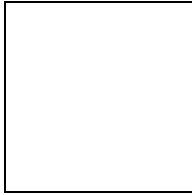
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3.4 Chile

Figure 3-7: Chile — real GDP growth



What is the Opportunity?



Chile's economy is expected to perform very well in the coming years: in 1995, gross domestic product (GDP) growth was 6.2 percent, and is expected to reach 6.5 percent. Full and sustained economic expansion will create important business opportunities in the environmental technologies market.

The best industrial opportunities for the sale of environmental equipment and services will be in the mining sector. Both the Chilean Copper Corporation (*CODELCO*), the principal state-owned copper mining company in Chile, and the private sector mining companies are making environmental upgrades an important part of their investment programs.

In addition to mining and other traditional heavy industry located in Santiago, environmental concerns surround two of Chile's other fast-growing industries: the fish processing industry, located both in the north and the south; and the timber industry located in the south.

Table 3-8: Chile at a glance	
Population	14 million
Economy (1993)	GDP: \$43.6 billion Annual real growth rate: 6 percent Per capita GDP: \$3,200
Natural resources	Copper, timber, fish, iron ore, nitrates, precious metals, and molybdenum
Agriculture	(8 percent of GDP) Products: wheat, potatoes, corn, sugar beets, onions, beans, fruits, livestock, fish
Industry	(17 percent of GDP) Types: mineral refining, metal manufacturing food processing, fish processing, paper and wood products, finished textiles
Trade (1993):	
Exports	\$9.4 billion: copper, fishmeal, fruits, wood products, paper products Major markets (percentage): US, 18, Japan, 16, Argentina, 6, UK, 6, Germany, 5, Brazil, 4
Imports	\$10.7 billion: petroleum, chemical products, capital goods, vehicles, electronic equipment, consumer durables, machinery Major suppliers (percentage): US, 23, Brazil, 10, Japan, 8, Germany, 6, Argentina, 5, Nigeria, 4
Exchange rate	US \$1 = 420 pesos

Source: US State Department

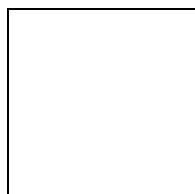
Enforcement of Environmental Regulations

Chile's main body of environmental legislation, the Environmental Framework Law passed in 1994, is still not fully implemented. As a result, companies use loopholes in the law to avoid compliance. Regulations for the Environmental Framework Law are being debated by Parliament and are expected to be approved by the end of 1996.

Given the severe air pollution in Santiago, one of the most important laws is DL 185, passed in 1991. This regulates the operation of facilities which emit airborne pollutants. It also sets standards for each region, with those in the Santiago Metropolitan Area being the most stringent. Existing plants must reduce emissions by December 1997 to comply with these standards.

Environmental protection is hampered by Chile's diffusion of authority and management through the environmental units (*unidades ambientales*) of the Ministries, the Regional Environmental Commissions (*COREMAS*), and the National Environment Commission (*CONAMA*). New entities like *CONAMA* will need to be strengthened to have an impact on the environment.

Figure 3-8: Chile pollution control equipment market (total vs. imports)



Key Environmental Subsectors

Municipal Water

The two largest water utilities, the Municipal Sanitation Company of Santiago (*EMOS*) and the Valparaiso Sanitation Company (*ESVAL*), have been approved for privatization, but political and public pressures have slowed down the process. Production Development Corporation (*CORFO*), the holding company for state-owned industries, has approved private sector majority ownership for *EMOS* and *ESVAL*. Until they receive special authorization, the other water companies will be allowed private equity of no more than 49 percent.

A recent scandal over an *ESVAL* sewer main contract with a private company has raised questions about the company's ability to organize bids and manage contracts.

Although privatizations in Chile's two largest cities have been bogged down, smaller privatizations are taking place:

- The Los Lagos Sanitary Services (*ESSAL*) that covers the Valdivia and Los Lagos area in the South is already privatized. Chilquinta and Aguas de Barcelona were awarded a long-term concession in 1994.
- In 1995, *CORFO* approved the privatization of municipal water companies in 13 smaller cities. The largest of these will be for Punta Arenas, a city of 100,000 people located at the southernmost tip of Chile.

Environmental Impact Assessments

Chilean companies have not yet felt the full impact of the 1994 Basic Environmental Law which requires companies to perform environmental impact assessments for new projects. Because implementing regulations have not yet been approved, companies are complying on a voluntary basis. Nonetheless, since 1993, the National Environment Commission (*CONAMA*) has reviewed over 100 environmental impact assessments. Of the US \$15 million invested in assessments, almost half went toward mining projects. *CONAMA* believes that the regulations will be in place by the end of 1996, at which time the market for environmental impact assessments will grow dramatically. In addition the local environmental regulatory agencies, many of which do not have specialized technicians, will contract private consultants to review environmental impact assessments.

Hazardous Waste and Wastewater

Industrial hazardous waste and wastewater contamination are concentrated in two areas. The Santiago Metropolitan Area, which makes up 43 percent of the country's population, includes the greatest concentration of industrial, domestic and vehicular pollution. Pollution related to the mining sector is scattered around the country, with the largest concentration in the two northernmost regions of Taparaca and Antofagasta. Pollution overall is becoming increasingly more severe in rural areas in the north and south. Pollution in Chile's most contaminated areas is centred around two of its booming nontraditional industries: the fishing industry, located both in the north and the south; and the timber industry, located in the south.

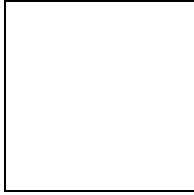
Discharges of untreated wastewater are regularly dumped into Chile's river systems that empty into the Pacific, and present health and environmental hazards for coastal cities. The Superintendency of Sanitary Services estimates that no more than 10 to 15 percent of Chile's wastewater is treated. The figure for Santiago is closer to 5 percent.

Wastewater treatment and hazardous waste disposal, once of little concern to the mining companies which were located in sparsely populated areas, are now major issues. In the arid north, water is at premium. With a fast growing mining industry, demand for water is rapidly increasing. Much of the water in the area needs to be pretreated due to the high salt and mineral content. Because pipe infrastructure is incomplete, some water must be trucked in to the mining sites. Companies, including the state-owned National Copper Corporation (*CODELCO*), are now beginning to treat wastewater contaminated with high levels of minerals absorbed in the process of separating copper from rock.

Air Pollution

Air pollution control is one of the top priorities for the country. The mountainous geography traps emissions of vehicles and industries, contributing to heightened public and political awareness of the problem. The Special Decontamination Commission for the Metropolitan Region (*CEDRM*) has taken the lead in trying to reduce vehicular air pollution by implementing a system that encourages the use of catalytic converters. Since September 1992, all new cars must use catalytic converters. Older cars that do not install them are prohibited in the Santiago Metropolitan Area on certain days of the week.

Figure 3-9: Chile's pollution control equipment market share



The Santiago Metropolitan Area has about 2,500 industrial facilities, all of which are required by the *CEDRM* to comply with emissions standards. Those that do not comply can be forced to shut down on days of poor air quality. One small business in Santiago reported being forced to stop production for a total of six days during smog emergencies in 1994. Some success has been achieved in the effort to dissuade industry from using highly polluting fuels. *AMPICH*, an association of small- and medium-sized businesses, reports that the air quality monitoring authorities have pressured its members, with some success, to switch from wood to cleaner burning fuels, such as gas.

To meet *CEDRM*'s NO_x and particulate emission standards, it is expected that oil, petrochemical, steel, glass, leather, textile and food processing plants will need to install and upgrade pollution control equipment. Chile's fast-growing demand for power, particularly in the mining sector, is spurring a number of new plant projects. Business opportunities are likely to be found in pollution control systems for the coal- and gas-fired thermoelectric power plants now in the works. Chilgener, for example, just finished installing electrostatic precipitators to reduce emissions by 98 percent from its thermoelectric plant in Ventanas.

Key Industry Subsectors

Mining

Bolstered by record prices for copper and other metals, the mining industry in Chile is experiencing an unprecedented boom. Annual copper production in Chile is expected to rise from 2.2 million tons in 1995 to 3.9 million tons, an increase of 75 percent. The increase in production for private sector copper mining operations will reach 130 percent over the same period.

The price of copper rose 11 percent in the first eight months in 1994. For the first eight months of 1995, Chilean production increased 8.9 percent. Gold and zinc are both up 8 percent. Mining is historically Chile's most important economic activity, representing 37 percent of the country's exports.

The state-owned National Copper Corporation (*CODELCO*) has undertaken a massive environmental investment program. Juan Villarzoe, the new president of *CODELCO*, has made the environment a priority. He plans to bring *CODELCO* into compliance with ISO 14000 standards within the next 10 years. In 1995 alone, he planned to invest US\$100 million, almost twenty percent of *CODELCO*'s total budget, in environmental projects including air pollution control in its smelters and wastewater and water reuse.

Forestry

Forestry, one of Chile's fastest growing industries, represents 3.5 percent of the country's GDP and 13.1 percent of its exports. About 60 percent of the Chilean forestry sector is managed and owned by seven large companies, four of which are multinationals. As in other segments of the Chilean market, international companies have a strong presence and are leading the industry in the implementation of environmental technologies. The large producers are under increasing pressure to adopt better environmental practices. One Chilean company, for example, utilizes its wood waste in a biomass-fuelled cogeneration plant. Looking towards European export markets, many wood-finishing companies are contemplating eco-labelling to promote their products.

Projects

North and South Concessions

While the Valparaiso Sanitation Company (*ESVAL*) may not be privatized as a whole, it wants to begin the process of establishing concessions for two smaller portions of its service areas. Located to the north and south of Valparaiso, the two stretches of coast are popular summer tourist destinations and have significantly larger service requirements during peak seasons.

Both projects are planned to be 35-year build-operate-transfer (BOT) concessions. The concessionaires will be required to invest in water and wastewater infrastructure and operate and maintain the system. The North Coast Concession will include the towns between La Ligua and Quintero Bay. The South Coast Concession will include the towns between Algarrobo and San Antonio. This area has a winter population of 150,000, which grows to almost a million during the summer.

Santiago Wastewater Plants

The Municipal Sanitation Company of Santiago (*EMOS*), is implementing an aggressive 15-year program for wastewater management and potable water treatment. Predicted population growth will generate increased quantities of wastewater, which authorities now recognize must receive treatment to avoid major public health consequences. *EMOS* has begun to execute its investment program with two treatment plants.

Santiago Sur, a wastewater treatment plant to be located in the Santiago metropolitan area, will provide primary and secondary treatment, mainly for domestic waste. This will be the first plant to be completed by *EMOS* on a BOT basis. The plant will initially have a capacity of 3.5 cubic metres per second. Later, the capacity will be expanded to 6.4 cubic metres per second. Pre-qualification for the 25-year concession will begin in May 1996.

The La Florida plant, to be built for *EMOS* on a contract basis, will provide potable water to the Santiago metropolitan area. The plant will be built with an initial capacity of 4 cubic metres per second. In a later phase, the capacity will be increased to 12 cubic metres per second. The US\$45 million project is divided into three contracts: equipment supply, installation and civil works. Pre-qualification for the US\$15 million equipment supply contract closed in January. Three pre-qualified consortia, composed of firms from Chile, the US and France, submitted bids that are now being evaluated. The installation and civil works contracts, with an estimated value of US \$30 million, will not be opened for bids until mid-1997.

In addition, *EMOS* has a plan to construct four additional wastewater treatment plants, valued at \$520 million.

Table 3-9: Wastewater treatment plants planned by *EMOS*

Plant	Initial flow (m³/s)	Final flow (m³/s)	Year of initiation of operations	Percentage
San Bernardo	2.9	5.0	1999	20
Maipo	0.5	1.5	1999	23
Zanjón Phase 1	2.5	2.5	2004	41
Mapocho	6.1	8.2	2009	100
Zanjón Phase 2	2.5	10.5	2009	100

CODELCO Wastewater and Water Re-use Projects

The state-owned National Copper Corporation (*CODELCO*) is also undertaking a number of innovative water projects. With many of its mines located in the arid north *CODELCO* is forced to look for ways to maximize local water resources for its needs and the needs of the community. *CODELCO* is studying different types of plants and animals which could use the company's treated wastewater. In addition, natural water sources in the north often contain high levels of arsenic, which must be treated prior to human consumption.

CODELCO will be investing in a number of water projects: potable water plants to remove arsenic, facilities to treat wastewater, and irrigation and mining water reuse applications.

CODELCO Air Pollution Control Projects

CODELCO is planning a series of plants that will remove hazardous sulphur emissions. Once removed, the sulphur is converted to sulphuric acid, which can be used in other mining processes. *CODELCO* will embark on three major projects: División Teniente, División Salvador and Chuquicamata.

The company will invest US\$100 million in its operations in División Teniente. Phase I of the sulphuric acid plant, already awarded to Mitsubishi, will treat 40 percent of the waste gases upon completion in 1998. The next two phases, which will be bid separately, will raise the treatment level to 75 percent in 2002 and 100 percent in 2007.

CODELCO also plans to build a plant for its División Salvador operations. The plant will be constructed at a cost of US\$100 million, and will treat 100 percent of the waste gases upon completion in the year 2000.

Chuquicamata, the company's largest mine, will need upgrades for its sulphuric acid plants. The four existing plants treat 80 percent of all emissions. *CODELCO*'s goal is to achieve 100 percent treatment by 2002.

Engineering studies and a cost/benefit analysis are underway to determine the feasibility of changing the production process to reduce emissions. While the 80 percent treatment levels conform to current standards, *CODELCO* wants to raise its company standards to the level of ISO 14000.

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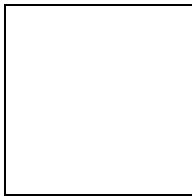
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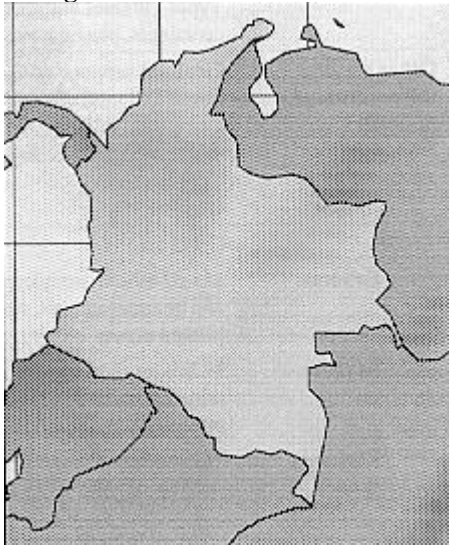
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3.5 Colombia

Figure 3-10: Colombia — real GDP growth



Background



With a population of nearly 33 million people, Colombia is the third most populous country in Latin America, after Brazil and Mexico. In recent years, the movement from rural to urban areas has been substantial, leading to many of the country's environmental problems. Today, over 74 percent of the population lives in an urbanized environment as opposed to 57 percent in 1951. Accordingly, Colombia is now facing many of the same environmental challenges as other Latin American countries.

A country with growing economic prosperity, Colombia recently experienced a political crisis stemming from accusations that President Samper's election campaign had accepted sizable contributions from the Cali drug cartel. This scandal has been followed by a number of high profile political assassinations, which have further clouded the investment climate in Colombia.

Still, in spite of its on-going political crisis, Colombia remains one of the most sound economies in Latin America. Relative to other Latin markets, Colombia has managed to gradually reduce inflation with a 1995 year end figure of 20 percent.

In spite of Samper's current political problems, his Administration has made a significant commitment to environmental protection. In fact, under his government's National Development Plan (1995–1998) the Colombian Government will invest over US\$1.4 billion in sustainable development programs, which includes operational budgets for the Ministry of Environment and Natural Resources (*Minambiente*) and its regional operating entities. This budget reflects an increase in environmental expenditures from 0.1 percent of gross domestic product (GDP) for 1995 to over 0.53 percent of GDP for 1998.

Table 3-10: Colombia at a glance

Population	32.9 million
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Economy (1993)	GDP (1994): US \$47 billion Annual growth rate (1993): 4.4 percent Per capita GDP: (1993): vs. \$1,390 Foreign debt (public and private): US \$17 billion
Population Centres	Bogota (6.3 million), Cali (1.8 million), Medellín (1.7 million), Barranquilla (1.0 million)
Natural resources	Coal, petroleum, natural gas, iron ore, nickel, gold, silver, copper, emeralds
Agriculture	Accounts for 21 percent of GDP. Products: coffee, bananas, cut flowers, cotton, sugar cane, livestock, rice, corn, tobacco, potatoes, soybeans, sorghum Cultivated land: 5% of total land area
Industry	Accounts for 21 percent of GDP. Types — textiles and garments, chemicals, metal products, cement, cardboard containers, plastic resins and manufactures, beverages
Other sectors (percentage of GDP)	Financial services: 15 percent Social and miscellaneous services: 14 percent Commerce: 11 percent Transportation, warehousing, and communications services: 9% Construction: 3 percent Utilities: 1 percent
Trade	Estimated for 1995
Exports	US \$11.57 billion: petroleum, coffee, coal, ferro-nickel, bananas, flowers, chemicals and pharmaceuticals, textiles and garments, gold, sugar, cardboard containers, printed matter, cement, plastic resins and manufactures, emeralds
Imports	US \$9 billion — Machinery and equipment, grains, chemicals, transportation equipment, mineral products, consumer products, metals/metal products, plastic/rubber, paper products, aircraft, oil and gas industry equipment and supplies
Exchange rate	US \$1 = 980 Colombian pesos

Source: World Bank, Government of Colombia, US State Department

What is the Opportunity?

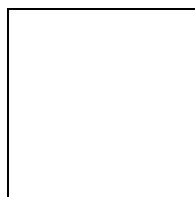
Until recently, environmental protection had been a secondary concern in Colombia, due to a lack of enforcement and well-defined environmental laws. In recent years, this has changed with the initiation of the government's "Social Leap" program, whereby \$500 million in public funds will be committed to the environment during 1996. Efforts to promote environmental protection have also been aided by the enactment of an environmental framework law in December 1993 (Law 99), which established the Ministry of the Environment (*Minambiente*), and the adoption of the National Environmental System (*INA*), which comprises the national, regional and municipal institutions responsible for environmental management. Under the law, Regional Autonomous Corporations (*CARs*) have the responsibility for implementing the Ministries policies across the nation. (See Chapter 2 for details.)

Before the adoption of Law 99, responsibility for environmental management in Colombia was dispersed among numerous national and regional institutions. At the national level, this included the ministries of health, agriculture, mines, public works, and defence, and the Institute of Renewable Natural Resources (*INDERNA*). At the regional level, a number of Regional Autonomous Corporations (*CARs*), operating under the National Department of Planning (*DNP*), implemented environmental policies. Under this arrangement, however, the lines

of authority were often unclear, and overlaps and gaps in responsibility resulted. This has changed with the establishment of *Minambiente*.

With *Minambiente*, and the Government of Colombia's increased spending on environmental protection, environmental enforcement actions have increased as have moves to force large industrial operations into compliance. This is particularly true in the oil sector, which has been under increased scrutiny by *Minambiente* as exhibited by the ministry's recent move to require both Oleoducto Central (Ocensa) and Houston-based Texaco to file environmental impact studies (EISs) before undertaking exploration and pipeline expansion projects. Similarly in the last two years, *Minambiente* has also been working to bolster Colombia's environmental regulations. A case in point is the agency's recently published resolution to raise emissions standards for solid and liquid fuels used in combustion engines as well as in commercial and industrial ovens, furnaces and other heating devices. The new regulation will enter into force on January 1, 1996 through the year 2006 and covers virtually all types of fuels and additives.

Figure 3-11: Colombia pollution control equipment market (total vs. imports)



Efforts to strengthen Colombia's environmental regulations will go hand-in-hand with institutional strengthening within *Minambiente*. The agency will obtain \$20 million during 1996 through the World Bank for institutional capacity building and employee training during the next three years (1996-1998).

Given *Minambiente*'s new get-tough stance on environmental enforcement, Colombia's larger corporations and multinationals are taking steps to ensure that they are in compliance with the country's newly enacted environmental law. To this end, key Colombian multinational corporations recently established the *Consejo Empresarial Colombiano para el Desarrollo Sostenible (CECODES)* Colombian Business Council for Sustainable Development. Members include: Compañía de Cementos, Argos, Propilco, Mobil de Colombia, Compaq Computer, Industrias e Inversiones Samper and Verela.

Greater compliance and increased governmental resources for environmental programs is translating into the emergence of an exciting new market in environmental goods and services. Assessed as a market of no more than \$44 million in total sales in 1992 by the US Department of Commerce (USDOC), the combined market in wastewater, solid and hazardous waste, and air pollution will exceed \$300 million in 1995, according to information provided by the World Bank and *Minambiente*.

Key areas of opportunity through the year 2000 include construction of wastewater treatment facilities for Colombia's major metropolitan areas; solid and hazardous waste management services; air pollution control equipment; and, above all, environmental services to the oil sector. Below is a summary of environmental expenditures by *ECOPETROL*, Colombia's state-owned oil company.

Table 3-11: ECOPETROL environmental investment (US\$ millions)

Sector	1995	1996
Wastewater	48.7	91.8
Contingency planning	2.2	3.1
Environmental services for refining sector	9.2	10.3
Total	60.1	105.2

Water

The major water pollution problems in Colombia are located in the industrial corridors of Bogota-Soacha, Medellín-Valle de Aburr, Cali-Yumbo, and Barranquilla-Soledad, where largely untreated industrial effluent and municipal wastewaters are discharged into nearby rivers or into the sea. The Bogota, Medellín, Cauca, Magdalena and Río Negro rivers are all seriously contaminated, as indicated by data on concentration of suspended solids and

on organic pollution levels. Although the main sources of organic contamination (measured in kg/day) in Colombia are the agriculture and livestock sectors, the largest volumes of wastewater are generated by the domestic and industrial sectors, especially the food, beverage, chemical and paper industries which are highly concentrated in urban areas. Groundwater pollution is also a problem, resulting from leaching of contaminated wastewaters, improper disposal of solid and hazardous waste, including oil, lubricants and batteries from the transport sector; and excessive use and inadequate disposal of fertilizers and pesticides.

Considerable progress has been made during the last decade to increase the number of water and sewage connections nationwide: 66 percent of households have water and 51 percent sewage services. There is still a sizable portion of the population not adequately serviced by water treatment facilities. Similarly, only about 50 of the 1,014 municipalities around the country have sewage treatment plants in operation. This deficiency has led to a very high incidence of waterborne diseases. Largely due to this inadequacy, between 1985–1990, Colombia invested roughly US\$300 million per year or US\$1.2 billion to develop water and sewage systems.

During 1996, the Government of Colombia has two major water-related public works projects that it will undertake with financial support from the World Bank: the Santa Fe de Bogota-I Water Supply and Sewage Rehabilitation Project and Second Water Supply Project for Colombia.

Air

Air pollution is widely recognized as one of the most serious environmental problems in Colombia's major cities, particularly in the industrial centres of Bogota, Cali, Medellín and Barranquilla. The air pollution from fixed sources, such as industry and energy production, accounts for 39 percent of total air emissions nationwide, whereas mobile sources contribute 61 percent, mostly as a result of the poor state of the automotive fleet. Data indicates that all four cities are among the areas of the country with the highest levels of suspended matter, carbon monoxide, sulphur oxides and nitrogen oxides.

Given the large percentage of Colombian companies with outmoded, environmentally unfriendly industrial operations and the growing level of environmental enforcement, demand for pollution control technologies is growing. According to the US Department of Commerce (USDOC), the market for air pollution control equipment was close to US\$20 million in 1993, with an estimated annual growth rate of 15 percent per year. American companies accounted for 60 percent of the import market in this sector in 1993.

As noted, the main target markets for air pollution control equipment include *ECOPETROL*, as well as the steel mills, the cement industry, and the automotive sector.

Table 3-12: Estimated average annual real growth (US\$ millions)

	1991	1992	1993	(1994–1996)
Import market	15.82	17.67	19.80	15 %
Local production	0.85	0.88	0.91	4 %
Exports	0.45	0.52	0.60	15 %
Total market	16.22	18.03	20.11	13 %
Imports from US	9.40	10.60	11.80	15 %
Exchange rate (pesos per dollar)	706.90	811.80	934.00	(official rate)

Solid/Hazardous Waste

Solid and hazardous wastes are disposed of together in Colombia, under conditions inadequate to ensure environmental protection. Bogota and Medellín are among the few cities that use sanitary landfills for the disposal of solid waste. Most of the other cities in Colombia, including Cali, either bury their wastes without benefit of modern technological advances or dispose of them in open dumps or bodies of water, often in extremely unsanitary conditions. In addition, informal collection often occurs at open dumps, with adverse social and health effects. Proper disposal of hazardous industrial waste only began in Colombia in 1988, with the construction of a sanitary landfill for the petroleum industry. Since that time, other disposal facilities have been built, including one outside of Bogota.

Currently, Colombia produces slightly over 5.1 million tons of solid wastes per year (14000 tons per day). Around 64 percent are organic biodegradable wastes and the remainder have a potential recyclable content: cardboard,

paper, plastics and glass bottles. The estimated cost of disposing of these wastes is around US\$0.00 per ton. Disposal methods are labour intensive and few landfills exist. The municipal services collect, transport and dispose of both domestic and industrial wastes, hazardous or not. Most of the Colombian solid wastes are dumped with no cover or treatment. Even though landfills are beginning to replace open-air dumps, much remains to be done to correct the landfill operations, especially in the area of leachate monitoring and control, vector control and slope protection. Very little recycling is done with solid wastes.

As for industrial hazardous waste, production in Colombia is estimated to be around 540 tons per day or slightly less than 200,000 tons per year. Hazardous waste accounts for 8.6 percent of all industrial waste produced. As with most solid wastes, hazardous wastes are largely disposed of in open-air dumps or are buried or discharged into rivers. At present, there are only eight Colombian cities with sanitary landfills: Bogota, Barranquilla, Bucaramanga, Popayan, Ibagua, Cartagena, Manizales and Pereira.

Though the management of solid and hazardous waste remains a problem throughout Colombia, the market for technology and services in this sector is growing. According the US Department of Commerce (USDOC), the total market for solid waste management is estimated at over 14million in 1994 with 2.2million of that going to foreign companies (100 percent American):

Table 3-13: Colombia's waste management market — estimated average growth rate, 1995-1997 (US\$ millions)

	1992	1993	1994	(1995-1997)
Import market	0.6	0.8	2.2	15 %
Local production	11.5	19.5	11.8	19 %
Exports	—	—	—	—
Total market	12.1	20.3	14.0	20 %

Source: US Department of Commerce

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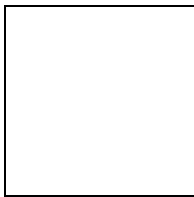
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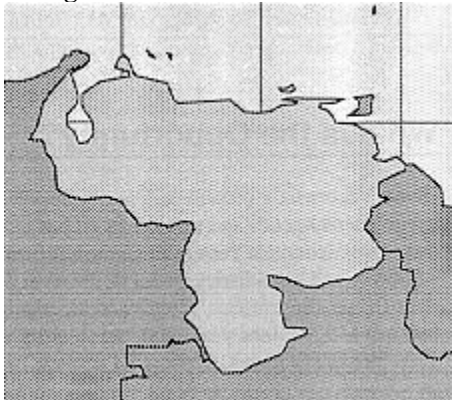
(Its role is to promote greater productivity, more efficient industrial processes and a reduction in negative environmental impacts.)

3.7 Venezuela

Figure 3-12: Venezuela — real GDP growth



Background



During the late 1980s, Venezuela was considered one of the most promising emerging markets in Latin America. However, in recent years it has experienced one of the most serious and systemic economic crises in its history. The crisis brought about the dramatic reduction in Venezuela's economic growth that led to Latin America's highest level of inflation, over 76.1 percent in 1995.

In June 1994, Venezuela imposed tight foreign exchange controls in order to stem capital flight, fixing the Bolivar at 140, and later 290, per American dollar. These controls precluded foreign investors from repatriating in-country profits, but also discouraged inward investment in the country.

In an effort to reverse this trend and put Venezuela on the road to economic recovery, President Rafael Caldera announced a national economic stabilization plan on April 15, 1996. The plan included tax and gasoline price increases, the liberalization of interest rates and, most importantly, a lifting of foreign exchange controls. As of May 1996, the Bolivar is traded at 435 to the American dollar, a drop of over 50 percent in value. A negative growth rate of -1.4 percent is forecasted for 1996.

The recent economic measures undertaken by President Caldera will be difficult for a country already experiencing its worst economic crisis in recent memory. The net effect on environmental expenditures during 1996 will be negative. While this is so, environmental business opportunities in Venezuela do exist, particularly in the oil and gas and mining sectors.

These environmental market opportunities are reinforced by Venezuela's Criminal Environmental Law (CEL), which entered into force on April 4, 1992 and established an important precedent for criminalizing violations of

the country's environmental regulations. Still, it is important to emphasize that specific enforcement actions have been limited to larger industries and the energy sector, due, among other things, to limited resources.

Population	
Economy (1993)	GDP (1994): US \$56.1 billion Annual growth rate (1994): -3.3 percent; -1.4 percent (estimated for 1996) Per capita GDP (1993):US \$2,800
Natural resources	Petroleum, natural gas, coal, iron ore, gold, other minerals, hydroelectric power, bauxite
Agriculture	(5 percent of GDP) Products: rice, coffee, corn, sugar, bananas, dairy, meat and poultry products
Petroleum industry	(23 percent of GDP) oil refining, petrochemicals
Manufacturing	(21 percent of GDP) Types: iron and steel, paper products, aluminum, textiles, transport equipment, consumer products
Trade (1994)	
Exports	US \$14.2 billion: petroleum (US \$10.5 billion), iron ore, coffee, steel, aluminum, cocoa
Exchange rate	Exchange rate: US \$1 = 435 Bolivars = (May 1, 1996)

Source: US Department of Commerce; Economist Intelligence Business Unit

What is the Opportunity?

Given Venezuela's present and near-term economic troubles, little opportunity exists in the market for environmental goods and services in all but the petroleum sector. In this sector, the country's national oil company, Venezuela Petroleum Company *PDVSA*, along with a number of its wholly-owned subsidiaries, intend to invest in excess of US\$130 million for environmental projects including remediation, air emission control and assessments during 1996 alone. Another \$482 million will be spent between 1997 and the year 2000. Subsidiaries with plans for environmental remediation or auditing during 1996 include: Maraven, Coperven, Lagoven, Pequiven, and Inervep.

Key areas of environmental investment for *PDVSA* will be effluent treatment, atmospheric emissions, industrial waste management and soil conservation. The following is a summary of these investments by area of priority as well as sector:

Table 3-15: *PDVSA* environmental investment, 1996–2000 (US\$ millions)

Air emissions	32.4	253.6
Wastewater treatment	59.1	53.0
Industrial waste management	21.1	122.4
Contingency planning	7.1	11.0
Other environmental investments	10.4	42.0
Total:	130.1	482.0

Table 3-16: *PDVSA* investment by sector

Sector	percentage
Oil production and exploration	58
Refining	30
Petrochemical	7
Market (operation of gas stations)	5

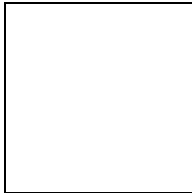
While environmental expenditures in the oil sector will be substantial, it is worth noting that at present few environmental service and technology firms are taking advantage of the opportunities to serve as contractors to PDVSA, an oil company that now ranks second in the world with revenues in 1995 exceeding US\$2 billion. In fact, as of January 1996 there were only twenty companies registered to undertake environmental work for PDVSA. Of these only five were North American firms.

With foreign exchange controls now having been lifted, Venezuela's mining sector, petrochemical industry, food processing and solid waste management market are areas of potential expansion for North American environmental technology and service firms. Key companies to target will be the *Corporación Venezolana de Guyana (CVG)*, Venezuelan Corporation of Guyana, and its subsidiaries including SIDOR.

Another area of potential opportunity is providing environmental infrastructure at the state and municipal levels, mainly in the area of wastewater treatment. The World Bank is nearing completion of a loan program totalling US \$165 million for projects administered through Hydroven, the state-owned water utility. The importance of the World Bank's loan programs are underscored by the fact that in February of this year no less than 151 beaches were closed due to health concerns arising from contamination and water-borne pollution.

The public sector in Venezuela will need to spend in excess of US\$1.5 billion over the next three to five years just to meet minimum requirements under the Criminal Environmental Law (CEL). Overall, the Venezuelan environmental market is estimated at over US\$2.4 billion through the year 2000.

Figure 3-13: Venezuela pollution control equipment market (total vs. imports)



The Venezuelan market for industrial toxic waste, air pollution and water treatment control equipment is estimated at US \$39 million for 1994, and it is expected to increase by approximately 3 percent annually between 1995 and 1997. The import of pollution control equipment declined from US\$75 million in 1992 to US\$49 million in 1993, a 34.7 percent decrease. Of the estimated 3,280 Venezuelan industries that discharge liquid effluents, only a few are sufficiently equipped to treat the effluent to meet international standards. Severe environmental problems associated with the untreated discharge of industrial effluents are particularly present in the Lake Maracaibo, northern coast, and Puerto Ordaz areas.

Table 3-17 shows a breakdown of environmental market opportunities (1995–2000) based on estimates of the US Department of Commerce (USDOC), Foreign Commercial Service.

Table 3-17: Environmental market opportunities, 1995-2000

Environmental Market	(US \$ millions)
Industrial sector	900
Petroleum	380
Mining	300
Chemical/ petrochemical	150
Food processing	70
Public sector	1,500
Domestic waste	300
Wastewater treatment system Caracas	200
Watersheds (e.g. Valencia Lake)	150
Other environmental services	150
Three major landfills	700
Total investment (public & private sectors)	2,400

Source: US Department of Commerce

It is worth noting that both the US Trade Development Agency (USTDA) and the Canadian International Development Agency (CIDA) have sponsored project feasibility studies in Venezuela leading to environmental contracts for American and Canadian companies respectively. TDA's most recent grant was for US\$10,000 to underwrite a comprehensive air quality monitoring modernization project for Venezuela which will lead to eventual government procurements of US\$40 million.

Municipal Water and Wastewater

The construction of municipal wastewater treatment facilities remains a priority for the Government of Venezuela, which plans to spend over US\$350 million to address shortfalls in this area and to bring water quality standards up to the minimum required under the country's Criminal Environmental Law. Priority projects include the reclamation of major watersheds that are highly polluted such as Lake Valencia, Lake Maracaibo, Tuy River, Guarico River, Central Coast Area and Puerto La Cruz Bay.

Between 1996 and 1998, the largest municipal water projects will be undertaken with World Bank assistance. These include the US\$100 million Ind Est water supply and sewage privatization project; a US\$35 million project to strengthen the State of Monaga's water agency; and the US\$30 million Caracas municipal water sanitation project.

For the Caracas water sanitation project, the German aid agency, GTZ, is financing a study for the establishment of a water basin authority to establish and enforce water resource and pollution control guidelines. However, this does not preclude North American environmental companies from competing on these projects.

Hazardous Waste

In Venezuela there is a growing concern over the need to properly dispose of the country's mounting quantities of industry-generated hazardous wastes. According to statistics from the Ministry of Environment and Renewable Natural Resources (MARNR), the country produces some 200,000 tons of toxic wastes annually of which some 30 percent originates in Zulia State alone, the country's oil production and refining centre. Other major generators of hazardous waste include the tanning textile, resin and plastics industries. In the absence of safe disposal sites, most large industries are presently accumulating and storing wastes onsite. Illegal dumping of hazardous waste is also a problem throughout the country. Yet, in spite of this growing problem, Venezuela does not have any adequate storage or recycling facilities, though MARNR is studying possible sites for such disposal. This remains a concern among some foreign manufacturers, who argue that the country lacks the necessary infrastructure (e.g. waste disposal and containment facilities) to get their operations in compliance with the Criminal Environmental Law (CEL).

Solid Waste and Recycling

The Government of Venezuela is currently attempting, through legislation, to induce several municipalities to build or upgrade their basic infrastructure, including waste disposal systems, sanitary burial and landfills, and recycling. But, the municipal solid waste problem is expected to improve only slowly in the short- to medium-term. This is largely due to the country's rapidly growing urban population (about 85 percent of Venezuelans live in cities), limited public resources to construct solid waste landfills and a lack of effective environmental protection programs.

Due to growth in both urban areas and individual consumption levels, municipal waste has reached quantities that have started to threaten the environment and public health. The majority of solid waste comes from households; the remainder comes from small industries and commercial activities. The composition of municipal solid waste varies but paper, cardboard, glass, metal and organic matter are the main components

According to government sources, Caracas produces an average of about 3,600 tons of solid waste daily, of which 40 percent is paper and cardboard, 20 percent fabric, 8 percent glass, 8 percent metal, 8 percent food, 7 percent plastic and 9 percent other materials. Local governments are only beginning to address recycling in Venezuela.

Until now, recycling has been carried out only by private entities, which tend to focus on materials for which there is high return and a steady market, such as glass and aluminum, and to ignore less profitable materials. A case in point is Polar Brewing Co., the country's largest beer producer, which has been in the recycling industry for over 14 years. Polar recycles over 78 percent of the cans it produces or approximately 900 million kilos, and has helped Venezuela attain the rank of second largest recycler of aluminum in the world.

For imported recycling equipment, services and technology, the US currently has the dominant market share. It is estimated that over US\$100 million will be needed to implement a comprehensive program to solve waste and recycling problems in Venezuela. The following chart provides an overview of the Venezuelan solid waste and recycling market.

Table 3-18: Solid waste recycling equipment — estimated average annual expenditures (US\$ millions)

	1992	1993	1994
Import market	44.6	78	60
Local production	18.0	27	32
Export	0	0	0
Total market	62.6	105	92
Imports from US	18.4	23.9	31
Exchange rate (Bs: USD)	71.0	92	170

Table 3-19: Share of Venezuelan solid waste market

Country	percentage
North America	50.0
US	38.0
Canada	12.0
Mexico	>1.0
Japan	18.2
France	10.0
Germany	13.8
Other	8.0

Source: Venezuelan Institute of Foreign Trade (ICE)

Air Pollution

In an effort to comply with the Venezuelan regulations concerning atmospheric emissions, PDVSA and a number of foreign companies have sought to invest in pollution control devices during the last couple of years. During the summer of 1995, PDVSA announced plans to invest US\$6 million in air pollution mitigation equipment.

Similarly, Mexico-based CEMEX's Venezuelan subsidiary, Vencemos, has already invested US\$50 million in pollution control devices during 1994. Another US\$9 million will be spent in the coming year for lead collectors, electrostatic air filters and air quality monitors.

Key Subsectors

Oil

As noted earlier, Venezuela's strongest single industrial sector is the petroleum industry, commanding yearly export revenues of US\$12 billion. Though the sector is led by state-owned Venezuela Petroleum Company (PDVSA), recent changes in Venezuela's national oil policy allow foreign oil companies to have partnership interests in PDVSA and even lead oil exploration projects. This recent liberalization, known as 'apertura', has led to a number of American, European and Japanese firms securing concessions to initiate oil exploration in different regions of the country. All foreign oil companies entering the market under apertura will be required to comply with the Criminal Environmental Law (CEL) and to undertake environmental impact assessments of the areas affected by oil exploration and extraction.

The list below is a summary of recently awarded concessions, along with the name of the PDVSA subsidiary that will serve as a joint venture partner and the designated location for oil exploration.

<i>PDVSA Subsidiary: COPRPOVEN:</i>	
Guçrico Occidental:	Mosbacher Energy Company
Guçrico Oriental:	Teikoku Oil de Venezuela
Oritupano-Leona:	Pérez Companç-Norcen-Cord
Quiamare-La Ceiba:	Astra Quimare de Venezuela -Ampolex Tecpetrol -Sipetrol
Sanvi-Guere:	Teikoku Oil de Sanvi -Guere C.A.
<i>PDVSA Subsidiary: LAGOVEN:</i>	
Jusepín:	Total Oil & Gas de Venezuela
Pederanles:	British Petroleum (BP) de Venezuela
Quiriquire:	Maxus de Venezuela; BP de Venezuela
Uraçoa-Bombal:	Benton-Vinccelor
Urdaneta Oeste:	Shell de Venezuela
<i>PDVSA Subsidiary: MARAVEN:</i>	
Colón:	Tecpetrol; Corexland; Wascana de Venezuela; Nomeco
Desarrollo Zulia Occidental:	Occidental Oil
Falcón Costera:	Olympic Oil & Gas; Clayton Williams Energy Inc.
Falcón Oeste:	Samsom-Vepica; Ingeneria 5020; Petrolago
Falcón Este:	Pennzoil; Vinccler

Mining

For environmental market opportunities, the country's second most important sector is the mining industry (iron, bauxite and gold) and refining industry, mostly iron and aluminum, and more recently gold. Venezuela's largest single mining concern is the *Corporation Venezolana de Guayana (CVG)*.

In this market, there is an estimated demand for environmental goods and services of US\$300 million, with most of the procurement opportunities coming through CVG. Other priority CVG projects to be undertaken with World Bank funding commencing in 1995 include:

- design and construction of a red mud management system;
- environmental management system;
- design and installation of a dust collector;
- wastewater treatment lagoon improvement;
- design and installation of chromate effluents treatment systems;
- flat products plant: transformer substitution;

- electric furnace: dust collector modernization;
- coal plant: design and installation of a dust collector;
- environmental improvement of shipping terminal;
- toxic residue store improvement; and
- conical plant: design and installation of a dust collector.

Petrochemical and Chemical Sector

The third most important sector in Venezuela for environmental market opportunities is the chemical and petrochemical industry, a sector composed of about 200 companies nationwide. Of these companies, about 150 are members of the Venezuelan Chemical Manufacturers Association (*ASOQUIM*). Some of these companies are 100 percent Venezuelan-owned and others belong to multinational corporations such as Procter and Gamble, Shell Oil, DuPont, Hoescht, Henkel and Dow Chemical. Most of the chemical industries are located in the Central Region of the country. The petrochemical plants are located in Zulia, Carabobo and Anzoategui states.

The greatest development in the petrochemical industry, as it relates to the environmental industry, has to do with its requirements for end products. Traditionally associated with oil refining and gas processing products, this sector is expanding to include investment opportunities in other areas, such as plastics and oxidants.

In October 1992, *ASOQUIM* launched the Responsible Care Program. This is a voluntary program structured around international standards and aimed at environmental protection, community awareness, industrial safety and occupational health. It has been endorsed by a majority of *ASOQUIM*'s member companies.

The result has been a growing demand for environmental goods and services among Venezuela's chemical industry. Presently, the estimated cost to meet existing Venezuelan environmental regulations is about US \$150 million for this sector.

Projects

BFI: Changing Policies Toward Municipal Waste Concessions

A good example of the evolving nature of the Latin American market for municipal environmental services is the experience of Browning Ferris International (BFI) in Venezuela.

In the early 1980s, BFI began to look into opportunities in municipal waste services in Venezuela. BFI was awarded a contract to provide municipal waste services to a portion of Caracas in 1981. BFI's initial investment in the Caracas municipal waste system was approximately US\$9 million. The service contract for Caracas led to similar arrangements in Maracaibo and Barquisimeto, two of the country's largest cities.

Venezuela preferred to centralize its private sector contracts with *EMAU*, a now defunct arm of the federal Ministry of the Environment. Control was kept at the federal, rather than the municipal level. In spite of this arrangement, BFI still faced the erratic payment and an unorthodox interpretation of its contract by *EMAU*. BFI attributed the interpretation to the "leftist school of economics" prevalent in Venezuela at the time. Furthermore, new elections brought changes in the rules established in the original contract. In the 1980s, Venezuela periodically imposed currency controls making profit repatriation in dollars difficult, a practice that continued until very recently.

Realizing the effect its policies have had on private sector concessionaires, Venezuela is revamping its system of contracting municipal waste services. First, the Ministry of the Environment ceded authority over waste management contracts to city governments. Secondly, it allowed city governments to set up regulatory entities to supervise the quality of the service provided by the concessionaire and to approve tariff changes. Thirdly, it changed the rate collection system by taking the money flow out of the hands of the government, thus providing a more reliable system for the concessionaire. In Caracas, the waste management concessionaire hired Electricidad de Caracas, a respectable electric power utility that has been in private hands for over 100 years, to collect waste tariffs along with its own.

BFI let its contracts expire and pulled out of Venezuela in 1993. However, the new changes in the contracting structure could make BFI contemplate a return to Venezuela.

PDVSA Environmental Investment Program

The Venezuela Petroleum Company (*PDVSA*) is making significant environmental investments in its upstream and downstream operations. The company's four-point environmental program covers: preventative measures, pollution control, contingency planning, and research and development. Between 1996 and 2006, the company plans to invest US\$612 million in the environmental program.

Preventative Measures

1. Environmental impact assessments
 - Mandatory for all major projects at early stages of development, including feasibility and conceptual design stages.
2. Incorporation of clean technologies and clean products
 - Replacement of mercury cell technology by selective membrane technology for chlor-alkali processes.
 - Conversion of chloride wastes to hydrogen chloride in vinyl-chloride plants.
 - Upgrade of refineries to remove sulphur and produce oxygenates and high octane components for reformulated gasoline production.
 - Production and distribution of compressed natural gas as a fuel for the Venezuelan public transportation fleet.
3. Raw materials substitution
 - Continuously evaluate and test less toxic drilling fluids.
 - Evaluate catalyst to prevent losses at FCC units.
4. Pollution prevention practices
 - Continuously study and identify opportunities at refineries and oil production sites.
 - Adopt closed-loop systems and reuse drilling fluids.
 - Reduce water usage for rig cleaning.
 - Prevent losses through appropriate materials inventory control.
5. Maintenance and telemetry systems
 - Detect and correct early, failures to prevent disruption of operations and leaks or spills.

Control Programs

1. Liquid Effluents
 - Reduce water use.
 - Treat refining and petrochemical effluents by physical, chemical or biological means.
2. Air Emissions
 - Inventory and monitor air emission sources and air quality at industries located on urban sites.
 - Install particle, sulphur dioxide, and nitrogen dioxide emissions control systems in refining plants and other petrochemical units.
 - Install carbon monoxide and nitrogen oxide control in combustion processes.
 - Evaluate and control evaporation emissions.
 - Recover associated gas.
3. Industrial Waste
 - Upgrade of hazardous waste temporary storage facilities.
 - Assess potential sites for hazardous waste landfills in western Venezuela as a joint effort with local authorities.
 - Recover and condition both onsite and offsite oil sludge and used oil.
 - Use fuel and raw material substitutes in industrial kilns.
 - Assess and reclaim oil production pits and lagoons using oil recovery and cleanup processes.
 - Dispose of PCB waste.

Contingency Plans

1. National Contingency Plan to Control Oil Spills in Venezuelan and International Waters.
2. Bilateral Cooperation Agreements to Combat Hydrocarbon Spills
 - Aruba;
 - Colombia;
 - Curaçao; and
 - Trinidad and Tobago.
3. Mutual Assistance Agreement with Oil Companies
 - Petrobrás (Brazil); and
 - *PEMEX* (Mexico).
4. Venezuelan Emergency Contingency Plan
 - hydrocarbons and other flammable substance spills; and

- releases of toxic substances.

Research and Development

1. Environmental Evaluations
 - air quality monitoring and source testing;
 - emissions inventory;
 - toxicity assessments;
 - environmental impact assessments; and
 - ground water dispersion assessment.
2. Control Technologies
 - traditional and emerging wastewater treatment methods;
 - SO₂ emissions removal; and
 - industrial waste treatment processes;
 - solidification/chemical fixation,
 - biotechnology, and
 - pollution prevention.
3. Site Cleanup and Ecological Restoration

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4.0 Supply of Environmental Goods and Services from North America

4.1 Canada

Strategic Positioning

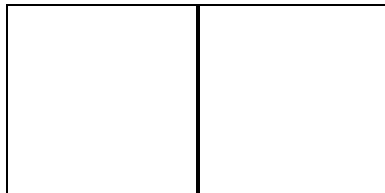
Prior to signing the North American Free Trade Agreement (NAFTA), Canada's position in the Latin American market was dependent primarily on three factors: its expertise in certain niche markets, the high rate of growth expected in environmental goods and services (EGS) exports, and its international reputation for leadership in the move towards sustainable development. Canada's position is further enhanced by the potential of the new trading relationship with Mexico (the NAFTA) to open doors to the rest of Latin America. As well, the prospect of a multilateral trade accord between Canada, Mexico and Chile further enhances Canada's presence in the Latin American markets.

While these external factors are dealt with elsewhere in this report, the conditions internal to Canada that affect its strategic position are outlined below. These conditions include the existing state of the EGS sector, the probable drivers of economic growth within the national EGS market and recent trends.

The Existing EGS Market

Canada's environmental goods and services (EGS) industry is young and diverse and serves a rapidly growing market. It is made up predominantly of small- to medium-sized companies. The industry was comprised of the following in 1990: water and wastewater treatment (48 percent), waste management (24 percent), and air pollution controls (15 percent). Other sectors, including noise, laboratory equipment, land reclamation and resource conservation, make up the balance. Figure 4-1 shows this breakdown along with comparable statistics for the United States.

Figure 4-1: Comparison of EGS market in Canada and the US



The estimated size and potential for growth is summarized in Table 4-1, again in comparison with other major exporters. In one comprehensive market analysis, it had been estimated that Canada's sales of environmental goods and services were approximately US\$9.49 billion in 1994, or 4 percent of the world market. Canada's potential for growth has been estimated to be 7.9 percent, the highest of the G7. Several other studies also have concluded that the rate of growth in the Canadian environmental market is higher than the world average.

Actual sales in 1994 were consistent with earlier projections: approximately C\$12 billion (US\$9.5 billion). Thus Canada's EGS industry is demonstrating that is vibrant and able to compete effectively in the global marketplace.

Economic Drivers

As a major resource producer, Canadian industries and manufacturers are experienced at responding to changes in the regulatory framework, especially in the areas of industrial processes and emission controls. This was evident, for example, in the pulp and paper sector with the introduction of the Pulp and Paper Regulations under the Canadian Environmental Protection Act (CEPA). Similarly, all sectoral markets have been driven largely by government legislation and regulations such as CEPA, and various pieces of provincial legislation.

It also is heavily influenced by events in the United States. Not only does Canadian legislation often draw on American experience, but Canadian markets often mirror American trends, with a lag time.

Recognizing that legislation has been a driving force behind growth in the environmental goods and services (EGS) industry over the past ten years, it is worth noting that this may be changing. The political climate in

Canada has become more conservative, with a priority on debt and deficit reduction on the part of government, and job creation and economic growth in the private sector. It is not clear how important environmental protection will be, given the current economic climate. Such protection may be seen as a luxury that falls victim to fiscal restraint. Or, the economic benefits associated with “green” initiatives, such as energy efficiency, may drive the market for “eco-efficient” environmental goods and services.

Other potential market drivers for Canada’s EGS have been identified as economic growth, population growth, consumer demand for “green” products and corporate environmental awareness. Canada’s prominent role in the Rio Earth Summit, and the existence of national and provincial economic and environmental round tables, indicates a relatively high level of corporate environmental awareness and commitment. Although somewhat volatile, public concern for the environment is relatively high and well informed.

ISO 14000

Through the leadership of the Canadian Standards Association, Canada is the international secretariat for International Standards Organization (ISO) 14000. The upcoming ISO 14000 series of environmental management standards is expected to have a significant impact on the demand for environmental goods and services (EGS), as manufacturers throughout the world strive to comply with ISO 14001 and the other guidelines in the 14000 series. ISO 14001 is the only series item requiring auditing for compliance. The 14000 series has not yet been released, but worldwide interest has already greatly surpassed the interest shown in ISO 9000 quality management standards.

It is expected that ISO 14000 compliance and registration may be highly desirable for many industries. In many cases, compliance may be required by the client base or industry association. Latin American exporters to environment-conscious nations such as Germany may find that their products have a marketing advantage if they can boast ISO 14001 compliance. ISO 14000 covers a planning element, environmental management practices, compliance with local environmental regulations, environmental literacy in the workforce, and environmental monitoring. In many countries where enforcement of environmental regulations is lax, ISO 14000 compliance may be a stronger driver of demand for EGS than local regulations. As the home of the International Secretariat for ISO 14000 is in Canada, Canadian companies are well informed of the terms of the draft regulations, and are preparing for the final publication of the ISO 14000 series of environmental management standards in late 1996. It should be noted that the ISO 14000 series is based on compliance with local environmental regulations. Therefore, where local environmental regulations are weak, ISO 14001 compliance is correspondingly less stringent.

Trends

In the early 1990s the focus of Canada’s environmental protection industries expanded to include reducing air pollution, solid wastes, and carbon dioxide emissions, and site remediation. Other factors that will drive market growth include the shift towards pollution prevention rather than end-of-pipe technologies, and specific initiatives such as the “National Pollutant Release Inventory” designation under the Green Plan of hazardous waste sites for cleanup.

Latin America Marketing Group

The Latin American Marketing Group (LAMG) was established March 9, 1995 in Vancouver, BC, Canada. Today, approximately 18 companies are paid members of this group, representing the Engineering, Environmental, Geomatic, Urban Development, and Educational sectors of British Columbia. The Consulting Engineers of BC and the BC Trade department of the BC provincial government are active supporters of LAMG.

The goal of this group is to improve the success rate of member companies pursuing business and projects in Latin America. In early 1996, the executive determined that this goal could be achieved by adopting a three-staged concurrent approach.

- providing a forum for focussed networking and member education;
- providing a forum for project partnering amongst member companies in Latin America; and
- establishing LAMG Inc., a member-held corporation actively pursuing Latin America partners for country-specific joint venture operations.

The first stage has been achieved with the holding of monthly dinner sessions, where Latin America specialists speak on relevant topics. It is the intent of the LAMG executive and member companies to pursue the second and third stages.

At this time LAMG welcomes applications from prospective new members.

Competitive Wage Rates and the Price of Goods

The average annual salary in 1990 of skilled workers such as technologists and engineers was US\$28,000 and US \$40,000, respectively. There has been little if any real increase in wages since then. The proportion of workers that are unionized is higher in Canada than in the United States, which tends to drive up the cost of labour in affected sectors in Canada. Many Canadian exports have a competitive edge over American exports because of the lower value of the Canadian dollar. In early 1996, the Canadian dollar was worth about US\$0.73.

Skilled Workforce with Relevant Experience

Canada currently employs between 60,000 and 70,000 people in the environment industry. This is almost as many as work in the pulp and paper sector. The Canadian workforce is highly educated, with years of experience in areas such as waste management and environmental protection. However, the rapid growth of the environmental goods and services (EGS) industry has outstripped the ability of academic institutions to provide adequate numbers of trained technicians. Also, managerial skills are not always as sophisticated as the industry requires.

Demographically, the Canadian workforce is maturing, with similar characteristics to the American workforce — large numbers of “baby boomers” approaching their fifties.

In response to these challenges, the Canadian Council for Human Resources in the Environmental Industry was formed in 1992 to address workforce issues. By openly identifying these and other workforce-related constraints to growth, Canada is better able to deal with the issues than many of its competitors.

Culturally Adaptive Workforce

After major restructuring within the workforce during the early 1990s, Canadian workers have become increasingly flexible and adaptable. Workers in some areas are bilingual, but their second language is likely to be French (in the east) or some language other than Spanish in areas of high immigration. This immigration is also creating an increasingly culturally diversified workforce. Nonetheless, strategic alliances with Mexican companies may be the most effective way of selling goods and services in the Latin American market.

Appropriate Technologies

Canadian firms have a distinctive presence in the global environmental goods and services (EGS) market: the Canadian environmental industry is growing faster than that of the larger exporters such as the United States, with areas of specialized expertise that are internationally recognized. However, the Canadian suppliers are a large group of small enterprises. Most of these are based on the ownership of a unique technology or special capability. The resources to continually acquire, up-date or apply new technologies are lacking. As a result, a significant portion of the environmental technologies used in Canada come from the United States and Europe. The Organization for Economic Cooperation and Development (OECD) has reported that most of the US\$10 billion spent annually on research and development in the environment sector is concentrated in the United States, Japan and Germany. The 1994 Canadian Environmental Industry Strategy paper notes that in these countries, 80 percent of environmental technologies research and development (R&D) funds came from industry. In Canada, in 1992, only 40 percent of R&D funding in the environment sector came from industry.

An evaluation of Canada’s environmental markets by Miller & Assoc. in 1995 concluded the following:

Canadian firms have established a good reputation for water and wastewater treatment systems, for handling liquid and solid wastes, and for providing such items as incinerators, shredders, compactors, and refuse recycling equipment. The capacity extends from the construction of large pollution prevention and control systems down to such components as pumps, filters, valves, and chemicals. The environmental protection industry includes firms that provide specialized goods and services used to prevent or cleanup damage to terrestrial, aquatic, and atmospheric environments. Major elements of the industry include manufacturing and onsite construction and assembly of environmental equipment, consulting engineering, solid and hazardous waste management and recycling services, and laboratory and other consulting services.

Table 4-1 further illustrates the areas in which Canadian products occupy specialized niches within the international market.

**Table 4-1: Estimates of manufacturing activity by products, 1990
(C \$ millions)**

Total Canadian Demand (Products & Services)		Products	Domestic Sales	Export Sales	Total
Water and wastewater treatment	\$3,000	Aerators, agitators and mixers	\$50	\$50	\$100
		Sedimentation systems	\$30	\$10	\$40
		Chemicals and supplies	\$250	\$100	\$350
		Filters, screens, and processing equipment	\$20	\$20	\$40
		Instruments	\$10	\$30	\$40
		Other	\$30	\$50	\$80
		Plant and equipment	\$1,300	\$150	\$1,450
		Total products	\$1,690	\$410	\$2,100
Waste management	\$1,500	Boilers, compactors, crushers, grinders, and shredders	\$100	\$30	\$130
		Hoppers and conveyors	\$100	\$20	\$120
		Transportation and disposal	\$100	\$10	\$110
		Other	\$50	\$10	\$60
		Plant and equipment	\$650	\$100	\$750
		Total products	\$1,000	\$170	\$1,170
Air pollution control/ monitoring	\$850	Electrostatic precipitators, scrubbers, associated controls, etc.	\$50	\$25	\$75
		Sampling and analysis Instruments	\$50	\$70	\$120
		Odour controllers, etc.	\$20	\$20	\$40
		Other	\$20	\$20	\$40
		Plant and equipment	\$150	\$20	\$170
		Total products	\$290	\$155	\$445
Other	\$750	Noise monitoring equipment	\$10	\$10	\$20
		Ozone and environmental monitoring equipment	\$5	\$10	\$15
		Miscellaneous regulatory monitoring instrumentation	\$50	\$120	\$170
		Other	\$120	\$80	\$200
		Plant and equipment	\$185	\$50	\$235
		Total products	\$370	\$270	\$640
Category totals	\$6,100		\$3,350	\$1,005	\$4,355

Source: Doyletech Estimates, from Doyletech 1994

Canadian environmental services companies also have carved out special niches. They are recognized as world leaders in environmental reporting and services relating to land and resource management. The Canadian Environment Industry Strategy has several components that can promote partnerships within the North American Free Trade Agreement (NAFTA) for accessing the Latin American environmental market. One is the US Markets Environmental Investment Promotion Group. This is a program of Industry Canada, and the Department of Foreign Affairs and International Trade (DFAIT) to promote the partnering of Canadian and American firms for technology development and investment. Support is provided for workshops, special market studies and missions. In addition, the Industrial Cooperation Program of the Canadian International Development Agency has a program called Project Support for Environmental Technology Cooperation. This program aims to establish a more efficient transfer of Canadian technology to developing countries through cost-sharing the expenses associated with the adaptation of a Canadian company's technology to a local situation.

The global trend is away from end-of-pipe solutions and toward more sophisticated, cleaner technologies and waste reduction, and site remediation is a major market for environmental goods and services. Even so, Latin American markets still require expertise in basic services such as water and wastewater treatment and solid waste handling, areas in which Canadians are recognized leaders.

4.2 Mexico

Mexico's relatively well-developed regulatory framework, combined with competitive wage rates and cultural similarity create the proper conditions for success in Latin American environmental markets. The Mexican economic crisis, which began December 1994, has had a direct negative impact on Mexican companies engaged in the sale of environmental technology and services. Nevertheless, the few firms that have positioned themselves to export their know-how abroad have seen their business grow. A case in point is the Mexican construction firm, Bufete Industrial. This firm has aggressively diversified its business throughout the Americas, including in the US, where the company has recently secured work to modernize a wastewater treatment facility in Houston, Texas. Other Mexican construction firms with interests in undertaking environmental infrastructure projects, have followed suit. Examples include Grupo ICA and Grupo Tribasa, which are now both active in Chile.

The need for increased dollar-based earnings has also prompted many major Mexican manufacturing companies to expand their operations abroad, in turn providing Mexican environmental firms with the opportunity to provide consulting services to these companies. *Cementos Mexicanos (CEMEX)* is one such Mexican company. In recent years it has diversified its operations to Panama, Spain, and Venezuela. In the case of Venezuela, *CEMEX* recently announced that during 1996 it would be investing US\$9 million in pollution control equipment, including lead collectors, electrostatic air filters and air quality monitors.

Apart from the potential to service existing domestic companies as they expand their operations internationally, Mexican environmental service firms are uniquely positioned to take advantage of the growing environmental business opportunities emerging throughout Latin America. There are various reasons for this, including Mexico's:

- strategic position;
- competitive labour rates;
- relatively skilled professional workforce in the area of the environment, with a good track record working on environmental regulatory issues;
- Spanish-speaking workforce that is culturally sensitive to the nuances of doing business in Latin America;
- inclination to use the most appropriate technologies over the best available technologies; and
- natural inclination towards being the training ground for environmental professionals in Latin America.

American and Canadian firms may want to merge or develop alliances with Mexican firms as they move to do business in Central and Latin America.

Strategic Positioning

In the absence of a broader hemispheric trade agreement such as the one that was originally envisioned at the Miami "Summit of the Americas," Mexico is emerging as a logical nexus for trade throughout Latin America. After all, besides its membership in the NAFTA, Mexico also has:

- an existing free trade agreement with Colombia and Venezuela, known as the G3 accord;
- a bilateral agreement with Bolivia;
- a bilateral free trade agreement with Chile, enacted in 1992; and

- the framework for a future free trade agreement with the nations of Central America (Guatemala, Honduras, Costa Rica and Nicaragua).

Besides these existing trade accords, Mexico has begun negotiations with Chile to expand their trade agreement to include “trade in services,” thereby directly benefitting Mexican environmental consulting companies wishing to do business in Chile. Furthermore, due to the United States’ inability to initiate negotiations for the accession of Chile to the NAFTA, both Canada and Mexico are now in the process of their own talks with government trade officials in Santiago, with the expectation of a Canada-Mexico-Chile multilateral trade accord which would be modelled after the NAFTA.

In addition to the promise of more liberalized trade with Chile, Mexico has also been recently invited to initiate discussions with Brazil regarding possible membership in the South American Common Market (*MERCOSUR*). This would open Mexico to more expanded trade with Brazil, Argentina, Uruguay and Paraguay. Similarly, *MERCOSUR* countries are hoping that Mexico’s inclusion in their customs union would provide member countries with a convenient gateway into the US and Canadian markets.

Just as Brazil and Argentina are eyeing Mexico with a view to the North American market, so should American and Canadian environmental companies view their neighbour to the south: a strategic entry point into the markets of Latin America. This is particularly true given that the prospect that the NAFTA will be expanded beyond Mexico do not appear too bright in the immediate future.

Competitive Wage Rates and the Price of Goods

While Mexico’s economic crisis and the resulting devaluation of the peso has been difficult for most Mexicans businesses and consumers, it has made the country’s wage rates and produced goods among the most competitive in the world. As a result, Mexican exports rose over three percent during 1995 over the year before.

For Mexican producers of environmental technology such as air pollution monitoring equipment, air filters, etc., export sales have become very attractive.

As for Mexican environmental consulting firms, a growing number are increasingly looking for work abroad. The reason is simple. Beside the fact that current opportunities for work are scarce in Mexico, Mexican environmental professionals are now more competitively priced than their counterparts in other Latin American countries such as Chile, Colombia, and Argentina. Where an experienced Mexican environmental scientist with a masters degree and/or Ph.D. and 7 to 10 years experience earned just over US\$68,000 in 1994, that same individual earned only US \$31,000 in 1995. This erosion of wage rates can be seen across the board, from environmental technicians to business development managers and senior level company representatives. In contrast, the factor that often keeps American environmental firms out of the running on bids for environmental impact assessments and other studies are the high wage rates of American professionals. Mexican environmental consultants will have a distinct advantage over European, Canadian and American rivals, and possibly over the local Brazilian and Argentinean ones.

A Growing Environmental Industry

When President Ernesto Zedillo took office in December 1994, he set off a series of changes within the federal government that are still underway. Most important was the creation of the new *Secretaría del Medio Ambiente, Recursos Naturales y Pesca (Semarnap)* Secretariat of Environment, Natural Resources and Fisheries, a cabinet level entity that absorbed duties previously assigned to a variety of other secretariats and agencies. In doing so, Mexico has joined a small group of Latin American countries that have attempted to integrate environmental protection and natural resource management.

Zedillo’s legislative priorities in the area of the environment are many. First, a movement begun in 1993 to revamp Mexico’s environmental standards for industry continues and will likely be stepped up *Semarnap* and its agencies, including the *Instituto Nacional de Ecología (INE)*, National Institute of Ecology, the *Procuraduría Federal para la Protección del Ambiente (Profepa)* Office of the Attorney General for Environmental Protection, and the *Comisión Nacional del Agua (CNA)*, National Water Commission, gain momentum *INE* officials have said that they are exploring new ways to reduce overlap among older standards, as well as to incorporate economic incentives and cost-benefit evaluations into standards before industry is forced to comply.

Second, the institutional changes have set off a chain reaction whereby environmental officials and federal legislators alike have stated that sweeping reforms to the 1988 General Law for Ecological Equilibrium, and possibly some of its regulations, will be necessary.

As part of an overall federal strategy to assist micro-, small- and medium-sized enterprises *Semarnap* has recently issued simplification procedures that will allow some companies in certain situations to avoid having to conduct a complete environmental impact study. While they will, nevertheless, have to submit a detailed statement of activities and potential environmental impact, they will not be subjected to the often lengthy review and implementation process conducted by *NE*.

In other areas, *INE's* Industrial Sector Cooperation department has begun promoting voluntary emissions reduction agreements in an industry-by-industry approach. Although these efforts are just getting underway and present complicated coordination difficulties with *Profepa*, the general consensus is that such agreements would significantly relieve some of the federal government's current burdens.

Likewise, *Profepa* has been promoting a voluntary audit program whereby companies can conduct an independent audit with the aim of developing long term compliance schedules that would help avoid fines and plant closures.

Profepa has also begun investigating the possibility of combining its efforts with provisions outlined in the much discussed International Standards Organization (ISO)14000 environmental management standards currently under development in international fora.

Mexico's commitment to environmental protection is paying off in the establishment of a rapidly growing domestic environmental industry that includes consultants, environmental equipment manufacturers and suppliers, as well as companies dedicated the construction and financing of environmental infrastructure. Today Mexico even has *Consejo Nacional de Industriales Ecologista, A.C. (Conieco)* a National Chamber of Environmental Manufacturers. While the country's economic crisis has stymied the market for environmental goods and services in the near term, market observers are optimistic that growth in environmental technology and service sectors will continue at between 3 and 10 percent over the next few years.

According to the US Department of Commerce (USDOC), Mexico's market for environmental equipment and services is estimated at US\$208.7 million in 1996, up from US\$181.5 million in 1995.

Skilled Workforce with Relevant Experience

Apart from Mexico's competitive advantage in terms of wage rate, the country has a skilled pool of environmental professionals with extensive experience in dealing with environmental regulatory issues. Whereas Colombia, Chile, Argentina and Brazil have only recently enacted environmental legislation in the last year or two, Mexico's General Law for Ecological Equilibrium has been in force since 1988. Currently Mexican universities have nearly 600 degree and diploma programs offering a broad range of environment-related options for Mexican professionals. In addition, the significant experience of Mexican firms in petroleum sector environmental technologies will be uniquely marketable in Venezuela, Ecuador, Argentina and other oil-producing countries.

Mexican know-how in the petrochemical industry should also be marketable in the rest of Latin America.

Because Mexico is a developing country with many of the same socioeconomic and environmental pressures as its Latin American neighbours, much can be gained from the Mexican environmental experience. In many respects, the experience of Mexican professionals is far more applicable to government environmental officials in Bogota, Caracas and Buenos Aires than the experience of environmental professionals from industrialized countries like Canada and the United States. It is for this reason that a growing number of Mexican environmental consulting firms are beginning to secure work in Latin America and, in particular, Central America (Panama, Guatemala and Honduras). This is a point well worth remembering for any American or Canadian company considering expanding its business into Latin America.

A good example is the Mexico City-based company, Controlquímico-México, a wholly-owned subsidiary of Norvmann International of Canada. Recently, Controlquímico-México secured a US\$ million World Bank-sponsored contract to promote laboratory equipment, technical training and support to Venezuela's Ministry of Environment and Renewable Natural Resources (*MARNR*). The success of Controlquímico in securing its contract in Venezuela was largely attributed to its relevant environmental experience in Mexico, coupled with its ability to mobilize additional technical resources from its Canadian parent company.

Culturally Adaptive Workforce

While an American and Canadian environmental company may have the desired technology or expertise, this does not necessarily mean that that company will necessarily succeed in doing business in Latin America. After all, there is a long list of foreign companies, American and Canadian included, that have sought to break into Latin American markets, only to "pull up their stakes" to go home after a year or two.

One reason why some North American companies have not succeeded in Latin America is a failure of their staff to master Spanish or, as in the case of Brazil, Portuguese, and become culturally receptive to the “Latin” way. This is not a problem for Mexican companies, for in their country, the “Latin” way is a way of life.

Because of the cultural adaptability of Mexican companies to other countries throughout the hemisphere, Latin America has turned out to be one of the fastest-growing regions for direct foreign investment by Mexicans. American and Canadian companies may have an opportunity to ride on the coattails of these Mexican investors.

Experience with State-owned Companies (*Paraestatales*)

At present, *Petróleos Mexicanos (PEMEX)*, the national oil company, represents a significant opportunity for a full range of environmental technologies and services in Mexico. Besides having to deal with large-scale remediation efforts at some of its older refining facilities, *PEMEX* has also begun a nation-wide program of environmental audits and environmental management programs. A new wave of privatizations in Mexico, ranging from the sale of *PEMEX's* petrochemical facilities to the privatization of rail, port, and energy operations, has already stimulated a demand for a full range of environmental services to assist in evaluation and cleanup efforts related to the sales. Mexican environmental firms have remained dominant in securing this work.

Accordingly, Mexican environmental consulting firms are well positioned to take advantage of the growing opportunities for work of a similar nature with other oil companies in South America such as the Colombian National Oil Company (*ECOPETROL*) and the Venezuela Petroleum Company (*PDVSA*), both of which are in the process of some privatization. Similar opportunities exist for Mexican firms with other state-owned industries across Latin America that are in the process of privatization or are now under greater environmental scrutiny.

Addressing Transboundary Environmental Issues

As Latin American countries move toward regional economic integration, both through bilateral trade agreements as well as larger, regional agreements such as the South American Common Market (*MERCOSUR*), they have begun to reevaluate many of their laws and regulations. This has been especially true in policies related to environmental protection.

While cross-border disputes among Latin American nations have largely focussed on boundary and natural resources allocation issues, such as the Colombian-Venezuelan maritime boundary or Venezuelan-Guyana border dispute over land and oil, increasingly the focus of attention will shift to environmental issues of a transboundary nature. Given their experience in addressing such issues along the 2,900 km border Mexican-American border, Mexican environmental consulting firms are well positioned to advise companies and government entities in South America. Mexican firms have experience in the transboundary movement of hazardous waste, air deposition, cross-border waste management, and water quality and resource allocation management.

Appropriate Technologies

Often what is needed more than anything else in developing countries such as Mexico, is not the best available technology, but the most appropriate technology. American and Canadian companies may find that their technological solutions shunned for a lower-tech, lower-cost approach to the problem at hand. Mexican companies face greatly diminishing returns when they buy, for example, smokestack scrubbers that remove 99.5 percent of toxic effluent, when there are products available that can reduce toxic emissions by 97 percent at half the price. Right now Mexico's money is much better spent on technologies that are 5 to 10 years old, rather than on technology that is state-of-the-art. The same lesson holds true for other markets throughout Latin America.

There are numerous examples of appropriate technologies that have been successful in Mexico and hold similar promise in other Latin American markets. A case in point is the Mexican firm, Ingeniera y Medio Ambiente de Coahuila, which has been effectively marketing its constructed wetlands approach to wastewater treatment as an alternative to higher cost primary and secondary wastewater treatment systems.

Wastewater control is a good example of a market for appropriate, not necessarily best available, technology. According to the Border Environmental Cooperation Commission (BECC), the economic crisis produced by the devaluation of the peso in December 1994 has put the squeeze on the wastewater sector. Successful technologies will be those that have both a low capital and low operations and maintenance costs.

The vast majority of Mexico's wastewater treatment plants are designed with conventional primary technology. Over half consist of oxidation ponds, which are little more than a step above primary treatment. Secondary and tertiary treatment is the exception, not the rule.

Older factories have no treatment capacity; facilities built in the 1990s do. The standards set forth by the regulatory agency, however, are between 150 and 250 BOD compared to 20 or so in the US. For effluents being dumped into the Rio Grande, an international water body, a BOD of 30 was decreed. But with the recession, the agency has held off on rigid enforcement.

What the Mexican Government, and the North American Development Bank (NADBANK) and BECC, for that matter, seem to be promoting is a combination of primary treatment and water reuse for agricultural purposes. This provides badly-needed water for irrigation, and the municipality or industry has to build a less complex plant than if it chose to discharge into the Rio Grande. It is interesting that three of the four projects certified by the Border Economic Cooperation Commission involve water reuse.

The four projects range from conventional to advanced technologies. It is not clear whether these are representative of the types of projects to come in Mexico. What follows is a description of the technologies that are utilized.

<p>FINSA Industrial Park Wastewater Treatment Plant (US\$1 million)</p> <ul style="list-style-type: none"> • Biological oxidation of organic matter through an activated sludge and extended aeration processes • Secondary biological treatment • Ultraviolet light disinfection • Treated effluent used for irrigation • Sludge used as fertilizer • Discharge of 30 BOD
<p>Enseñada Wastewater Treatment Plant and Agricultural Reuse (US\$8 million)</p> <ul style="list-style-type: none"> • Primary sedimentation • Dual treatment trickling filters • Waste stabilization lagoons (anaerobic, facultative, and maturational) • Chlorination of final effluent for agricultural use • Discharge of 30 BOD • Aerobic sludge stabilization before disposal
<p>Naco Water Supply, Wastewater Collection and Treatment Project (US\$650,000)</p> <ul style="list-style-type: none"> • Waste oxidation lagoons (one anaerobic, two facultative) • Water used for agriculture
<p>Nogales Water Supply and Distribution Project (US\$39 million)</p> <ul style="list-style-type: none"> • Use of high-efficiency pumps • Sanitary recycling of wastewaters, by aquifer recharge • Rehabilitation and construction of aqueducts and pipelines

Outside of the realm of wastewater treatment, another success story in Mexico is the Monterrey-based company Utopia, S.A. de C.V. which has found a niche market recycling used motor oil into diesel fuel. Other Mexican companies have found opportunities recycling metals, glass and water.

Finally, in partnership with Atlanta-based Choice Environmental, Inc., the Mexican environmental firm of Grupo Arregui and the Mexican Tequila Manufacturing Association have teamed up to undertake a unique biomass/cogeneration project which integrates waste management, energy cogeneration and water treatment systems into one comprehensive plan.

With Mexico's ongoing economic crisis, companies throughout the country are looking to cut costs where ever possible. In Mexico, as in other Latin American countries, most companies have dated, inefficient and/or leaking water or energy systems. Accordingly, a few Mexico City-based environmental consulting companies have begun

marketing energy and water audits. The prospective energy saver faces a win-win opportunity when an auditor contracts to reduce the company's use of water or electricity. If the potential saving is estimated at 10 percent, then the auditor may contract to take 3 percent of that savings as payment, leaving the saver with 7 percent of "free" savings in the form of reduced consumption costs.

The above four examples are not the only opportunities that exist to introduce the most appropriate technology or expertise to the market. They are meant to be representative of the type of innovative business opportunities that are being carved out by Mexican environmental firms even in the midst of the country's tough recessionary times.

4.3 United States

Strategic Positioning

The United States is the largest exporter of environmental goods and services in the world. This, combined with its proximity to Mexico, and the presence in the country of a large Spanish speaking population makes it well positioned to serve the Latin American market. Under the North American Free Trade Agreement (NAFTA) the US has the potential for an increased presence in Mexico and for strategic alliances with Mexico that open other Latin American markets as well. Direct bilateral trade accords with other Latin American countries seem unlikely in the near future.

The US is increasingly aware that its global domination of the environmental goods and services (EGS) market has weakened in recent years in the face of numerous pressures. These include dynamic change within the domestic market, increased competition from other countries as they carve out specialized niches and conditions in importing countries that require approaches different from those developed for the domestic American market. Many of the external forces are described elsewhere in this report. The conditions internal to the US that affect its strategic position are outlined below. These conditions include the existing state of the EGS sector, the probable drivers of economic growth within the national EGS market, and recent trends.

Existing EGS Industry

The American goods and services (EGS) industry is the largest in the world, with 39 percent of the US\$200 billion global market in 1990. The following table summarizes the breakdown by the Organization for Economic Cooperation and Development (OECD) categories (excluding services): 32 percent of product sales were related to water and wastewater; 34 percent, waste management; 16 percent, air; and 18 percent, other (noise control, land reclamation, resource conservation, etc.) In addition, the EGS industry generated US\$48 billion in environmental services, 24 percent of the overall total. It is a diverse industry, with some very large, well-established, well-capitalized sectors, and many small, innovative companies. As a mature industry, some sectors are experiencing a decline in growth.

The American EGS industry is highly competitive in many sectors of the market, with countries such as Canada beginning to move into portions of it. The Office of Technology Assessment has noted in particular aggressive policies by Japan, Germany and the European Community that point to a need for a more integrated approach if American companies are to maintain their share of a growing market. Table 4-2 identifies the major international contractors in four OECD market sectors: sewer and solid waste, water, hazardous waste, and power. The international dominance of American companies in dealing with hazardous wastes is evident.

Table 4-2: Largest winners of international contracts in selected market sectors

Sewer/waste	Hazardous Waste
1. Bouygues (France)	Parsons Corp. (US)
2. Parsons Corp. (US)	Bechtel Group (US)
3. Mitsubishi Heavy Industries (Japan)	ABB Lummus Crest (US)
4. Bilfinger + Berger Bauaktieng — (Germany)	Bouygues (France)
5. Foster Wheeler (US)	Foster Sheeler (US)
6. NCC International (Sweden)	The Badger Co. (US)
7. Consolidated Contractors (Greece)	CEGELEC (France)
8. Kajima (Japan)	Jacobs Engineering Group (US)
9. Skanska International Civil Engineering (Sweden)	Bilfinger + Berger Bauaktieng. (Germany)
10. The Badger Co. (US)	Spie Batignolles (Italy)
Water	Power
1. DUMEZ (France)	CRSS (US)
2. Bechtel Group (US)	Mitsubishi Heavy Industries (Japan)
3. Fiatimpresit (Italy)	Spie Batignolles (Italy)
4. SGE Group (France)	Bechtel Group (US)
5. Impresit-Girola-Lodigiani IMPREGGIO (Italy)	DUMEZ (France)
6. Bouygues (France)	ABB SAE Sadeimi (Italy)
7. Hochtief (Germany)	Guy F. Atkinson (US)
8. Girola (Italy)	John Brown/Davy (UK)
9. GTM-Entrepose (France)	CEGELEC (France)
10. Morrison Knudsen (US)	Ansaldo (Italy)

Source: Engineering News Record, Aug. 24, 1992, p.37. From Office of Technology Assessment, 1994.

An overall review of the industry's strengths and weaknesses by the Office of Technology Assessment is summarized in Table 4-3.

Table 4-3: The American environmental industry — strengths, weaknesses, opportunities, threats

Strengths:	Weaknesses:
<ul style="list-style-type: none"> • Large domestic market supports US EGS development • Head start; toughest standards in many areas • High technical capability • Good reputation of EPA technical information abroad • Strong federal and university research and development (R&D) capacity • Many small innovative firms • American political, economic, technical, and cultural leadership 	<ul style="list-style-type: none"> • Large domestic market inhibits desire to export • Other nations often perceive American technology as too expensive or sophisticated • Spotty between public and private sector links in R&D, export promotion • Limited federal effort to certify or provide objective evaluation of technologies • Slow transfer of technology to the marketplace • Small firms have difficulty accessing capital, exploiting export opportunities • Limited effort to understand foreign cultures, languages, business practices • Limited role of industry associations in trade and R&D • Some regulatory measures impede environmental technology innovation
Opportunities	Threats:
<ul style="list-style-type: none"> • Growing American and foreign demand • Possibility of others adopting standard American practices • Development assistance can promote American exports • Internationalization of EGS business: <ul style="list-style-type: none"> – Acquisition of foreign firms(US gets profits) – Licensing abroad (royalties) – License from abroad (US jobs) • Opening of many countries to greater trade, foreign investment and privatization 	<ul style="list-style-type: none"> • Growing foreign environmental industry capacity, including penetration of the American market • Foreign standards higher in some cases • Possibility of others adopting foreign standards and practices • Other donors' use of tied aid credits keep American firms from winning some business • Internationalization of EGS business: <ul style="list-style-type: none"> – Acquisition by foreign firms (foreigners get profits) – Licensing abroad (jobs abroad) – License from abroad (royalty paid) • Strong foreign public/private cooperation in R&D, export promotion • Stronger foreign trade association role in trade promotion and R&D

Source: Office of Technology Assessment, 1993, From Office of Technology Assessment, 1994.

The specifics will vary from sector to sector. For example, the water and wastewater sector is highly fragmented with many different companies, each offering a different approach to water treatment. This has created

opportunities for niche markets. The advantage for importers is that there is more likely to be a solution suitable for their particular situation. The difficulty is in finding out about and sorting through a wide array of candidates.

Economic Drivers

The strength of the American EGS industry has been determined by relatively rigorous American environmental legislation and the size of the American market. Key legislative drivers have been the Superfund legislation and regulations, the Clean Air Act and amendments, and several pieces of clean water legislation.

The recent flattening of some parts of the domestic market, notably air pollution controls, is a reflection of the disappearing regulatory stimulus. Other sectors also affected are hazardous wastes and solid waste disposal. These trends could become more widespread across the domestic market, given the current agenda of the American Congress and the move away from a regulatory approach to environmental protection.

Workforce

The industry in the United States has been fully developed since the 1980s. It employs a highly skilled and experienced workforce. Recent declines in some sectors have resulted in bankruptcies and layoffs. Therefore conditions within the workforce may be highly competitive.

Its common border with Mexico and the presence in the southern US of a large Spanish-speaking population gives the US a potential advantage in pursuing markets in Latin America. The success of many individual companies in establishing productive business alliances in Mexico and Latin America is an indicator of both the desirability of Mexican and other Latin American partners, and the orientation of the players in the American environment industry towards the Latin American market.

Internet

The Internet originated in the US and is becoming a forum for interactions between providers and clients, predominantly in the American environmental technology industry. For example, the P2TECH mailing list on the Internet invites all those involved in providing technical assistance to industries for pollution prevention to share information and assist one another. The P2TECH mailing list was implemented by the National Roundtable of State Pollution Prevention Programs, with support from the Environmental Protection Agency's (EPA's) Pollution Prevention Information Exchange System (PIES), the National Institute of Standards and Technology's (NIST) Manufacturing Extension Partnership TECNET Program, Battelle Pacific Northwest Laboratories, and the Great Lakes Information Network (GLIN). In addition to its function as a problem-solving forum, the list will post information that "improve(s) the level of collaboration among subscribers such as: identifying significant new technical assistance resources, requests for proposals, or announcements of collaborative research or training projects." (To subscribe to the list, send an email message to: GLIN-majordomo@great-lakes.net)

Another major actor on "the net" is the Global Environmental Technology Enterprise (GETE) program of the Department of Energy, executed in the US by the Global Environment and Technology Foundation. This program is aimed at making American environmental technology, developed within the national laboratory system, more readily available to advance American commercial, academic and other government agency interests. GETE uses GNET, an electronic network, to disseminate its information on environmental, technological and related political and economic topics. This network is linked with the Internet, and is designed to help subscribers identify, commercialize and market environmental technologies. This project is part of the White House's Technology for a Sustainable Future Project.

Appropriate Technologies

The top environmental priorities in Latin American countries have been identified in Chapter 1 as:

- wastewater treatment;
- air pollution control;
- hazardous waste management;
- solid waste management;
- cleanup of industrial pollution associated with the oil industry, railroads and mining; and
- environmental capacity building within regulatory agencies.

In Chapter 1 we noted that 70 percent of the environmental goods and services (EGS) market is expected to be construction of municipal and industrial wastewater facilities, with another 21 percent in air pollution control and

nine percent for solid and hazardous waste management. Both Canada and the US have internationally recognized expertise in these areas. The challenge will be to adapt this expertise to the special cultural, economic and regulatory circumstances of each Latin America country. The technologies of special interest will be those suitable to situations characteristic of developing economies, for example:

- Money is available for installation, but operations and maintenance budgets are limited, as are trained personnel.
- High-tech solutions run counter to existing realities. For example, the large informal economy that is based on scavenging at dumps may be jeopardized by sanitary landfilling techniques.

One way to ensure that technologies are appropriate is to incorporate local input into design and implementation of a project. There are numerous examples of the opposite approach. North America has specialized in “turnkey” developments where the entire facility is installed and ready to operate at the turn of a key. In developing countries this sometimes results in facilities that are soon rendered inoperable because a few key components cannot be readily replaced. With experienced local input, these potential pitfalls can be minimized. Sometimes the resulting design may not achieve the same level of technical performance as a “state-of-the-art” design. But it may have a greater chance of being accepted, and therefore still in operation after 10 or 15 years.

Chapter 5 explores these and other non-technical aspects of appropriate technology in more detail.

Hudson Industries: Ultra-Fast Track to US/Mexico Alliance

Hudson Industries is a small Ohio-based company specializing in oil/water separation and oil skimming equipment. President Eric Kenney wanted to find a Mexican licensee to act as a launching pad for getting his products into Latin America. Five years ago, he had absolutely no experience in Mexico and was not considering the Latin American market, but the North American Free Trade Agreement (NAFTA) changed that. The State of Ohio has a very strong commercial department. Along with the US & Foreign Commercial Service, the State of Ohio identified several companies in Mexico as potential partners for Hudson Industries. One year ago, Kenney flew down to Monterrey and spent three days interviewing potential licensees. He visited twenty company facilities, using an interpreter arranged by the Foreign Commercial Service. His visit coincided with a trade fair, and he spent three days talking to everyone there. By the time he left Mexico after a one-week visit, Kenney had decided on his licensee, called a meeting, and told them he would draft an agreement. When he got home to Ohio, he sent a draft agreement out by courier. It all happened very quickly.

Hudson Industries developed a relationship with its licensee through faxes and phone calls. They sent down sales leads, and let the licensee cultivate potential clients. Apart from product customization, and the supply of major components by Hudson, the Mexican licensee is autonomous. Since the NAFTA was enacted, transfers of components from Ohio to Mexico have been duty-free. Hudson reserves the right to make inspections of the Mexican operation but the need has not arisen thus far. Despite the fast-track, long-distance approach to partnership employed by Hudson, the alliance has been remarkably successful. In the year since Eric Kenney flew to Mexico for the first time, Hudson’s Mexican licensee has made sales in Ecuador, Chile, Colombia and Peru.

4.4 Winning Technologies

Specific environmental technologies that have been successfully exported to Latin America from Canada, Mexico, and the US may be useful indicators for environmental business managers in evaluating their export prospects. Successfully exported technologies can be grouped into the categories of water and wastewater, solid waste management, air emissions control, remediation technologies, analytical services, information technologies, and general engineering and environmental consulting services. These groupings correspond to the opportunities for export that have been identified in Chapter 3. The target countries that were most frequently cited as the importers were Brazil (11), Chile (10), Argentina (9), Colombia (5), and Venezuela (4). The citation frequency of Brazil, Chile and Argentina are approximately the same. However, the lower values for Colombia and Venezuela may reflect the security risks associated with the former and the financial risks associated with the latter, at least up until the changes in Venezuelan monetary policy.

Table 4-4 shows 10 exported technologies and services is provided below. This is not in any way an exhaustive list of companies active in the Latin American market.

Table 4-4: Exported technologies and services

Product Category	Technology/Service	Company Name and Head Office Location	Active Latin American Market
water and wastewater	turnkey water and wastewater plants	ADI Group Inc., Fredericton, NB, Canada	Latin America
air emission control	high technology air filtration systems and water pollution systems mist eliminators	Air Purification Inc., Scotia, NY, USA Kimre, Miami, FL, USA	Brazil, Chile, Argentina Brazil, Chile, Venezuela
information technology	PC-based integrators for computer automation and process control.	Altersys, Longueuil, PQ, Canada	Brazil
solid waste, water and wastewater	sewer cleaning water jetting and vacuum combination trailers, trucks and knocked down units	Aquatech Inc., Streetsboro, OH, USA	Venezuela
engineering	full service engineering, especially vapour control systems and spill containment for railcar loading facilities	Babet Engineering Inc., Pasadena, TX, USA	Central and Latin America
energy services	distribution and utilization of natural gas, including energy efficiency and air pollution control	BC Gas International Inc. Vancouver, BC, Canada	Argentina, Brazil
solid waste	collection of solid waste, processing for recycling, transportation and disposal	Browning Ferris Industries Inc., Houston, TX, USA	Latin America
air emissions energy	air pollution control, energy production from biomass wastes and management of landfill gas at dumping sites	Biothermica International Inc., Montreal, PQ, Canada	Chile
air emissions waste	consulting services relating to air quality management, and waste management	Bovar Inc., Calgary, AB, Canada	Latin America
information technology	software for environmental monitoring and data management	Cadham Hayes Systems Inc. Ottawa, ON, Canada	Brazil

An extended series of companies and the technologies and services they provide is organized by target markets in Appendix G. These companies were profiled at the GLOBE 96 International Trade Fair and Conference, which focussed on developing the business of the environment. As a result, there is some bias towards businesses that are based in or near the Trade Fair's site in Vancouver, Canada. However, since a very large number of firms were profiled, this summary should provide a representative sample of successfully exported technologies.

5.0 Successful Market Access Strategies

Establishing a successful market presence in Latin America is a process demanding the investment of time, organizational resources and money. It entails a commitment and is more art than science.

However, there are certain strategic principles that can significantly enhance the chances for success. These can be grouped into the following areas: understanding the environmental marketplace and information gathering; and defining a strategy.

5.1 Understanding the Environmental Marketplace

A successful market presence is constructed on the foundation of a thorough understanding of the Latin American environmental marketplaces and their customers. A baseline effort should be made to build an understanding of the target marketplace, its dynamics, business culture, the major government and business players, the competition and the market niches that offer the best opportunities for profit. Such an understanding will lead to the critical success factors pertinent to the market, which then provide the appropriate grounding for comprehensive strategy formulation, and hence, effective market positioning.

Critical Success Factors

There are four general factors which are important for positioning a firm in Latin American environmental markets.

1. For North American companies to effectively operate in Latin American environmental markets, in-country presence is absolutely necessary. This may be attained by means of direct presence, or by local partnering. The latter is recommended for North American companies not used to conducting business in Latin America. A local partner will prove an extremely valuable added component, with knowledge of local practices, and strong local relationships.
2. Environmental firms in particular should be prepared to develop a complete package encompassing all aspects of the job, including: equipment supply, consulting services, and financing or financing feasibility. The current need for financing has enhanced the need for such complete business packages. European and Asian firms have mastered this approach and are strong competitors in most markets.
3. Mastering the forthcoming International Standards Organization (ISO) 14000 standards is becoming increasingly important in Latin America. Although ISO adherence is in the formative stages in Chile and Argentina, in Brazil the movement is well established. For environmental suppliers to Brazil, this is imperative, especially in the medium- and long-term. In Brazil, all multinational and local companies must be ISO certified to guarantee future exports to European customers. Unfortunately, the US has fallen behind in expertise in ISO standards. Nevertheless, North American environmental equipment and services companies should familiarize themselves with the standards before expecting to engage in operations in Latin America.
4. Promoting visits and exchanges can be a decisive source of competitive advantage. The underlying logic is that by participating in trips, Latin American companies will be exposed to the host company's products in a sustained and detailed way. This is currently being done by companies in Japan, France and Spain.

Information Gathering

Some of the best informal sources of information on environmental business opportunities are the following:

1. *Non-competitive expatriate business people*
Business people in other new markets, from banking to technology, are often outstanding sources of information. This is particularly true in complex areas, like profit remittance and the development of professional relationships.
2. *Creative local business people*
Local business people are also often outstanding sources of information. They are eager to prove that the country is a good place in which to do business, not the Latin America of old, but a modern, changing environment. They can provide very useful first hand-experience on regulation enforcement and compliance.
3. *Potential business partners*
This is the trickiest area, given that there is little built-in incentive for providing information beyond what is of most interest to these executives.

It is imperative to develop reliable information sources as soon as possible. This is normally done through firms that are accustomed to training foreign managers, by opening up solid contacts and sources of information for them.

There are also a number of traditional sources, the “usual sources”, that can be used to fill in gaps in market information. These sources include:

1. *North American Embassies and Consulates and Related Government Programs*

The US & Foreign Commercial Service periodically provides useful subsector analyses and project information with timetables for bidding and contact information. The Commercial Service is particularly well-established in Latin America, often with consulates in regional cities outside of the capital. This is also the case for Canada and Mexico (See Appendix B). In the United States, there is a host of federal and state agencies which offer programs to help American firms compete and win international environmental business. The Department of Commerce publishes a Guide to US Government Resources describing these programs. The Canadian Department of Foreign Affairs and International Trade (DFAIT) also publishes market summaries by sector and subsector for many countries in Latin America and the Caribbean. Currently, up to date summaries are available for Chile and Venezuela’s environment sectors. Industry Canada, Environment Canada, DFAIT, and the Canadian International Development Agency (CIDA) have a number of programs to facilitate exports of Canadian environmental goods and services and to promote technology transfer to developing countries. Information on these programs can be obtained from the Industry Canada Environmental Industries Directorate in Ottawa ,Tel.: 1-613-954-3382. In Canada call-800-267-8376 for the DFAIT InfoCentre).

2. *International Business Chambers*

These organizations offer opportunities to network with other Latin American and North American firms that have developed important knowledge of the local environmental market. American and Canadian Chambers of Commerce, for instance, offer frequent seminars or workshops on specific topics, publish newsletters and do a special report series on good cities for doing business, industry subsectors and the economy. They are excellent sources of information on specific companies and business opportunities.

3. *Local Associations*

Many Latin American countries organize industry along well-established chamber networks, representing specific sectors, e.g. construction, steel, petrochemical, etc. These chambers can provide an industry overview and will often make referrals to their member firms or have databases on industry members. The Argentinean Industrial Union (*UIA*) in Buenos Aires, for example, is among the largest of such organizations. Located in the industrial centre of Argentina, it has its hand on the pulse of heavy industry, including trends in the utilization of environmental technologies and new regulations.

A good example of another effective association in Latin America is the Tietê-Paraná Development Agency (*ADTP*). This São Paulo-based agency promotes the integration of major infrastructure projects, including municipal wastewater treatment facilities. *ADTP* promotes project opportunities in a five-state area of southern Brazil, as well as in the border regions of Paraguay and Bolivia.

4. *Local Private Consultants and Researchers*

Private providers of market information and industry contacts are an increasingly important source of information. In choosing private consultants or researchers, professional credentials and experience need to be carefully reviewed.

5. *Specialty Business Publications and Conferences*

There are an increasing number of specialty publications and conferences focussed on business issues in Latin America. These provide not only an overview of the business climate and an assessment of opportunities in specific sub-sectors, such as renewable energy, hazardous waste, wastewater, etc., but also a very solid opportunity for developing contacts.

6. *Participation in the Environmental Export Council and in the Hemispheric Environmental Business Committee*

The private and public sectors in Mexico, the US and Canada have supported the creation of business and business and government groups to foster environmental commerce within the nations of the Americas. The Environmental Export Council (EEC), Mexico’s National Chamber of Environmental Manufacturers (*Conieco*), Canada’s Environmental Industry Association, British Columbia’s Latin American Marketing Group, and the Hemispheric Environmental Business Council (HEBC), formerly the US/Mexico Environmental Business Committee, are two such organizations. Companies interested in exploring specific

geographies can join these groups and have an opportunity to network with counterparts in various countries and approach organizations which have a need for environmental services.

Project Partnering

Many international firms are partnering with local firms on a project basis, often with the implicit or explicit understanding that if the resulting project is successful a more permanent relationship might be established. Under this model, a firm might partner with local companyX on one project, companyX's competition on another project and with companyY on a third. Local partners are usually selected according to either regional strengths or strengths in a given market segment.

The advantage of this approach is that it avoids long term commitment while allowing the foreign firm to selectively partner based on the particular strength of a local partner for a particular project. If successful, a revenue stream can be established prior to having to make decisions involving major capital expenditures.

Many companies doing business overseas for the first time have learned the hard way that choosing a partner in a foreign country is probably the most important aspect of a business strategy. A poor decision will result in expenses, delays and lost business opportunities. To coordinate projects with distinct partners and to constantly have to build new relationships requires a large expenditure of effort. This strategy may also create the impression that a firm is indecisive and unreliable. Local partners are cautious about sharing information for fear that the foreign firm may use it to advantage in a competing venture.

Defining A Strategy

Developing a Team of Local Professionals

In addition to gathering information on the marketplace and opportunities, the foreign firm should seek to identify and bring into the team qualified professionals who are "wide band" in terms of their ability to perceive and communicate a range of relevant, high-value information. These executives will become a part of the firm's permanent team, and will largely determine strategy and tactics, success and failure.

These professionals should include not only lawyers, accountants, business consultants and financial advisors, but also those professionals who can act as informal advisors on a periodic basis. This latter group might consist of industry or government contacts that can be trusted to provide an independent perspective on questions strategic to the business and yet have no vested interest in the process. This approach is only feasible for large firms, but smaller firms may do well to identify local professionals for use as-required.

Culture

Cultural differences, both business and social, should be factored into every aspect of project management. It is important to remember that cultural rules and norms differ radically even within a region such as Latin America. Chilean business culture is different from that of Venezuela, for instance, and should not be blindly left to a company's "Latin American expert," unless he or she is knowledgeable of the cultural differences between countries.

Additionally, personal relationships are fundamental to successful business in all of Latin America. This is a well-worn truism throughout the region. Latin American businessmen perceive relationships as extremely important, while North American executives feel that Latin Americans overvalue relationships. This creates tension. Whereas the Latin American executive perceives relationships as currency built up over a lifetime, a North American executive tends to see "contacts" as business associates who should be made available in the normal course of business.

In a region where the rules of doing business — laws, regulations, government policy, and even constitutions — have changed frequently over the years, the personal relationship between two businessmen can be a more predictable, lasting, and dependable force.

Black Market, Graft and Corruption

"Unregulated" economies do exist in Latin America, but it is difficult to accurately gauge the magnitude of trade in illegally bartered or smuggled goods. This black market not only damages the local economies, but it is also counterproductive to the development of industry. Certainly, the black market is a significant concern for investors in Latin America and for exporters of consumer goods to the region. However, it is unlikely that significant black market sources exist for the environmental goods and services exported by North American suppliers.

Graft and corruption are also serious problems in the region. It is essential to learn to deal with the perils of corruption by recognizing it and responding to it appropriately. To be successful, the business person must differentiate between corruption, tips and fees for service. It is advisable to employ able personnel with intimate

knowledge of the local customs and practices who can assist in recognizing corruption when it arises, and provide advice on the most appropriate course of action. Any appearance of participation in corrupt activities can have far-reaching negative consequences and should be scrupulously avoided.

Spending Time in the Country

Executives who will play a supervisory role in establishing Latin American operations should spend as much time in the country as possible. Without such exposure, it is difficult for most executives to understand the fundamental transformation of the local economies or to appreciate the deep impact that cultural norms have on business practices and market opportunities. Spending time in the country also builds personal relationships.

Setting a Focus

Due in significant part to the large amount of resources needed to enter environmental markets overseas, foreign firms are often best served by focussing on market areas in which they are most competitive.

By focussing on a single project, fundamental experience and contacts are gained as the layers of the business and public policy communities are uncovered. As the deal is negotiated, one recognizes the key actors and their real importance.

In a sense, it is fundamental to set the initial focus on one project or one market subsector in a given country. This can be difficult since, given the vast environmental opportunities in Latin America, it is tempting to cast as wide a net as possible.

Strategy depends on good information, a capable organization and a confident sense of objectives.

Guard Reputation Carefully

The Latin American business community and government tend to be linked through friendships and family. As a result, reports of foreign firms' successes, failures or reputation spread quickly and often irreversibly. Thus, new market entrants must be cognizant of the intense scrutiny that they will receive during the market entry process. Inappropriate cultural behaviour, alliances with less than reputable local firms or individuals, or any hint of less than above-board dealings with government officials must be avoided.

On the other hand, a firm that manages the entry process well will establish a strong reputation and increase the number of opportunities available to it.

Credibility

Regardless of the reputation and size of the foreign firm in its home market, credibility will not be established until it has successfully completed work in a Latin American country. Latin Americans want evidence not only that the foreign firm has the ability to successfully manage projects or sales outside of the home market, but also in the unique context of their country. There is a pervasive sense that until a foreign firm has demonstrated this ability in a given Latin American country, it cannot be considered a serious player.

For firms interested in large environmental infrastructure projects, a priority of the market entry strategy should be to identify and participate in projects as quickly as possible. This is more than the obvious point that winning projects is good for business; it is that the establishment of a track record is critical to serious consideration for leadership in major projects in Latin America. A visiting executive is not real in the eyes of in-country executives until he or she has mastered the system.

Many companies fall into the trap of touting their track record in other Latin American markets. A word of caution must be given, since Brazilian or Argentinean firms, for instance, do not like to use their Latin American neighbours as models. Brazilian firms, as well as Brazilians in general, view their own experience as unique and separate from that of Latin America. The same holds true for many other Latin American countries.

Chile, on the other hand, has one of the most internationally-minded business communities in the region. This is due to Chile's extensive investments in other Latin American markets. It is well known that Chileans are accustomed to doing business in Argentina, while the reverse is not always true.

Case Study: Hatfield Consultants Ltd.:

Lessons Learned in Four Joint Ventures

Hatfield Consultants Ltd. is a 22-year-old medium-sized Canadian environmental consulting firm with gross revenues at or under \$10 million. Hatfield's capabilities range from full-scale environmental impact assessment and monitoring of industrial operations to fisheries evaluation and management, aquaculture site assessment, facility design and operation, and institutional and human resource development. Since 1980, Hatfield has established two joint venture companies in Chile, one in Indonesia and another in Thailand. Table 5-1 is a summary of Hatfield's joint ventures.

Table 5-1: Hatfield Consultants Ltd. — summary of joint ventures

	Chile — consulting	Chile — salmon production	Indonesia	Thailand
Time to first meeting with ultimate partner	1 year	0.5 years	1.5 years	2 years
Length of “courtship”	2 years	0.5 years	2.5 years	1 year
Year of joint venture incorporation	1982	1984	1990	1994
Silent vs. active partner	active	active	silent	active
Primary business of partner	engineering	food/mfg.	pharmaceuticals	engineering
Joint venture president or general management	partner	partner	Hatfield	partner
Government requirement for local ownership	yes	yes	yes: >=1%	yes: >50%
Shares owned by Hatfield Group	50%	25%	60%	49%
Hatfield Group considered “well represented”	yes	no	yes	yes
Joint venture still active in 1996	yes	no	yes	yes

Hatfield has learned a number of lessons in establishing and managing these joint ventures. A number of their success strategies are summarized below.

Seeking a partner. Keep your eyes open, since you may meet potential partners anywhere. Don’t rule anyone out at first, as conditions may change, or you could gain information that changes your selection criteria.

Expectations of your partner Your partner should have excellent local knowledge and contacts which they can use in marketing the new company. They should be able to facilitate dealings with the government through their knowledge of the local language, contacts and procedures.

Share structure Try to maintain a major position (close to 50 percent) within legal constraints. If you are short on cash, you may want your partner to increase their financial contribution, in which case they may raise their shareholdings. In order to demonstrate your commitment to a true partnership, local participation should be at least 25 percent to 30 percent.

Communications Hold quarterly board meetings face to face to facilitate communication and problem solving, and to ensure that all partners understand the status of the joint venture. Provide regular communication to the staff by e-mail, fax, phone and visits. Make sure staff stationed abroad do not feel isolated. They need support and positive reinforcement from the head office.

Staffing Do not send a hard-driving, aggressive individual to a developing country. The individuals sent should have experience in the chosen country, they should be flexible and open, and they should have loyalty to head office. Expatriate staff need to be culturally and socially sensitive, as they will be involved with local partners, staff and clients on a social as well as a professional basis.

Financial Management The joint venture is going to cost more than you originally budgeted. If the new company does not have access to a line of credit from inception, you may have to act as banker. Expect the unexpected, such as urgent requests for large cash transfers.

5.2 The NAFTA Context

As Chapter 4 clearly illustrates, each of North America’s trade partners possesses its own distinct strengths and weaknesses. In the case of American and Canadian companies, they may be more technologically advanced than their Mexican counterparts, but their “know-how” and “best available” technological solutions are either too expensive for the Latin American market or language and cultural barriers keep them from making a sale.

In light of the potential difficulties that American and Canadian companies may have in breaking into markets throughout Latin America, there are some very compelling reasons for establishing a strategic partnership or partial or full acquisition of a Mexican company.

First, a strategic partnership between an American or Canadian and a Mexican company, combines the most advanced environmental technological expertise with practical knowledge on how to do business in Latin America. Second, a team of this nature makes for more competitive pricing of either a good or service, since only the highest value-added components or services are ultimately sourced from the US or Canada. Third, partnering with a Mexican company could also translate into easier access and lower tariff rates for markets in Latin America such as Colombia, Venezuela, Chile, Bolivia, Brazil, Argentina, Paraguay, and Uruguay, countries which either have existing free trade agreements with Mexico or soon plan to.

Strategic Position for North American Environmental Goods and Services (EGS) Companies

The idea of strategic partnerships between an American or Canadian and Mexican companies is not new, although the trend towards the establishment of such alliances has been accelerated by the North American Free Trade Agreement (NAFTA). Some of the more notable strategic partnerships in the area of the environment include those of the Irvine, California-based construction firm Fluor Daniel with the Mexican construction firm ICA to pursue a variety of infrastructure projects, including wastewater treatment facilities in Mexico and the rest of Latin America. Another ICA strategic partnership has also been established with El Paso Natural Gas Company to pursue a variety of energy-related infrastructure projects, including natural gas pipelines and hydro-electric power plants, throughout Mexico, Central America and Latin America. At present, the two companies are partners in the Samalayuca II Power Plant, a 700,000 kW gas-fired power plant planned for the border state of Chihuahua. Another notable strategic partnership was initiated in the early 1990s by the Tennessee Valley Authority (TVA) and the Saltillo-based, *Ingeniería y Medio Ambiente de Coahuila (IMAC), S.A. de C.V.* Together the two institutions developed a constructed wetlands project for the Cementos Apasco-Orizaba plant in Orizaba, Veracruz. The project consisted of: 1) a "free-flow" shallow marsh; 2) a deep pond, planted with nymphaeae; and 3) a free surface flow shallow marsh to give secondary and tertiary treatment to primary treated sanitary effluent (about 36 cubic metres per day). Since the TVA/IMAC partnership, IMAC has been actively going it alone, undertaking a variety of constructed wetlands projects throughout the state of Coahuila, including major projects for General Motors de México and Harris Graphics.

In the area of hazardous waste remediation, the Canadian company ELI EcoLogic has teamed up with SAIC de México, S.A. de C.V., the Mexican subsidiary of US-based Science Applications International Corporation, to introduce its newly developed technology for the chemical reduction of polychlorinated biphenyls (PCBs) and other harmful hydrocarbons. This unique closed-loop mobile technology is viewed as a cost-effective alternative to the exportation of PCBs abroad for incineration. Already approved for use in Canada and Australia, and recently certified by the US Environmental Protection Agency (EPA), the EcoLogic Process is currently being reviewed by the *Instituto Nacional de Ecología (INE)*, National Institute of Ecology of Mexico for its applicability in Mexico. Financing is another area where strategic partnerships have emerged. Recently, Mexico's *Nacional Financiera (Nafin)*, National Development Bank, has partnered with Grupo ICA, *Petróleos Mexicanos (PEMEX)*, WMX Technologies and the Irvine, California-based Ventana Venture Capital Funds to establish the North American Environmental Fund (NAEF), a US\$50 million private-equity fund formed to promote the development of environmental industry in the US, Canada and Mexico. Major deals funded by NAEF to date, include a wastewater treatment facility operated by Mexico-based Grupo Fypasa and a capitalization of Reciclados de México, S.A. de C.V., a plastics recycling company.

On a smaller scale, SAIC has initiated a strategic alliance with the *Instituto Mexicano del Petróleo (IMP)*, Mexican Institute of Petroleum, to undertake environmental auditing work for Mexico's state-owned oil company, *PEMEX*. Similar alliances have also been undertaken by other North American environmental firms, such as Seattle-based Hart-Crowser and Battelle Pacific Northwest Laboratory to secure work with *PEMEX*.

Acquisitions

Acquisition of existing Mexican environmental companies has been another way in which American and Canadian companies have entered into the Mexican market, often buying instant name recognition, market share and an existing pool of able local employees. With a weakened peso and the current sluggishness in Mexico's domestic environmental business, this may be the preferred option for visionary American or Canadian companies looking

to make a strategic investment in a presently undervalued Mexican company for either long-term expansion in the Mexican environmental market or shorter-term opportunities in Chile, Venezuela, Argentina or Colombia. Since the passage of the North American Free Trade Agreement (NAFTA), there have been a number of such acquisitions in Mexico. Some of the more notable ones include:

- Houston-based Jones & Nuessli's US\$5 million acquisition of ABC Laboratorios, an environmental testing lab in Mexico City;
- Newport Beach, California-based Metalclad Corporation's purchase of Química Omega, as a springboard to undertake a hazardous waste disposal facility in San Luis Potosí;
- Canada-based Laidlaw Corporation's acquisition of Cd. Juárez' Química Olimpia to facilitate transboundary hazardous waste transport for the *maquiladora* industry;
- Sanifill Corporation's controlling interest of the Tijuana municipal landfill, formerly owned by King Kong, A.C. de C.V., and
- the purchase of a controlling interest in Acapulco's landfill from a locally based firm.

Another noteworthy acquisition was that by WMX Technologies Inc. of Monterrey-based *Residuos Industriales Multiquim, S.A. de C.V. (RIMSA)* the only existing operating hazardous waste treatment and disposal facility in Mexico.

Direct Investment

Apart from the direct acquisition of an existing Mexican company, American and Canadian companies seeking to export environmental products to the Mexican and Latin American markets, may want to give careful consideration to the establishment of *maquiladora* or "in-bond" manufacturing or assembly facility. To date, there are over 2,200 such plants located throughout Mexico, with the majority situated along the US-Mexico border.

With Mexico's most recent currency devaluation and the country's increased competitiveness vis-à-vis Asia and other Latin countries, over 250 American companies decided to establish *maquiladora* operations during the first six months of 1995. This is also why foreign multinational companies committed to investing over US\$6 billion in Mexico during 1996 alone.

Out of more than 2,200 *maquiladoras* currently in operation in Mexico, only eight are producing environment-related products. Of these, all were owned by American parent companies. None were from Canada, although Canadian *maquiladoras* producing other products now number fifteen.

Accordingly, if an American or a Canadian company is considering expanding its existing manufacturing operations for the fabrication of air filters, pollution monitoring equipment, etc., the time to invest in Mexico is now. Not only will American and Canadian companies considerably lower their operating expenses but, as noted earlier, they will also expand their market base into Latin America. Depending on the products manufactured, tariff rates for Mexican-produced goods exported to Chile, Colombia and Venezuela can be as low as zero.

5.3 Case Studies - Argentina

Alenco: Replicating Success in the Argentinean Industrial Wastewater Market

In the last four years, the American company, Alenco, has designed and implemented three industrial wastewater treatment projects in Argentina.

Typical of Alenco's efforts is its project at the Sancor yoghurt factory in the province of Córdoba. The US \$1.1 million Sancor project renovated existing treatment facilities and added a new treatment facility. The completed facilities now treat 180,000 US gallons of wastewater per day. Alenco modified the existing tankage to allow for additional pretreatment and sludge conditioning. For secondary treatment, Alenco designed and built an extended aeration system, the appropriateness of which had been indicated by a pilot study that tested the effluent quality. In addition to taking charge of the plant design, equipment procurement and construction supervision, Alenco has been contracted to operate the plant for 10 years, a first for an American company in Argentina. The project was not put out for competitive bidding. Alenco was able to win the contract essentially for two reasons. Firstly, Alenco had already completed an industrial plant project which boosted its reputation in the local market. Secondly, Alenco has a financing division that was able to finance the project, and provide capital, at roughly half the market rate in Argentina. In addition, Alenco secured equipment financing from the US Export-Import Bank. Through the subsidiaries of its parent firm, Alenco had the advantage of being able to offer a full

package of services to Sancor: implementation of feasibility and pilot studies, engineering design, and manufacturing of certain types of equipment, operations, and financing.

The legal structure providing for protection of the environment in Argentina is still rather lax by American standards. However, it is becoming stronger since the enactment of hazardous wastes laws at the federal and provincial level in the last four years. Sancor opted to begin immediately to improve its wastewater treatment system and became one of the first industries in Córdoba to comply with the provincial hazardous waste law. After four years of developing projects in Argentina, Alenco can now boast a string of successes in addition to Sancor. It recently designed and built a plant at the Arcor candy factory, also located in Córdoba. The project had a total cost of US\$4 million and provided a plant capacity of 3.8 million gallons of treated wastewater per day. Another, is a US\$2.5 million project for a Coca Cola plant located in the city of Buenos Aires. The project modified existing tankage and increased treatment capacity to 1.8 million gallons per day. As a multinational corporation, FEMSA, the Mexican-owned bottling company, had additional incentive to invest early in environmental improvements, so that it would not attract negative publicity in its highly visible location in the capital.

Tucumán: Rough Waters

One of the first provincial water utilities to be privatized, the Provincial Water and Sewage Agency of Tucumán (*DIPOS*), experienced a number of difficulties.

The provincial legislature approved the Privatization Act in May 1993. After two years, the concession was finally awarded to Aconquija, S.A., a consortium of Compagnie Générale des Eaux, a French water company; Benito Roggio e Hijos, an Argentinean construction company; and a local firm. Aconquija and the provincial government came to an agreement on labour. Of the 2,300 *DIPOS* employees, the new concessionaire will keep only 900. Aconquija signed the 30-year concession contract with the government in May 1995 after a series of objections submitted by the provincial courts.

A regulatory framework was approved early in the process, but the regulatory agency was not set up until after the bidding had begun. After awarding the concession, the Legislature still had not officially constituted the regulatory agency. The new agency was set up with a board of five directors and sufficient staff to fulfill its obligations. However, the regulatory agency will receive financial support, in part, through a fee paid by the concessionaire, a situation that could lead to a conflict of interest.

In addition, the privatization of *DIPOS* has been criticized by the public for carving out a concession area in the wealthiest areas of the province, like the capital and surrounding towns, and leaving the poorer rural areas to fend for themselves. Without the cross subsidies from the capital, rates in the rural areas have risen by 80 percent.

Chase Manhattan: Taking a Stake in Hazardous Waste Disposal

In an unusual move for a US-based financial institution, Chase Manhattan Bank has become directly involved in organizing an effort to build and operate two hazardous waste disposal facilities in Latin America. Based on the success of its model in Brazil, Chase has decided to essentially replicate the model in Argentina. The projects can serve as a model for privately-financed environmental infrastructure projects utilizing safe, proven technologies for disposal of hazardous waste.

The careful and thorough manner in which the two projects were organized, and their steady progress toward final licensing and startup, make the entire effort lesson in the right way to develop a hazardous waste project in a foreign country.

The Brazil Model

Chase mobilized a team consisting of technology partner Nortru, Inc., a Canada-based company with a facility in Detroit, which will be replicated in São Paulo; the Brazilian environmental consulting and engineering firm, Resicontrol; and Brazilian investors. After surveying all relevant technologies, Chase chose to work with Nortru, whose Detroit hazardous waste fuel-blending facility could be replicated in São Paulo to handle spent solvents and other liquid hazardous wastes. The São Paulo fuel-blending facility is located in the city of Sorocaba, approximately 100 kilometres west of the city of São Paulo, with good highway access to the heavy industrial concentrations in the state. The waste materials will be blended into a uniform fuel and shipped to a nearby cement kiln for burning. The fuel-blending facility will process 30,000 tons per year of liquid waste in Phase 1; final capacity is planned for 60,000 tons per year. This latter figure represents 40 percent of the total liquid waste fuel that metropolitan São Paulo is estimated to generate annually.

All equipment has been shipped to its final assembly point in Sorocaba, and the installation and operating permits from the São Paulo Environmental Protection Agency (*CETESB*) were granted last year — operations to begin in March or April of 1996.

Chase's financial share is a one-third equity interest in the project. The Brazilian National Development Bank (*BNDES*) will provide the bulk of the financing.

The Argentina Model

Chase is attempting to replicate its success in Brazil with a similar fuel-blending project in Argentina, by assembling a similar project team. Once again, Chase paired up with Nortru and a local cement company in a consortium called Recycomb. Chase is taking a 25 percent equity stake in the Recycomb project.

The site is located between the cities of Buenos Aires and Santa Fe, an area that is home to the bulk of Argentina's waste-producing industry. The US\$9 million project will blend high BTU wastes such as solvents and paint thinners to be used as fuel at a cement plant. Recycomb will truck the blended fuel to Loma Negra, Argentina's largest cement-maker, with over 50 percent of the market. Loma Negra will burn blended fuel in its two state-of-the-art cement kilns. It is also in the process of contacting other cement-makers. The project will process 30,000 tons per year of liquid of about 5,000 BTUs per pound. The project expects to take a significant share of the market of hazardous waste oil disposal. Although fees have not been fixed, Chase estimates that the current rates for incineration in Argentina are around \$1,000 per ton of waste. Operation should begin in the third quarter of 1996.

Among the correct steps and decisions that Chase took in these endeavours were the following:

1. Chase avoided a "not in my backyard" (NIMBY) battle. By choosing an industrial site that had been built to house an automobile parts manufacturer, but which suddenly became available, the actual incineration of the fuel will be at a cement kiln that is already in operation. For the fuel-blending process in both Argentina and Brazil, the consortium chose sites outside of the metropolitan area. This was particularly important in Argentina, where political controversies have arisen in recent years over proposals to site landfills and storage facilities in the suburbs of Buenos Aires.
2. Chase made a thorough survey of applicable technologies and chose the most appropriate one for the Brazilian and the Argentinean markets.
3. Chase drew on its extensive knowledge of the Brazilian and Argentinean markets and deepened it further by comprehensive market studies.
4. In Brazil, Chase made sure that *CETESB* was kept fully informed about the project and has worked cooperatively with the agency during the detailed licensing process. In Argentina, it worked closely with the federal *Secretaría de Recursos Naturales y Ambiente Humano* (*SRNAH*), Secretariat for Natural Resources and Human Environment, as well as the authorities at the provincial level, to secure permitting.

In startling contrast to many failed hazardous waste ventures promoted by North American environmental firms in Mexico and other Latin American countries, it appears that Chase and Nortu will succeed in Brazil and Argentina.

ACUBA: A Second Attempt

ACUBA is an association of leather tanneries in the Buenos Aires suburb of Lances that recognized the environmental problems that its industry is facing. A majority of its members are small- and medium-sized companies without the resources or the space to build individual plants to treat the chrome used in the tanning process. *ACUBA*'s chrome recovery project started in the 1970s and was hailed as an efficient model for the future: a collective solution. However, over a decade after groundbreaking, the plant was still unfinished, its technology was out of date, and its capacity underutilized.

What went wrong at *ACUBA*? Two fundamental problems plagued *ACUBA*: the Municipality of Lances provided no regulatory and enforcement pressure to give companies incentive to treat waste; and companies located far from the plant had to either invest in expensive pipe networks to connect to the plant or transport the waste in trucks. *ACUBA* has recently contracted a German firm to assess the obstacles faced in the past and present a plan for the rehabilitation and upgrading of the plant. The Association is confident that attitudes toward waste treatment have changed and that more companies will be likely to use the plant. For example, the *ELIPA* tannery association in nearby Avellaneda, has copied the *ACUBA* industry collective model.

5.4 Case Studies - Brazil

Ribeirão Preto:

Opening the Brazilian Municipal Wastewater Market

In May 1995, Ribeirão Preto awarded a 20-year concession for a new wastewater treatment system to a consortium composed of the Brazilian construction and municipal services firm, REK Construtora, and the American environmental engineering firm, CHM Hill. The concession contract was signed at the end of September 1995 with the project company formed by the consortium. Ribeirão Preto (population 455,000) is one of Brazil's wealthiest cities, with a GDP *per capita* of approximately US\$7,000. It is located 200 miles north northwest of the city of São Paulo. The local economy is centred around food processing and light industry.

Ribeirão Preto currently generates over 1.4 m³ per second of municipal wastewater, of which only three percent is treated. The concessionaires are planning to implement a system using primary sedimentation tanks followed by biological filtration and aeration lagoons. Secondary treatment will be provided by sedimentation tanks before the wastewater is discharged into the Pardo River.

The concession contract calls for the design, construction, financing and operation of one larger and two smaller wastewater treatment plants. The main station, called Ribeirão Preto, is planned to serve approximately 490,000 inhabitants in 2006 and 587,000 in 2016. Initial maximum capacity is estimated at 1.4 m³ per second (1,400 litres per second). The two smaller facilities, Palmeiras and Caiara will serve 23,000 inhabitants each in 2006 and 30,000 each in 2016. The concessionaires will also expand the collection network to cover virtually all of the population.

Total investment in the concession is estimated at US\$28 million. Construction costs are estimated at US\$23 million. Over the 20-year life of the concession, some US\$200 million in revenues could be generated. The bidding process for the wastewater concession in Ribeirão Preto opened on October 27, 1994, well before the federal Congress passed the Law of Concessions in February 1995. Hence, it was based entirely on Ribeirão Preto's own municipal concession law. The concession was awarded on the basis of least cost charged per m³ of treated wastewater, but the municipality divided the bidding process into two stages to be able to examine and approve technical proposals. After the bid was won in May 1995, the winning consortium spent the next four months arranging a sufficient level of financing to convince the city to formally execute the contract on September 28, 1995.

The case of Ribeirão Preto demonstrates the technical, political and administrative capacity of the individuals and organizations involved in the project. Nevertheless, the Brazilian experience with concessions is limited, and outside assistance will be useful in structuring future concessions and focussing on specific problems such as financing and guarantees.

Three consortia competed for the concession. The consortium, composed of CHM Hill and REK, offered to provide the service at the lowest cost and was consequently awarded the concession. Construtora Centro Oeste, another local construction company, and its partner withdrew from the competition after receiving advice that its price was not considered economically viable. Camargo Corrêa, one of Brazil's largest construction companies, and Multiservice, a Brazilian environmental engineering and operation firm, later claimed that their calculations had also generated a viable price, but the municipality awarded the contract to CHM Hill and REK.

Limeira

Limeira, a city with a population of 220,000 located 120 miles northwest of São Paulo, awarded a 30-year concession in June 1995 to a consortium composed of the French water giant Lyonnaise des Eaux and the well known Brazilian construction firm Odebrecht. The concession covers potable water supply and wastewater treatment. The consortium will expand the city's drinking water supply as well as complete a partially-built wastewater treatment facility and operate it for the balance of the concession term. It is expected that the consortium will invest about US\$100 million over the next five years to complete the capital works. The lesson here is that water operators with deep pockets are needed in these projects.

5.5 Case Study - Colombia

Santa Marta: A Cross-Cultural Team Takes the Field

An international consortium led by Ogden-Yorkshire recently won the privatization of Metroaguas, the municipal water and wastewater company of Santa Marta, Colombia. The consortium plans to improve and expand potable water and sewage service for the 700,000 inhabitants of this city on the Caribbean Coast.

The plan, to be implemented over a period of 6 to 10 years, consists of a short-term program to refurbish existing facilities and a three-phase project to increase potable water supply. Phase I will boost the drinking water supply by 500 litres per second. Currently, the city relies heavily on surface and well water. The consortium will construct new aqueducts from two small rivers, the Rio Guachaca and the Rio Piedras. It will also make improvement to the sewage network. Each of the three phases is estimated to require an investment on the order of US\$60 million.

In the short-term, the consortium will invest US\$2–3 million in maintaining the pumping stations, cutting water losses, improving billing methods and making other network repairs. To boost bill collection, the company will install micrometers with the goal of connecting 95 percent of users in this manner.

Ogden-Yorkshire assembled an international consortium putting together the strengths of companies from three continents. Each of the partners is an investor as well as provider of one of the key services in the project. ICA, one of Mexico's largest civil construction companies, provides construction management experience. Most of the aqueduct construction will be carried out by the Colombian firm Termotecnica, which also has an existing contract to maintain well-water supplies. Iberdrola of Spain has the important role of managing public relations, customer service and bill collection. And finally, Ogden-Yorkshire — a joint venture made up of Ogden Projects, the American waste energy firm, and Yorkshire, the British water operator — will take charge of network operations. Formed in May 1994, the joint venture takes advantage of the extensive operations experience of Yorkshire and the project development and service experience of Ogden.

5.6 Case Studies - Chile

Kimre:

A Small Business Breaks into the Equipment Market

A good example of a small business that is breaking into the environmental equipment market in Latin America is Florida-based Kimre. A small firm with sales of US\$5 million, Kimre produces pollution control equipment.

With the rapid growth of the mining industry and the tightening of particulate emissions standards, Chile was identified by Kimre as a promising market. After surveying the market, Kimre identified a local company, Fibra, to act as its representative. Although Fibra is a producer of fibreglass, its excellent knowledge of the local chemical industry, Kimre's target market, allowed it to identify opportunities. In developing its relationship with Fibra, Kimre executives made several trips to Chile to train Fibra in the performance of the Kimre product line. Fibra introduced Kimre to *ENAMI*, the state-owned smelting company, which was in need of improving its emissions control equipment. Beginning work in 1992, Kimre closed the sale of mist eliminators to *ENAMI* a year later.

Having established its market presence in Chile with a major industrial player, Kimre and Fibra successfully pursued the National Copper Corporation (*CODELCO*), Chile's largest mining company. By 1995 *CODELCO* was in the process of carrying out a US\$300 million plan to upgrade its sulphuric acid plants, which also required the replacement of air pollution control equipment. Later on that year, it sold a number of mist eliminators to *CODELCO* and to companies like Mitsubishi, which have won contracts to build new sulphuric acid plants for the copper conglomerate.

In addition to its Chilean efforts, Kimre successfully closed sales with the fertilizer subsidiary of the Brazilian company Manah, S.A., and with the Venezuelan steelmaker SIDOR.

Kimre was successful in developing relationships by concentrating on one market at a time. It also understood that in Latin America, closing a deal requires time and patience. Another factor in Kimre's success is its understanding of the cultural issues involved working in Latin America. With Miami-based sales and marketing unit that learned to speak and read Spanish, Kimre was well positioned to gather information about the markets in Latin America.

**ASL: Lessons Using Multinational
Clients as a Springboard to the Chilean Market**

Analytical Service Laboratories (ASL), a British Columbia-based environmental testing firm, used its experience with locally-established Canadian mining companies to break into the Chilean market. ASL, which provides testing services to a wide range of companies in Canada, decided to follow its clients into the Chilean market. While Chile's emissions standards are still not in place, the majority of Canadian mining companies have taken it upon themselves to voluntarily control emissions. However, many have found this difficult, due to the lack of modern laboratory testing facilities in Chile.

In April, 1996, ASL broke ground with a US\$1 million project to construct and operate an environmental testing laboratory in Antofagasta. The laboratory will allow clients to measure and control pollution by testing air, water and solids. Initially, many of ASL's clients will be multinational mining operations. As emissions standards are established, the need for environmental testing will increase among Chilean companies.

Having no real experience with Chilean market practices, ASL chose to partner with another Canadian firm with six years' experience in the country. Through this alignment, ASL was able to develop a marketing plan consistent with local conventions and obtain a rapid introduction to local customs. Thus, ASL avoided the need for a local Chilean partner.

In the medium term, ASL plans to expand beyond mining. ASL is specialized in testing pesticides and chemical residues, and wants to pursue opportunities in the agricultural sector. With a solid record in the pulp and paper industry at home, ASL wants to look into testing opportunities in this growing market as well.

6.0 Financing

6.1 Introduction

With most of Latin America's financial markets still feeling the effects of the Mexico economic crisis of December 1994, financing for environmental infrastructure projects, technology and services has become all the more challenging. This is true in spite of the efforts made by countries throughout the hemisphere to liberalize their economies, promote privatization and facilitate foreign investment during the past ten years. The result is that the region, as a whole, remains cash strapped.

Latin America's present liquidity problems, can not be blamed on Mexico alone. Still, Mexico's economic instability has made institutions considering investing in Latin America much more wary of the potential risks (political, regulatory and exchange rate) which could negatively affect the financial viability of any major infrastructure project such as a power plant or wastewater treatment facility. While this is so, the relative financial risk varies from country to country within the region. According to the 1995 World Competitiveness Report, Chile is ranked as the safest country to invest in throughout the region and ranked nineteenth worldwide. Venezuela, in turn, is considered the riskiest. The following is the ranking of relative financial risk by country along with information on changing exchange rates and interest rates during 1995.

Table 6-1: Ranking of relative financial risk

Country	Risk Ranking	Currency per US\$		Interest Rates short-term percentage per annum
		Latest	A year ago	
Chile	19	413	405	10.69
Colombia	30	994.5	925	30.8
Argentina	39	1.0	0.99	7.30
Brazil	45	0.96	0.85	40.40
Venezuela	46	265	170	45.01

Source: Economist (12/2/95), *América Economía*, Annual Edition 1995–1996

In spite of the inherent risks in each of the countries surveyed, a variety of environmental infrastructure projects across Latin America have successfully secured financing during 1995. Financing for these projects has come from a variety of sources including:

- export credit agencies
 - Canadian Export Development Corporation (EDC)
 - US Export-Import Bank (Eximbank)
 - US Overseas Private Investment Corporation (OPIC)
 - *Nacional Financiera (Nafin)*, Mexico's National Development Bank
 - *Banco Nacional de Comercio Exterior (Bancomext)*, Mexico's Foreign Trade Commission
- multilateral development banks
 - Inter-American Development Bank (IADB)
 - World Bank
- private sector financing
 - venture capital
 - commercial lending
 - private placements, etc.

Each of these financing sources have their own unique requirements which should be thoroughly evaluated before proceeding with any planned export sale or project financing.

6.2 Financing Issues

Knowing the Market

Whether one is considering the sale of air emissions control equipment to a company in Argentina or the financing of a wastewater treatment facility in Bogota, the question of affordability, in particular the ability to pay, becomes a key issue. After all, in most communities throughout Latin America *per capita* income is low. The income disparity between rich and poor is also great. For these reasons it is essential to know the market. What may be financially feasible in one community may be an economic disaster in another. The following is a summary of *per capita* incomes (1994) and a representation of the magnitude of skewed income distribution between the richest and poorest classes across the countries surveyed.

Table 6-2: Summary of *per capita* incomes

Country	Per capita income (US\$)	How many times the income of the richest 20 percent exceeds the income of the poorest 20 percent, 1981-1992 average
Argentina	\$8,197.8	N/A
Brazil	\$3,336.7	32.1
Colombia	\$1,686.2	15.5
Chile	\$3,730.2	17.0
Venezuela	\$2,619.6	10.3

Source: UN Human Development Report, 1995; Inter-American Development Bank

Due to low household incomes throughout the region, the ability to cover debt service payments through user fees can become problematic especially if project financing was, for example, secured prior to a major currency devaluation and heightened inflation. In Mexico this is precisely the problem that many recently financed wastewater treatment concessions ran into.

Accordingly, a key consideration in undertaking any project in Latin America is determining a degree of certainty regarding cash flow. Questions worth asking include: Are there buyers for the service provided by the infrastructure? If so, at what price? What is a buyer's threshold for covering debt service payments in the event of inflation?

Before considering exporting environmental goods and services to Latin America or financing an environmental infrastructure project there, a thorough country risk analysis is essential to minimize potential financial losses which can unexpectedly arise. Such an analysis should include a review of both political and financial risks likely to be faced for each country in question, including transfer, sovereign and exchange risks.

With the increased risk associated with financing projects in Latin America or exporting to the region, it pays to do your homework. The following is a summary of risks one is likely to confront.

Political Risk

Regardless of the country where one is doing business, a certain degree of political risk is inevitable. Nowhere is this more true than in Latin America. During the past year, companies doing business in the region have been affected by a host of political risks. In Colombia, political unrest has been brought about by allegations that President Ernesto Samper's election campaign had illegally benefited from contributions by the Cali drug cartel. This scandal has led to a number of high profile resignations among Samper's cabinet. The net result has been that government decision-making has grown to a virtual stand-still as federal agencies, including the Colombian Environmental Ministry (*Minambiente*), wait to see the fate of the present administration.

In Argentina, plans for the highly touted US\$4 billion Corpus hydro-electric plant on the Argentinean-Paraguayan border came to a grinding halt after residents of the Misiones province voted "no" to its construction. For investors

in the project, the decision came as a surprise, particularly given the fact that both President Carlos Menem and Paraguayan President Juan Carlos Wasmosy has signed a bilateral accord to go forward with the project. Besides the examples mentioned, other likely political risks for environmental technology and service companies include the possibility of a host country expropriating or confiscating property or a concession previously owned by a foreign company; project slow-downs; acts of terrorism; and change of direction by administration fiat.

Transfer Risk

Transfer risk involves the possibility that the borrower or buyer of your goods or services may not be able to convert domestic currency into foreign currency. Venezuela is a case in point. During the early 1990s, Venezuela was perceived as one of the most promising emerging economies in Latin America due to its economic reforms and efforts to privatize state-owned industries. Then in June 1994, as a result growing economic and political pressures, the Venezuelan Government imposed exchange rate controls making it difficult for foreign companies engaged in business in the country to repatriate their profits. Similarly, these same controls made it virtually impossible for Venezuelan companies which procured equipment overseas to repay the bank that had provided them with financing based on American dollar. These controls have only recently been lifted.

Sovereign Risk

Sovereign risk involves loans to governments, government entities, or non governmental entities under government guarantee for which there is no credit risk, but there may be an inability or unwillingness to serve a debt to foreign creditors or goods and service suppliers on the part of the government. Latin America's economic crisis of the 1970s is a stark reminder of the potential for sovereign risk as countries such as Bolivia ended up re-negotiating repayment of their debt obligations at \$0.17 on the American dollar.

Exchange Rate Risk

Exchange rate risk involves the change in a home country's currency relative to the currency of another. Regardless of where one decides to do business in Latin America, no business is immune from this risk, particularly in countries such as Venezuela and Colombia, where political and economic risks are greater.

Regulatory Risk

In an industry whose market is often predicated on the strength of environmental regulations and their degree of enforcement, North American environmental technology and service firms must be particularly cognizant of the inherent regulatory risks associated with doing business in any country, even their own. This is particularly true in Latin America, where environmental regulations and their enforcement are still in their infancy. In Chile, for example, a new environmental law has been recently enacted but specific norms and standards for its application have yet to be approved by the Chilean Congress. Hence, there are few incentives for most companies to comply with the law. The same is true in Venezuela, which is known for its stringent Criminal Environmental Law, a law that is tough in principle, yet because of limited resources for enforcement, is rarely applied. The lesson here is to pay close attention to the evolving nature of environmental regulation and the ultimate success in its application throughout the region.

Investment Risk

Whenever a company engages in the establishment of a joint venture or assumes an ownership interest in a local company overseas, there will always be a certain degree of investment risk (See Chapter 5). Clearly, a country may be economically and politically sound, yet the government may decide to nationalize all foreign ownership of its locally operated facilities thereby putting one's concession in jeopardy. Similarly, a company may appear financially solid, but changing political conditions or a shift in exchange rates could turn what appeared to be a wise investment decision into a serious financial liability. For environmental infrastructure projects, investment risk also includes the coverage ratio needs, the lack of power of many municipal authorities and, in general, the lack of guarantees provided by executing agencies.

6.3 Financing Alternatives

Regardless of whether a company plans to export environmental goods and services or invest in an environmental infrastructure project, it pays to develop a solid financing strategy. After all, as unique as your environmental technology or service may be in the target market, more often than not, closing the deal will be predicated on the type of available financing you bring to the table. With the present high rate of interest in many Latin American countries, the ability to bring foreign-based financing becomes critical.

Government-sponsored financing vehicles may range from loan guarantees (such as those provided by the Canadian Export Development Corporation or the US Export-Import Bank) to direct seed grants for project

evaluation such as those provided by the US Trade Development Agency (USTDA) and the US Agency for International Development (USAID).

It is important to emphasize that for most government-sponsored environmental services contracts or for capital projects in Latin America, the financial package will be as important as the technical proposal, if not more so.

Export Credit Agencies

Typical types of financing arranged by export credit agencies in the US, Canada and Mexico include loan guarantees, issuance of insurance against political or exchange rate risk, as well as short- and medium-term loans to facilitate the sale of environmental goods and services. One such example can be found in Argentina where Sancor, a Córdoba-based dairy co-op, secured medium term loan financing for a wastewater treatment plant at its yogurt factory through the US Export-Import Bank (Eximbank).

Multilateral Development Banks

Across Latin America there are numerous examples of World Bank and Inter-American Development Bank (IADB) supported projects. In almost all cases, financing from these institutions is in the form of medium- to long-term loans, with the host country providing an equity contribution of up to 50 percent of total project cost. It is important to emphasize that the average length of time to process an application for financing for either the World Bank or IADB is 500 days.

The following are just a few of the projects that secured financing during 1995 in each of the countries surveyed:

- Argentina: Rio Reconquista Sanitation and Flood Control Project (Total Financing: US\$280 million; IADB loan: US\$150 million; Japanese Government: US\$80 million; Buenos Aires province: US\$50 million)
- Brazil: Belo Horizonte Metropolitan Area Sanitation Program (Total Financing: US\$307 million; World Bank: US\$152 million; municipality: US\$145 million; other: US\$10 million)
- Chile: San Jose Watershed Management Program (IADB: US\$25 million)
- Colombia: Santa Fe de Bogota-I water supply and Wastewater Treatment Rehabilitation Program, Bogota (World Bank: US\$200 million)
- Venezuela: Lake Valencia Cleanup project in Venezuela (Total financing: US\$125 million; IADB loan: US\$50 million)

Private Sector Financing

Outside of lending from the multilateral development banks and guarantees provided through export credit agencies, sources of private sector financing (e.g. commercial lending) and risk capital have become more difficult to find. However, a few selected projects have been successfully financed during 1995. One such example is Acron, a Córdoba, Argentina-based chocolate manufacturer that secured a US\$4 million loan from US-based Citibank for its 4 million-gallon per day wastewater treatment facility. In this case, financing was secured directly from the end user. This is more the exception than the rule, however.

More often than not, it is municipalities and not private corporations that are seeking financing for major environmental infrastructure projects such as wastewater treatment facilities. While a good number of these projects do, in fact, secure financing from multilateral development banks, other communities, particularly in Chile, are increasingly seeking out private sector concessionaires to build, operate and eventually transfer these facilities to the municipalities after the expiration of the concession period. Examples of build-operate-transfer (BOT) wastewater treatment projects in Latin America include: the planned US\$520 million Santiago wastewater program; US\$40 million Temuco Wastewater Treatment Plant (Chile); water privatization projects in Buenos Aires; and the US\$20 million Cuernavaca wastewater treatment facility in Mexico. See Appendix B for a review of BOT financing alternatives.

In the area of venture capital, US-based Texas-Pacific Corporation is launching a venture fund dedicated to financing environmental infrastructure projects in Latin America. Texas-Pacific's initial focus will be on the Brazilian and Argentinean marketplaces. Similarly, Irvine, California-based Ventana Global Ltd. has established the North American Environmental Fund (NAEF) in cooperation with Mexico's National Development Bank (*Nafin*), to provide equity infusions in selected environmental projects in North America. Already, several projects in Mexico have been financed through the NAEF, including a wastewater treatment company with 40 percent of its concessions in Mexico, a solar collection company and others. Ventana intends to expand NAEF's focus beyond the continent through two newly created entities: Grupo CIMA (Capital Investment Management Advisors), which

serves as Ventana's merchant banking unit; and Ventana's Inter-American Fund, which aims at targetting emerging sectors in Latin America.

Other venture firms eyeing investment possibilities in Latin America include: Abbott Capital Management, Advent International, Gemini Capital Fund, and Alex Brown & Sons. These firms are focusing their attention on securing equity positions in some of the larger family owned corporations across the region. To the extent that these companies follow the lead of Mexico's leading corporations, such as CYDSA and ICA, to expand into the environmental services/technology market there could be increased equity capital investments in the area of the environment.

6.4 Financing Sources

The following is a summary of relevant governmental agencies from Canada, the US and Mexico that provide export finance assistance.

Export Financing— United States

US Export-Import Bank (Eximbank)

Eximbank provides financing assistance for US exports of capital equipment and services that are normally financed on a term of more than one year. Eximbank offers financing in the form of:

- direct loans to a public or private buyer abroad;
- loans to a financial intermediary, who then makes a loan to the international buyer; or
- guarantees of a private credit to a foreign buyer.

Eximbank also offers special financing for small American-owned environmental businesses for products and services designed to control pollution or protect against toxic substances.

Eligibility:

For direct or intermediary loans, there must be evidence of foreign, officially-supported export credit competition although this may not be necessary if the industry is known to be competitive. This is not required for loans of less than US \$2.5 million where the term is less than seven years for a sale of products produced by small business. The applicant must submit the best information available regarding the existence of foreign, officially-supported competition, preferably including the name of the foreign suppliers and the terms and interest rates they are offering. When the specific identity of the foreign competitor or its financing offer is not known, other means of indirectly establishing subsidized official export credit competition will be pursued by Eximbank.

Terms and Coverage:

Terms and coverage of Eximbank-sponsored loan guarantees vary from program to program. For example, Eximbank's small business environmental program offers 100 percent political risk protection; 95 percent commercial risk protection; interest covered up to the prime rate minus 0.5 percent, and a maximum term of 180 days (360 days for bulk agricultural commodities, consumer durables and capital equipment). For specific terms and coverage, check with Eximbank.

Contact:

US Export-Import Bank

811 Vermont Avenue, NW

Washington, DC 20571

USA

Tel.: (202) 566-8187

Fax: (202) 566-7524

Overseas Private Investment Corporation (OPIC)

OPIC's Lease Financing

This program offers financing assistance to foreign leasing companies in which there is a significant American private business interest. The funds are used to encourage American exports of productive equipment for projects that contribute to the host country's development.

Eligibility:

The borrowing company or American sponsor must be an established leasing company with a history of successful leasing operations. Companies must demonstrate the capability to proceed with the proposed leasing plan. Leases should be made to private sector companies on a medium-or long-term basis. In some cases, OPIC will also consider financing the equipment costs of a single cross-border lease.

Terms:

Terms of the guarantees are typically from 4 to 7 years, with appropriate grace periods before principal repayment begins. American dollar loans are provided by an American lender under an OPIC guarantee which covers 100 percent of all lender risk. The loan can carry a fixed or a floating rate geared to US Treasury obligations. The borrower also pays an annual guarantee fee to OPIC in the range of 1.5 to 3 percent. OPIC lends up to US \$6 million per project at a fixed rate priced at prevailing American government agency rates of comparable maturity.

Security for the loans may include first liens on the assets financed and/or other collateral or pledges as required to adequately secure OPIC's financing.

Contact:

Overseas Private Investment Corporation

1615 M Street, N.W.
Washington, DC 20527
USA
Tel.: (202) 457-7180
Fax: (202) 223-3824

Export Financing— Canada

Export Development Corporation (EDC)

EDC is a customer-driven, financial services corporation dedicated to helping Canadian business. EDC provides insurance and financing to Canadian exporters and their customers. The EDC has been in service since 1944, providing export financing in over 120 countries. Apart from its work with large-scale exporters, EDC has a dedicated program for "emerging exporters", with sales of less than C\$ 1 million. EDC shoulders the commercial and political risk associated with repayment. It also provides visible, documented support appropriate to the stage of development of the commercial transaction and corresponding to the level of detail available on the transaction and the credit. In addition, EDC has extensive international export financing experience, and both government and business contacts that they will share with exporters. EDC can connect a buyer with worldwide capital markets and structure a tailor-made financing solution.

To obtain EDC support, typical requirements are a draft of the commercial document; three years' audited financial statements from both buyer (if possible) and seller; and a completed Canadian Benefits Policy, or a simplified declaration if the contract value is less than C\$ 5 million. Other documents may be required depending on the size and nature of the transaction.

EDC offers direct buyer loans; leasing in a capital lease financing transaction; lines of credit and protocols; note purchases whereby EDC buys promissory notes issued by foreign buyers; pre-shipment financing for exporters; and project financing, which is increasingly being applied to infrastructure development. Interest rates are competitive fixed or floating. Standard fees associated with financing are payable by the borrower, except in the case of note purchases. Repayment is matched to the specific transaction, and financing can be arranged in most convertible currencies. In most cases, EDC disburses directly to the Canadian exporter's bank on a non-recourse basis, so the money never leaves Canada. Risk of nonpayment of the loan is typically reflected in the financing fee.

Contact:

Export Development Corporation

151 O'Connor Street, P.O. Box 655
Ottawa, Ontario K1P 5T9
Canada
Tel.: (613) 598-2500
Fax: (613) 237-2690

Canadian Commercial Corporation

The Canadian Commercial Corporation (CCC) offers exporters a wide range of services designed to help them conclude sales, particularly with foreign governments and international agencies. CCC's participation assures contract performance to a foreign customer, enhancing the Canadian exporter's chances of securing a contract on advantageous terms. The CCC acts as a prime contractor and guarantor for sales by Canadian exporters to foreign governments, international organizations and private sector buyers. The CCC's new Progress Payment Programme works in conjunction with eight major Canadian banks to extend credit up to C\$ 2 million per company for Canadian firms with sales of under C\$ 50 million.

Contact:

Canadian Commercial Corporation

1100 — 50 O'Connor St.
Ottawa, Ontario K1A 0S6
Canada

Tel.: (613) 996-0034

Fax: (613) 995-2121

Website — <http://www.ccc.ca/>

Business Development Bank of Canada

The Business Development Bank of Canada, formerly the Federal Business Development Bank, was established to provide financial assistance, management counselling, management training, information and advice to small- and medium-sized enterprises. The Bank acts as a complementary lender, providing loans, equity financing, and, through its Venture Capital Division, equity capital.

Contact:

Business Development Bank of Canada

Website — <http://www.bdc.ca/>

Office for Liaison with International Financial Institutions

The Office for Liaison with International Financial Institutions (OLIFI) is headquartered at the Canadian Embassy in Washington, DC. OLIFI helps Canadians access business opportunities funded by the World Bank and Inter-American Development Bank. The first point of contact for Canadian companies interested in such projects is the local International Trade Centre.

Contact:

Office for Liaison with International Financial Institutions

Canadian Embassy
501 Pennsylvania Ave. NW
Washington, DC 2001
USA

Tel.: (202) 682-1740

Fax: (202) 682-7726

Website — <http://www.cdnemb-washdc.org/>

Canadian International Development Agency

The Industrial Cooperation Programme of the Canadian International Development Agency (CIDA/INC) was established to promote sustainable development in emerging economies in cooperation with Canada's private sector. CIDA/INC's objectives are to build capacity in developing countries, encourage mutually-beneficial transfers of Canadian technologies and services, promote Canadian investment, encourage the efforts of Canadian companies to enter emerging markets, assist Canadians in accessing non-Canadian sources of funding and assist Canadian efforts to increase the benefits of their programmes in key sectors.

Eligibility:

- a) The company must demonstrate that their project will have sustainable economic, social and industrial benefits in the target country.
- b) The company must be liable to pay corporation tax.
- c) The firm must have been in business for at least two years, and annual sales must be over \$100,000.

CIDA/INC provides support for the following activities:

- viability studies;
- project supports, i.e. technology transfer costs that would not be applicable if the projects were implemented in Canada;
- capital project preliminary study (CPPS) at the prefeasibility phase of the project;
- capital project detailed study (CPDS), at the feasibility phase of the project;
- capital project support;
- business revitalization support; and
- planning and industrial development support.

Contact:**Canadian International Development Agency**

Enquiries and Service to the Public Unit

Communications Branch

200 Promenade du Portage

Hull, Quebec K1A 0G4

Tel.: (819) 997-5006

Fax: (819) 953-6088

Website — <http://www.acdi-cida.gc.ca>

BC Trade Development Corporation

The BC Trade Development Corporation's Export Loan Guarantee Programme provides loan guarantees for the working capital that BC companies require for export development. The programme is designed to encourage financial institutions to be more responsive to loan request from exporters. BC Trade may guarantee up to 85 percent of a loan, to a maximum of C\$ 2.5 million per firm.

Export Guaranteed Loans can be used in financing:

- raw materials;
- labour and benefits;
- work in progress;
- finished goods inventories;
- shipping costs;
- engineering, planning for the export order;
- letters of credit in support of bid bond or performance guarantees;
- project-related overhead costs; and
- purchase of made-in-BC finished goods to be used for export.

Contact:**BC Trade Development Corporation**

730 — 999 Canada Place

Vancouver, BC V6C 3E1

Canada

Tel.: (604) 844-1909

Fax: (604) 660-3917

Government of Ontario

The Government of Ontario's Export Support Loans provide up to a \$ 1 million revolving line of credit. Ontario-based small manufacturers or exporters experiencing working capital financing problems are eligible for this programme. For further details contact, Tel.: (416) 326-1070.

Export Financing— Mexico***Banco Nacional de Comercio Exterior (Bancomext)***

Bancomext is the federal financial institution responsible for channelling credit, guarantees and promotional services to support the needs of the importing and exporting community throughout Mexico. Founded in 1937, the Bank performs its credit operations mainly through the banking system's infrastructure and other financial intermediaries such as leasing and factoring companies and credit unions.

Bancomext offers the following services:

- short-, medium- and long-term loans for exports, imports and import substitution of non-oil goods and services;
- short-, medium- and long-term export guarantees;
- information, training and advice in financial, trade and legal matters to facilitate trade and foreign investment; and
- promotion of foreign investment in Mexico by facilitating the establishment of strategic alliances between American, Canadian and Mexican companies.

The services are offered to:

- Mexican public- and private-sector companies to support exports and imports of non-oil goods and services; and
- Mexican trading companies, producers' associations and suppliers of raw materials.

In Mexico, *Bancomext* is open to exporters and importers through its main branch and 40 regional offices. Abroad, *Bancomext* has a network of 28 representative offices in 20 countries identified as strategic markets for Mexico including: Argentina, Brazil, Chile, and Venezuela. Within the region *Bancomext* is working to promote joint ventures between Mexican corporations and companies in target markets.

Contact:

Centro Bancomext Ciudad de México

Periferico Sur No. 4333,
Col. Jardines en la Montaña
14210 México, D.F.
México
Tel.: (525) 227-9200

Table 6-3: Bancomext's representative offices

Atlanta

Bancomext

229 Peachtree St. N.E. Suite 917,
Cain Tower
Atlanta, GA 30303
USA
Tel.: (404) 522-5373
Fax: (404) 681-3361

Los Angeles

Bancomext

350 South Figueroa St.
World Trade Center, Suite 296
Los Angeles CA 90071
USA
Tel.: (213) 628-1220
Fax: (213) 628-8466

San Antonio

Bancomext

1100 N.W. Loop 410
Suite 40
San Antonio, TX 7821
USA
Tel.: (210) 525-9748
Fax: (210) 525-8355

Vancouver

Bancomext

Granville Street, 1365-200
Vancouver BC V6C 1S4
Canada
Tel.: (604) 682-3648
Fax: (604) 682-1355

Chicago

Bancomext

225 N. Michigan Ave., Ste 708
Chicago, IL 60601
USA
Tel.: (312) 856-0316/18/19
Fax: (312) 856-1834

Miami

Bancomext

New World Tower, 100 N.
Biscayne Blvd. Suite 1601
Miami, FL 33132
USA
Tel.: (305) 372-9929
Fax: (305) 374-1238

Montreal

Bancomext

1501 McGill College
Suite 1540
Montreal, PQ H3A 3M8
Canada
Tel.: (514) 287-1669
Fax: (514) 287-1844

Argentina

Bancomext

Esmeralda 715, 4th floor B
Buenos Aires
Argentina 1007
Tel.: (541) 394-3602/3571
Fax: (541) 322-5619

Dallas

Bancomext

2777 Stemmons Freeway, Ste. 1622
Dallas, TX 57207
USA
Tel.: (214) 688-4096/97
Fax: (214) 905-3831

New York

Bancomext

375 Park Avenue 19th floor
New York, NY. 10152
USA
Tel.: (212) 826-2978/39
Fax: (212) 826-2979

Toronto

Bancomext

66 Wellington St. West
P.O. Box 32, Suite 2712
Toronto, ON M5K 1A1
Canada
Tel.: (416) 867-9292
Tel.: (416) 867-9325
Fax: (416) 867-1847

Brazil

Bancomext

Rua Holanda, 14 Jardim Europa
CEP. 01446-030
São Paulo
Brasil
Tel.: (5511) 280-3941/4725
Fax: (5511) 280-4811

Colombia
Bancomext
Calle 100 8A-55
World Trade Center
Bogota
Colombia
Tel.: (571) 621-1479/48/39
Fax: (571) 610-5303

Chile
Bancomext
Felix de Amesti 128 2o. Piso,
Las Condes
Santiago
Chile
Tel.: (562) 206-5147/5181
Fax: (562) 206-6285

Venezuela
Bancomext
Asociación Bancaria de Venezuela,
4o Piso
Oficina 44
Ave. Venezuela,
El Rosal
Caracas
Venezuela A.P. 61181
Tel.: (582) 951-6078/5147
Fax: (582) 951-2494

Mexico's National Development Bank, *Nacional Financiera (Nafin)*

Founded in 1934, Mexico's National Development Bank (*Nafin*) is the largest development bank in Mexico, with more than US \$20 billion in assets. *Nafin* offers a variety of financing instruments to assist Mexican companies export abroad, including:

- global short-term lines of credit in American dollars;
- export letters of credit (L/Cs); and
- loan guarantees.

Domestically, *Nafin* has developed a low-interest loan program to encourage small- and medium-sized businesses to purchase cleaner environmental technologies. A similar loan program is being offered to encourage the development of exportable technologies by Mexican industry.

Contact:

Mexico
Nacional Financiera
Insurgentes Sur 1971o
Col. Guadalupe Inn1
010202 México, D.F.
México
Tel.: (525) 325-7324/7033/7078/7079
Argentina
Nafin — Buenos Aires
25 de Mayo No. 555, 4 Piso
Oficina No. 1
Buenos Aires
Argentina
1002

Investment and Project Financing

Overseas Private Investment Corporation (OPIC)

OPIC provides medium- to long-term financing for American business ventures in over 115 developing countries. Two of OPIC's traditional loan programs available to American companies involved in global environmental projects are:

- Direct Loans.* OPIC loans generally range up to US\$6 million and are reserved exclusively for projects sponsored by, or significantly involving, American small businesses.
- Guaranteed Loans.* OPIC also issues loan guarantees, under which funding can be obtained through American financial institutions. These loan guarantees, which cover both commercial and political risks, are available for projects having significant American involvement. OPIC loan guarantees can be as large as US\$50 million. This program is available for projects sponsored by any American company, regardless of size. The loans may be arranged on either a fixed or floating rate basis.

Eligibility. OPIC's eligibility criteria are the same whether it makes a direct loan in American dollars or issues a loan guarantee. The project must be environmentally and financially sound, and it must be sponsored by an investor having a proven record of success in a closely-related business.

Terms. Repayment of both direct loans and loan guarantees is usually made in equal, semi-annual principal payments following a suitable grace period, with a final maturity of 5 to 12 years or more. The length of the grace period is generally contingent upon the time needed by the project to generate a positive cash flow. Direct loan interest rates generally parallel the commercial equivalent.

OPIC's Environmental Investment Fund

So as to promote increased American environmental exports, OPIC has created a privately owned and managed Environmental Investment Fund. The Fund will identify, invest in and support new or expanding business enterprises in developing countries, including Latin America, that sustain natural resources and practice sound environmental management.

Capital. The actual amount of the fund's capitalization will be determined by the market size of projects meeting the fund's criteria. However, the fund's initial capital will be in the range of US\$60-100 million. OPIC plans to commit 40 percent of this capital and will raise the other 60 percent through the sale of limited partnership interests to American firms and institutional investors.

Contact:

Overseas Private Investment Corporation

1615 M Street, N.W.
Washington, DC 20527
USA

Tel.: (202) 457-7116

Fax: (202) 223-3824

US Agency for International Development (USAID)

AID's Bureau of Private Enterprise (PRE)

The PRE will consider market-term financing for projects in developing countries through its Private Sector Revolving Fund.

Eligibility. Although projects in a number of different industries are eligible, environmental projects are given high priority. For loans or loan guarantees, the bureau will consider only private enterprises with substantial local ownership. Sponsors must be either host country nationals, American firms or American citizens. Projects must have a substantial development impact by sustaining sound environmental development, generating net employment opportunities, earning net foreign exchange, developing managerial and technical skills and/or involving technology transfer. Loans may be used to capitalize a new enterprise and/or expand an existing enterprise. Fund managers give priority to innovative and financially viable projects benefitting small businesses in developing countries that can serve as models for replication in other countries. Increasingly, PRE financing is made in conjunction with AID Mission financing.

Terms. The PRE has flexibility in negotiating terms and conditions depending on the nature, riskiness, and developmental impact of the project. Financing is available up to US\$3 million, with emphasis on the US \$250,000 to US\$1,000,000 range but never more than 25 percent of total project costs. The maximum term of the loan is 10 years, with a negotiable grace period of principle repayment. There are no fixed or minimum requirements for collateral. Repayment is on a semi-annual or annual basis.

Contact:

US Agency for International Development

Office of Investments
Bureau of Private Enterprise
Room 3208 NS
Washington, DC 20523
USA

Tel.: (202) 647-9842

Fax: (202) 647-1805

Nacional Financiera/Ventana: North American Environmental Fund

The North American Environmental Fund (NAEF) is a US\$50 million private equity fund formed to promote the development of the environmental industry in the US, Canada and Mexico, specifically through strategic technology alliances. NAEF has been jointly developed by Mexico's National Development Bank (*NaFin*) and Ventana Environmental Corporation, a private global equities firm.

The *Fundación Empresarial para la Restauración Ambiental, A.C.* Mexican Foundation for Environmental Restoration, is also working closely with the fund and is participating in its Business Advisory Council.

Foundation members include representatives from major companies in Mexico including: Volkswagen de México, Grupo Cifra, Banca Confia, Concord, Cervecería Modelo, ICA, Grupo Desc, Grupo Cydsa, Grupo Bimbo, Grupo Condumex and Industrias Resistol.

Targetting high-growth environmental opportunities, NAEF focusses primarily on air pollution control, alternative energy, hazardous waste management, medical waste management, resource recovery and recycling, waste-to-energy, and water treatment projects. Ventana also has a new inter-American fund that includes environmental and infrastructure components beyond Mexico, throughout the Americas.

NAEF Strategic Partners:

- Ebara Corporation
- Grupo ICA
- *PEMEX*, the Mexican national oil company
- WMX Technologies, Inc.
- Consolidated Contractors, Ltd.

Contacts:

Ventana Environmental
1881 Von Karman Avenue, Tower 17, Suite 350
Irvine, California 92715
USA

Tel.: (714) 476-2204

Fax: (714) 752-0223

Ventana Environmental

Mexico Representative

Avenida Lomas de Sotelo,

1112 Despacho 202

Col. Loma Hermosa

02020 México, D.F.

México

Tel.: (525) 395-8247, 580-1734

Fax: (525) 582-1381

Nacional Financiera

Insurgentes Sur 1971

Col. Guadalupe Inn

01020 México, D.F.

México

Tel.: (525) 325-7324

7.0 Conclusion

The need for environmental technologies and services in Colombia, Venezuela, Brazil, Argentina and Chile, the target markets of this report, is well established. However, entering Latin American environmental markets can be difficult. There are risks involved, not the least of which are fluctuating exchange rates, high interest rates, payment problems and, in some countries, social and political instability.

Doing business in Latin America requires time and patience, as well as organizational and financial resources. Information gathering is key to assuring business success. Many Canadian and American companies in the past blindly entered Latin American markets only to pull up their stakes after a year or two, when returns did not meet their expectations. Just as it is important to have a full understanding of the environmental marketplace, it is also important to understand the politics and social customs of the country where one is doing business. Establishing an in-country presence and developing personal relationships with clients is a fundamental part of doing business in Latin America. Also important is to focus on developing those market areas in which a company is most competitive.

Financial Reforms and Trade Integration

Despite the region's history of economic and political volatility, Latin America's business climate is showing signs of change. From Venezuela to Chile's southern cone, Latin American countries are decentralizing and streamlining government, instituting reforms in their banking and monetary systems, and opening up their economies through deregulation and trade liberalization. As part of their decentralization and deregulation efforts, governments have accelerated the privatization of state-owned companies such as railroads, ports, airports, highways, water and sanitation services, and petrochemical industries.

While instituting reforms at home, Latin American governments have also been forging ahead on regional integration, with the goal of creating a Free Trade Agreement of the Americas by the year 2005. Between 1990–1994, regional trade exports in Latin America doubled spurred by the creation of the Latin American Common Market (*MERCOSUR*), the Caribbean Economic Community (*CARICOM*), the Andean Pact and the G3 (Mexico, Colombia and Venezuela). Although open economic and free trade policies do not necessarily translate into greater environmental protection, they do constitute good news for North American environmental companies interested in expanding their services and products in Latin and Central America.

As a result of the North American Free Trade Agreement (*NAFTA*) and its numerous other trade agreements, Mexico is rapidly becoming an important nexus for trade between North, Central and Latin America. As noted in this report, not only has Mexico signed trade agreements with *CARICOM*, and Colombia and Venezuela (*G3*), but it has also signed bilateral agreements with Bolivia (1993), which is part of the Andean Pact, and Chile (1992) slated to join *MERCOSUR* in 1996. In February 1996, Mexico also agreed to resume negotiations with Central American Countries to develop stronger trade and economic ties. As well, Mexico is presently negotiating with Chile to incorporate "trade in services" as part of their agreement and Brazil recently proposed inviting Mexico to become a member of *MERCOSUR*.

Mexico: a North American Bridge to Latin American Markets

Given Mexico's strong and ever expanding trade ties with Central and Latin America, Mexican environmental service companies are in an excellent position to take advantage of the growing environmental opportunities in the region. *CEMEX (Cementos Mexicanos)* is a good example of a Mexican company that has expanded into Panama, Venezuela and recently Brazil, while at the same time contracting environmental services in these countries. Just as American and Canadian firms have ridden the coattails of national and multinational corporations in Latin America, Mexican companies are also following suit.

Mexican environmental companies also have a distinct advantage over their American, Canadian, European or Asian competitors. Common cultural and language factors aside (except for Brazil where Portuguese is spoken), Mexico's environmental problems and socioeconomic conditions are very similar to those of Central and Latin American countries. Although Mexican environmental companies may not always offer the latest in environmental technology, their experience working under similar conditions can prove to be more practical for Latin American countries that are often not in the financial position to purchase the "best available" technology. In addition, Mexican companies also offer more competitive wage rates than their North American, European and even Latin

American rivals, making them more competitive bidders for environmental impact assessments or other studies requiring long person-hours.

For Canadian or American environmental companies, the NAFTA has made joint partnerships with Mexican companies easier. Joint partnerships can be an excellent way to combine advanced Canadian or American environmental technological experience with Mexico's keen knowledge of Latin American business practices, lower wage rates and potential access to lower tariff rates for markets in Latin America. American or Canadian companies looking to make a strategic investment in Latin American environmental markets, may find it advantageous to partially or fully acquire existing Mexican environmental companies that are currently undervalued due to the devaluation of the peso.

Financing

Financing will always be an important factor in providing environmental services and products in Latin America. European and Asian companies have mastered the art of establishing the financial feasibility of their projects. A case in point is the British and French success in wastewater treatment in Argentina. For large projects, multilateral and development bank moneys will often be necessary. Nevertheless, Latin American countries are also turning to long-term private concessions as a means of financing much-needed infrastructure projects, a practice which has proven largely successful to date.

Environmental Opportunities

Latin American governments have begun to recognize that they can no longer ignore the numerous environmental problems in their countries. Not only do environmental problems present serious health problems issues, but they also serve as an obstacle to economic development and growth. The privatization of state companies and the overwhelming need for infrastructure development has opened up new opportunities for environmental companies in Latin America.

At present, the greatest environmental opportunities lie in the area of water treatment. On the average only 5 to 25 percent of all municipal and industrial wastewater in Latin America is treated. Both in Argentina and Chile state water companies are being privatized and in the Brazilian states of Sao Paulo and Rio Grande Sur, for example, the private sector is increasingly being encouraged to construct, finance and operate new sewer treatment plants. Wastewater treatment is also a priority in Venezuela, where, despite the economic crisis, US\$50 million in government funds has been promised for the reclamation of major watersheds and for sewage treatment. Hazardous waste storage, treatment and recycling facilities is another growth area in Latin America, where onsite storage and illegal dumping of hazardous waste is common practice. In Sao Paulo, Brazil, Chase Manhattan Bank was recently successful in building a hazardous waste fuel-blending facility and is now trying to replicate the plant in Argentina.

In Argentina, Colombia and Venezuela, environmental opportunities also exist in the area of oil and mining. YPF, Argentina's recently privatized oil company, has promised to devote greater attention to emissions controls, wastewater treatment and remediation at its refineries. Similarly, the Venezuela Petroleum Company (PDVSA) planned to invest US\$130 million in 1996 in environmental assessment, remediation and air emission control projects. Remediation is also needed in the Venezuelan and Chilean mining sector. CODELCO, Chile's National Copper Corporation, has set 2005 as the target date for full compliance with International Standards Organization (ISO) 14000 environmental standards and plans to invest US\$100 million in new equipment and remediation. Air pollution equipment and services will also be needed in Chile and Colombia in the near future. With 85 percent of the Latin American population living in urban areas, solid waste management is also an area where North American expertise can be utilized. In Argentina, the Buenos Aires Metropolitan Area recently contracted out the operation of four of its landfills to private consortia. In Sao Paulo, Brazil, a new composting, recycling and waste-to-energy facility was recently built entirely with private funds. Although many citizens in Latin America are still not accustomed or able to paying for the true cost for proper solid waste management, opportunities, particularly, in large urban areas are bound to increase.

Latin America's environmental markets are not likely to be instant gold mines for North American environmental companies. Competition from European and Asian companies with a presence in Latin America is steep. Financing is often a delicate issue. Nevertheless, in the light of the continued trend toward economic integration in the Americas, North American companies that form part of the NAFTA are in as strong a position as ever to enter the Latin American environmental market. With patience and appropriate market selection, both short- and long-term profits are to be made.

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Appendix A: Summary Data on the Latin American Market

Basic Indicators

	Population (millions) mid-1992	Area (‘000 of km ²)
Argentina	33.1	2,767
Brazil	153.9	8,512
Chile	13.6	757
Colombia	33.4	1,139
México	85.0	1,958
Venezuela	20.2	912
Canada	27.4	9,976
United States	255.4	9,373

Selected air quality indicators for various cities

			Sulphur dioxide				Avg. annual growth rate (percentage)	Suspended particulate matter			
			Annual Mean Concentration (micrograms per m ³)			Avg. annual growth rate (percentage)		Annual Mean Concentration (micrograms per m ³)			Avg. annual growth rate for series (percentage)
			1979- 82	1983- 86	1987- 90			1979- 82	1983- 86	1987- 90	
City	Type of Site										
Brazil	Sao Paulo		78	46	41	-7.5	134	98	-	-9.1	
Chile	Santiago	CCC	69	85	-	2.5	-	-	-	0.0	
Venezuela	Caracas	CCC	32	27	21	-0.5	-	-	-	0.0	
Canada	Montreal	CCC	41	23	-	-11.0	67	55	61	-1.8	
	Toronto	CCC	-	14	11	4.0	60	60	61	-0.5	
	Vancouver	CCC	21	-	-	-7.0	70	50	42	-4.5	
United States	Houston	CCC	-	-	-	0.0	82	62	-	-7.3	
	New York City	CCR	79	60	-	-5.8	49	46	-	-2.7	

CCC, city centre commercial

CCR, city centre residential

Commercial energy

	Average annual growth rate				Energy use (percentage oil equivalent)	
	Energy Production		Energy Consumption		Per capita (kg)	
	1971-80	1980-92	1971-80	1980-92	1971	1992
Argentina	2.7	2.3	2.5	1.2	1,285	1,351
Brazil	6.1	8.4	8.4	3.9	360	681
Chile	(1.1)	2.1	0.2	4.8	708	837
Colombia	(1.7)	12.9	4.0	3.8	443	670
Mexico	16.6	1.9	10.3	3.1	653	1,525
Venezuela	(4.7)	1.7	4.8	2.0	2,094	2,296
Canada	2.8	3.6	3.9	1.6	6,261	7,912
United States	0.7	0.7	1.7	1.2	7,615	7,662

Infrastructure

	Paved roads		Water	
	Road density (km per million persons)	Roads in good condition (percentage of paved roads) 1988	Population with access to safe water (percentage of total) 1990	Losses (percentage of total water provision) 1986
Argentina	858	35	64	-
Brazil	704	30	86	30
Chile	753	42	87	-
Colombia	309	42	86	38
Mexico	820	85	81	-
Venezuela	10,262	40	92	-
Canada	-	-	100	-
United States	14,172	85*	-	333

Urbanization

	Urban population as percentage of total population		Population in capital city (1990) as percentage of	
	1970	1992	Urban	Total
Argentina	78	87	41	36
Brazil	56	77	2	2
Chile	75	85	42	36
Colombia	57	71	21	15
Mexico	59	74	34	25
Venezuela	72	91	23	21
Canada	76	78	4	3
United States			74	76

Selected water quality indicators for various rivers

	Dissolved oxygen				Fecal coliform			
	Annual mean concentration (mg per l)			Average annual growth rate for series (percentage)	Annual mean concentration (number per 100 ml sample)			Average annual growth rate for series (percentage)
River, city	1979- 1982	1983- 1986	1987- 1990		1979-1982	1983-1986	1987-1990	
Argentina								
de la Plata, Buenos Aires	7.6	7.5	-	0.0	828	230	-	23.1
Paraná, Corrientes	8.1	8.0	8.1	0.1	185	146	111	-6.6
Brazil								
Guandu, Tomada d' Agua	8.1	7.8	7.7	-0.7	1,202	2,452	6	-47.0
Paraíba, Aparecida	6.0	6.1	6.0	-0.4	13,950	9,800	6,075	-11.5
Paraíba, Barra Mansa	7.4	7.6	7.8	0.4	8,003	8,100	8	-33.4
Chile								
Maipo, El Manzano	12.9	13.2	10.8	-1.4	817	705	775	5.3
Mapocho, Los Almendros	11.8	12.1	10.0	-1.7	2	2	5	8.0
Colombia								
Cauca Juanchito	-	5.2	4.8	1.0	-	10,000	10,000	0.0
Mexico								
Atoyac	3.5	1.7	0.3	-47.5	157,500	105,000	916,667	23.9
Balsas	7.6	6.3	6.8	-1.9	1,558	26,333	130,000	95.4
Blanco	5.0	3.4	4.1	-3.7	21,717	39,500	12,150	1.8
Colorado	7.9	8.7	8.2	1.4	277	58	37	-28.7
Lerma	0.3	0.4	0.5	-18.6	192,250	165,000	67	5.7
Panuco	7.7	8.1	8.3	0.7	110	201	-	-27.8
United States								
Delaware, Trenton, NJ	11.1	10.6	-	-2.5	74	197	-	-4.0
Hudson, Green Island, NY	9.8	12.1	-	4.2	941	792	-	-7.4
Mississippi, Vicksburg, Miss	8.4	8.3	-	-0.2	435	1,473	-	40.2

Natural resources

	Natural Forest Area				Nationally protected areas 1993	Freshwater resources: annual withdrawals 1970-92							
	Total area (1000 km)		Annual deforest. 1981-90			1000 km ²	Number	percent- age of total area	Total (km ³)	As percent- age of total water resources	Total	Per capita domestic	Industrial and agricultura l
	1980	1990	1000 km ²	percent- age of total area									
Argentina	445	-	-	-	93.4	100	3.4	27.6	2.8	1,042	94	948	
Brazil	5,978	5,611	36.7	0.6	277.4	214	3.3	36.5	0.5	245	54	191	
Chile	76	-	-	-	137.2	65	18.1	16.8	3.6	1,623	97	1,526	
Colombia	577	541	3.7	0.6	93.9	79	8.2	5.3	0.5	174	71	103	
Mexico	554	486	6.8	1.2	99.0	60	5.1	54.2	15.2	921	55	865	
Venezuela	517	457	6.0	1.2	275.3	104	30.2	4.1	0.3	387	166	220	
Canada	-	4,533	-	-	494.5	411	5.0	43.9	1.5	1,688	304	1,384	
United States	2,992	2,960	3.2	0.1	984.6	937	10.5	467.0	18.8	1,868	244	1,624	

Appendix B: Embassy Contacts

Latin American Embassies in Canada

Complete data on foreign representatives can be obtained in Canada by calling Reference Canada, 1-800-667-3355.

Embassy of the Argentine Republic

Royal Bank Centre
90 Sparks Street #620
Ottawa, ON K1P 5BR
Canada
Tel.: (613) 236-2351
Fax: (613) 235-2659

Embassy of the Federative Republic of Brazil

450 Wilbrod Street
Ottawa, ON K1N 6M8
Canada
Tel.: (613) 237-1090
Fax: (613) 237-6144

Embassy of the Republic of Chile

151 Slater Street #605
Ottawa, ON K1P 5A9
Canada
Tel.: (613) 235-4402
Fax: (613) 235-1176

Embassy of the Republic of Colombia

360 Albert St. #1130
Ottawa, ON K1R 7X7
Canada
Tel.: (613) 230-3760
Fax: (613) 230-4416

Embassy of the Republic of Venezuela

32 Range Road
Ottawa, ON K1N 8J4
Canada
Tel.: (613) 235-5151
Fax: (613) 235-3205

Embassy of the United Mexican States

45 O'Connor Street #1500
Ottawa, ON K1P 1A4
Canada,
Tel.: (613) 233-8988
Fax: (613) 235-9123

Canadian Embassies in Latin America

For complete data on the Canadian Trade Commissioner Service, a Directory is available from the Department of Foreign Affairs and International Trade, at the InfoCentre in Ottawa, 1-800-267-8376.

Argentina

Street Address:
Tagle 2828,
1425, Buenos Aires, Argentina

Mailing address:

Canadian Trade Commissioner Service

Canadian Embassy

Casilla de Correo 1598,
1000, Buenos Aires,
Argentina

Tel.: 011-54-1-805-3032

Fax: 011-54-1-806-1209

Brazil

Canada has an embassy in Brasilia and a consulate in São Paulo. The São Paulo office has responsibility for trade development.

Brasilia

Street address:

Ses-Av. das Nações. Lote 16,
Brasilia — DF 70410-900,
Federative Republic of Brazil

Mailing address:

Canadian Embassy

Caixa Postal 00961

Brasilia — DF 70359-970,

Federative Republic of Brazil

Tel.: 011-55-61-321-2171

Fax: 011-55-61-321-4529

Hours:

Mon, Tues, Thurs, Fri: 08:30-17:30

Wed: 08:30-14:00 Time: EST + 2

Ambassador: Ms. Nancy Stiles (1995 data)

Commercial Counsellor: Ms. Pearl Williams

Chile

Street address:

Ahumada 11, 10 Piso
Santiago, Republic of Chile

Mailing address:

Canadian Trade Commissioner Service

Canadian Embassy

Casilla 771

Santiago

Republic of Chile

Tel.: 011-56-2-696-2256

Fax: 011-56-2-696-0738

Hours:

Mon-Thurs 08:30-17:30

Fri-08:30-14:00

Time: EST +1

Ambassador: Mr. Robert Clark (1995 data)

Commercial Counsellor: Ms. Susan Harper

São Paulo

Street Address

Edifício Top Centre,
Avenida Paulista 854,
5 Andar

01310-913 São Paulo SP

Federative Republic of Brazil

Mailing address:

Canadian Trade Commissioner Service

Canadian Embassy

Caixa Postal 22002,

01495-970 São Paulo SP,

Federative Republic of Brazil

Tel.: 011-55-11-287-2122

Fax: 011-55-11-251-5057

Hours:

Mon-Thurs: 09:00-18:00

Fri: 09:00-14:30

Consul General: Mr. Michael Spencer

Hours:

Mon-Thurs: 08:30-17:30

Fri: 08:30-13:00

Time: Mid Mar to Mid Oct: EST

Mid Oct to mid Mar: EST +2

Ambassador: Mr. Marc Lortie (1995 data)

Commercial Counsellor: Mr. Peter Furesz

Colombia*Street address:*

Calle 76, No. 11-52,
 Santa Fe de Bogota
 Republic of Colombia

*Mailing address:***Canadian Trade Commissioner Service****Canadian Embassy**

Apartado Aero 53531
 Santa Fe de Bogota 2
 Republic of Colombia
 Tel.: 011-57-1-217-5555
 Fax: 011-57-1-310-4509

Mexico

Canada has an embassy in Mexico City, and a consulate in Monterrey.

*Embassy:**Street Address:*

Calle Schiller No. 529,
 Colonia Polanco
 11560 México, D.F., México

*Mailing Address:***Canadian Trade Commissioner Service****Canadian Embassy**

Apartado Postal 105-05
 11560 México, D.F., México
 Tel.: 011-525-724-7900
 Fax: 011-525-724-7982

Hours: Mon-Fri: 08:45-17:15 Time: EST -1

Ambassador: Mr. Marc Perron (1995 data)

Economic/Commercial Counsellor: Mr. Denis Thibault

Commercial Counsellor: Mr. Jean Prevost

Venezuela*Street Address:*

Edificio Torre Europa, Piso 7
 Avenida Francisco de Miranda
 Campo Alegre, Caracas 1060
 Republic of Venezuela

*Mailing address:***Canadian Trade Commissioner Service****Canadian Embassy**

Apartado Postal 62.302
 Caracas 1060-A
 Republic of Venezuela
 Tel.: 011-58-2-951-6166
 Fax: 011-58-2-951-4950

Hours:

Mon, Tues, Thurs, Fri: 08:00-17:00

Wed: 08:00-13:30

Time: EST

Ambassador: Mr. Archie McArthur (1995 data)

Commercial Counsellor: Mr. Zen Burianyk

*Consulate:**Street address:***Canadian Trade Commissioner Service****Canadian Embassy**

Edificio Kalos, Piso C-1, Local 108-A
 Zaragoza y Constitution,
 Monterrey, NL, México

Tel.: 011-52-83-44-32-00

Fax: 011-52-83-44-30-48

Hours: Mon-Fri: 09:00-17:30

Consul and Trade Commissioner: Mr. Thomas Cullen

Hours: Mon-Thurs: 07:30-16:30

Fri: 0730-1300

Time: EST +1

Ambassador: Mr. Yves Gagnon (1995 data)

Commercial Counsellor: Mr. Georges Lemieux

Latin American Embassies in Mexico**Embassy of Argentina**

Bld. M. Avila Camacho 1, Piso 7
 11000 México, D.F.
 México
 Tel.: (525) 520-9431
 Fax: (525) 540-5011

Embassy of Brazil

Lope de Armendariz 130
11000 México, D.F.
México
Tel.: (525) 202-7500/8737

Embassy of Chile

Martes Urales No. 460-1
Lomas de Chapultepec
11000 México, D.F.
México
Tel.: (525) 502-0025, 520-0081/0219
Fax: (525) 520-3527

Embassy of Colombia

Paseo de Reforma 1620
Lomas de Chapultepec
11000 México, D.F.
México
Tel.: (525) 207-5589
Fax: (525) 535-0383

Embassy of Venezuela

Shiller 326
Col. Polanco
11570 México, D.F.
México
Tel.: (525) 203-4232

Embassies of Mexico throughout North and Latin America**Embassy of Mexico in Argentina**

Larrea #1230
1117 Buenos Aires
Argentina
Tel.: (541) 821-7210
Fax: (541) 821-7251

Embassy of Mexico in Brazil

S.E.S. Av. das Nacoes Lote 18
70412-900 Brasilia D.F.
Brasil
Tel.: (55-61) 244-1011
Tel.: (55-61) 244-1411 (Commercial office)
Fax: (55-61) 244-1755

Embassy of Mexico in Canada

45 O'Conner Street, Suite 1500
Ottawa, ON K1P 1A4
Canada
Tel.: (613) 233-8988
Fax: (613) 235-9123

Embassy of Mexico in Chile

Felix de Amesti No. 128
Las Condes
Santiago de Chile
Chile
Tel.: (56-2) 206-6133
Fax: (56-2) 206-6147

Embassy of Mexico in Colombia

Calle 82 No. 9-25
Santa Fe de Bogota
Colombia

Tel.: (57-1) 610-4070

Fax: (57-1) 610-3045

Embassy of Mexico in the USA

1911 Pennsylvania Avenue, N.W.
Washington, DC 20006
USA

Tel.: (202) 728-1694

Fax: (202) 728-1698

Embassy of Mexico in Venezuela

Calle Guaicaipuro
Con Av. Principal de las Mercedes
Edificio Forum, Piso 5
Urbanización el Rosal
Caracas, Venezuela

Tel.: (58-2) 952-5777

Fax: (58-2) 952-3003

Latin American Embassies in the United States

Argentinean Embassy in the United States

Mr. Antonio Seward, Economic Attaché

Embassy of Argentina

1600 New Hampshire Ave., NW

Washington, DC 20009

USA

Tel.: (202) 939-6413

Fax: (202) 775-4388

Brazilian Embassy in the United States

Sergio Tamm, Chief of Commercial Section

3006 Massachusetts Ave., NW

Washington, DC 20008

USA

Tel.: (202) 745-2769

Fax: (202) 745-2827

Chilean Embassy in the United States

Mario Matos, Commercial Attaché

1732 Massachusetts Ave., NW

Washington, DC 20036

USA

Tel.: (202) 785-2370

Fax: (202) 659-9624

Colombian Embassy in the United States

Nicolas Lloreda, Director of Colombian Trade Bureau

2118 Leroy Place

Washington, DC 20008

USA

Tel.: (202) 387-8338

Fax: (202) 223-0526

Venezuelan Embassy in the United States

Alejandro Reyes, Minister Counselor
1099 30th Street, NW
Washington, DC 20007
USA
Tel.: (202) 342-6807
Fax: (202) 342-6820

United States Embassies in Latin America**United States Commercial Center**

Ricardo Rose, Commercial Officer
Lucy Lessard, Commercial Officer
Rua Estados Unidos 1812
São Paulo, SP Brazil
Tel.: (55-11) 853-2011
Fax: (55-11) 853-2744

United States Embassy in Argentina

Alvaro Mendes, Commercial Advisor
Robert Shipley, Commercial Advisor
Colombia 4300
1425 Buenos Aires, Argentina
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Fax: (54-1) 777-0673

United States Embassy in Brazil

Mark Tadeu, Commercial Officer
Av. das Nações Unidas, Quadra 801, Bloque 3
Brasilia, DF 70403-900
Brazil
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Fax: (55-11) 853-2744

United States Embassy in Chile

Carlos Poza, Commercial Counselor
Avenida Andres Bello 2800
Las Condes
Santiago, Chile
Tel.: (56-2) 330-3316
Fax: (56-2) 330-2172

United States Embassy in Colombia

Soledad Salguero, Commercial Officer
US Embassy
Calle 28 No. 8-61
Bogota, Colombia
Tel.: (57-1) 288-4045, 232-6550
Fax: (57-1) 285-7945

United States Embassy in Venezuela

Milton Chaves, Commercial Advisor
Willima Burck, Commercial Advisor
Calle F con Calle Suapure
Colinas de Valle Arriba
Caracas, Venezuela
Tel.: (58-2) 977-2011
Fax: (58-2) 977-0843

Appendix C: Latin American Environmental Sites on the World Wide Web

Latin American Web Servers— Regional

Latin World (regional and country specific information):

<http://www.latinworld.com/>

Latin American Cyber-Sites, sponsored by the Inter-American Development Bank (IADB):

<http://ww2.iadb.org/otherwww.htm>

Latin American Network Information Center/University of Texas at Austin

<http://lanic.utexas.edu/>

Web Servers for Latin America:

<http://www.public.asu.edu/~aswpk/>

Ole! Spanish government-sponsored page with excellent governmental and institutional links throughout Latin America:

<http://www.ole.es/paginas/gobiernos/>

Summit of Americas-Regional Energy Balance, Sponsored by the US State Department:

<http://198.76.0.5/summit/energyb.html>

Internet in Latin America — List of Links:

<http://syy.oulu.fi/~kempis/latin.html>

Web Servers in the Americas, Florida International University, Summit of Americas Center:

<http://americas.fiu.edu/sncontac.html>

Canadian/Latin American Trade Opportunities:

<http://www.dfait-maeci.gc.ca/english/geo/lac/trade.html>

Latin American News

MundoNet News. News sources (newspapers and magazines from throughout Latin America)

<http://www.he.net/~spiro/mundonet/aldia.html>

Interpress Latin American Wire:

<http://worldnews.net/wnews/>

Omnivore Latin America News:

<http://way.net/omnivore/lat-am.html>

Newspapers & Magazines from throughout Latin America and the Caribbean:

<http://ww2.iadb.org/prensa/la-news-link.htm>

Multinational Development Banks

A. World Bank-Latin America:

World Bank Environmental Reports-Latin America:

<http://www.worldbank.org/html/lat/english/page/env.htm>

World Bank Environmental Resources:

<http://www.worldbank.org/html/lat/english/page/env.htm>

B. Inter-American Development Bank (IADB):

IADB General Home Page:

<http://www.iadb.org>

IADB List of Project Proposals by Country-Latin America:

<http://www.iadb.org/doc/Lcountry.htm>

IADB Approved List of Projects:

<http://www.iadb.org/apr/acountry.htm>

IADB Environmental Projects:

<http://www.iadb.org/doc/enpaises.htm>

Country-Specific Resources

A. Argentina:

Panamnet Argentina Internet Gateway:

<http://www.panamnet.net/gateway/argentina.html>

Argentinean Ministry of Economy & Public Works and Services:

<http://www.mecon.ar>

Argentina's New Constitution:

<http://reality.sgi.com/employees/omar/personal/argentina/Constitucion>

University of Buenos Aires:

<http://www.uba.ar>

University of la Plata:

<http://www.unlp.edu.ar/>

University of Córdoba:

<http://dns.uncor.edu/webhome.htm>

B. Brazil

Panamnet Brazil Internet Gateway:

<http://www.panamnet.net/gateway/brazil.html>

Brazil WWW Servers:

<http://www.unikey.com.br>

Brazil Web:

<http://www.escape.com/~jvgnky/>

Rio de Janeiro:

<http://www.puc-rio.br/>

Journal of Brazil (Jornal do Brasil—Portuguese)

<http://www.ibase.br/~jb/jb.htm>

News from Brazil:

<http://www.earthlink.net/~brazzil/index.htm>

Brazilian Business Directory:

<http://www.brazilbiz.com.br/english/>

Change in the Amazon Basin:

http://boto.ocean.washington.edu/eosram_home.html

Deforestation Maps of the Amazon Basin:

<http://www.inpe.br/Amazonia/>

Brazilian Ministry of Environment:

<http://www.mma.gov.br/>

C. Chile:

Panamnet Chile Internet Gateway:

<http://www.panamnet.net/gateway/chile.html>

Welcome to Chile:

<http://sunsite.dcc.uchile.cl/chile/chile.html>

Chile WWW Servers:

<http://sunsite.dcc.uchile.cl/chile/servers.html>

D. Colombia:

Panamnet Colombia Internet Gateway:

<http://www.panamnet.net/gateway/colombia.html>

Colombian WWW Servers:

<http://univalle.edu.co/hosts.html>

Colombia Information:

<http://www.colostate.edu/Orgs/LASO/Colombia/>

Colombian National Center for Statistics:

<http://www.sin.com.co/clientes/DANE/>

ECOPETROL (*Empresa Colombiana de Petróleo*) — Colombian National Oil Company:

<http://www.ecp.com/>

University of del Valle *Universidad del Valle*

<http://www.univalle.edu.co/MapaSens.html>

University of the Andes *Universidad de los Andes*:

<http://www.uniandes.edu.co/>

E. Venezuela:

Panamnet Venezuela WWW Site Gateway:

<http://www.panamnet.net/gateway/venezuela.html>

Venezuela's Web Server:

<http://venezuela.mit.edu/>

Venezuela: General Information:

<http://lanic.utexas.edu/la/venezuela>

Embassy of Venezuela, Washington, DC

<http://venezuela.mit.edu/embassy/>

CONAPRI— National Council for Investment Promotion (*Consejo Nacional de Promocion de Inversiones*)

<http://iadb6000.iadb.org/~http/venezuela/vebsed.html>

Simon Bolivar University *Universidad Simon Bolivar*:

<http://www.usb.ve/>

Central University of Venezuela *Universidad Central de Venezuela*

<http://www.sagi.ucv.edu.ve/>

CONICIT - National Council for Science & Technology (*Consejo Nacional de Investigaciones Científicas y Tecnológicas*):

<gopher://dino.conicit.ve:70/1>

PDVSA - Venezuela's state-owned oil company: (*Reptróleos de Venezuela*)

<http://www.pdv.com>

Appendix D: Glossary of Selected Terms on Methods of Financing Infrastructure

build-own-operate (BOO)	As the owner of the infrastructure facility, the sponsoring private concerns finance and oversee its construction and subsequent operation.
build-own-operate-transfer (BOOT) or simply "BOT"	A financial consortium sponsors, oversees the construction of and operates a new project for a specified period of time, after which it is transferred to the host government. BOT may require host governments to contribute to the financing of the project and set tariff structures to prevent monopolistic pricing practices.
build-transfer-operate (BTO)	In contrast to BOT, there is no private ownership of the infrastructure facility under BTO. The host government may participate in the project's initial funding and its subsequent maintenance. Operation of the facility is similar to a franchise arrangement. Public ownership of BTO limits the legal risk involving tort liability to the private concerns involved.
buy-build-operate (BBO)	BBO provides a means for governments to expand the capacities of existing infrastructure facilities via privatization. Sponsoring consortiums purchase the government assets, increase their capacity and operate them.
Three derivative methods of Buy-build-operate lease-develop-operate (LDO)	Under LDO the government retains ownership rights of the existing infrastructure facility and receives cash flows as specified by a lease agreement with a private lessee who finances and oversees its operation.
add-own-operate (AOO)	As a means of increasing the efficiency of state-owned infrastructure facilities private concerns finance the expansion of existing facilities of which the government retains ownership while the private sector owns the expansion.
contract-add-operate (CAO)	<p>The government retains ownership of the existing infrastructure facility as well as of the private sector-financed expansion.</p> <p>Common infrastructure facilities and services include: water distribution and treatment, electricity, roads, bridges, port facilities, railroads, cargo handling, gas distribution, telecommunications and solid waste disposal.</p> <p>Principal elements of co-rate finance involved in infrastructure: concessionaires, construction and financial institutions.</p> <p>"Replacement value" is a figure often cited when referring to the value of an existing element: infrastructure.</p>

Appendix E: International Funding Sources

Financing source	Funding Type				Potential for environmental projects in Latin America
	Grants	Loans	Financing	Other	
Multilateral institutions, United States Environment Program World Branch (UNEP & WB)	✓			✓	Fair — funds channelled to “global” environmental problems and poorest countries
Inter-American Development Bank (IADB)		✓			Good — public and private
International Finance Corporation (IFC)		✓		✓	Good — for private participants
World Bank		✓			Good — large projects
Bilateral-US-Mexico					
North American Development Bank		✓			Good — provides financing for border environmental projects, with BECC
United States					
Export-Import Bank of the United States			✓		Good — for American exports used in projects
Overseas Private Investment Corporation		✓		✓	Low — Currently does not operate in Mexico. However, it is active elsewhere in Latin America
Small Business Administration		✓	✓		Good — international institutions
US Agency for International Development	✓				Low — limited scope in Mexico
US Trade and Development Agency (TDA)				✓	Good — co-finances feasibility studies
Canada					
Export Development Corporation (EDC) Canadian Commercial Corporation	✓	✓	✓		
Mexico					
Nacional Financiera	✓		✓		
Bancomext			✓		

Source: MEGA-TEK Inc.; US Department of Commerce; *Nacional Financiera*; *Bancomext*; Canadian Commercial Corporation

Appendix F: Interviewees and Affiliations

Argentina

Javier Cantero, Secretary General
Federal Council for Water and Wastewater
Buenos Aires, Argentina
Orlando Caporal, President
Buenos Aires Provincial Institute for the Environment
Buenos Aires, Argentina
Ariel Carbajal, Environmental Sector Manager
Secretariat of Natural Resources and Human Environment
Buenos Aires, Argentina
Alberto Ferral, Undersecretary of the Environment
Municipality of Córdoba
Córdoba, Argentina
Alessio Frassi, Technical Advisor
Avellaneda Liquid Industrial Effluents Treatment Plant (TELIPA)
Buenos Aires, Argentina
Ana Lamas, Attorney
Buenos Aires, Argentina
Silvia Malabarba, Environmental Sectoral Specialist
Inter-American Development Bank
Buenos Aires, Argentina
María José Pérez Dorrego, Second Vice-president
Chase Manhattan
Buenos Aires, Argentina
José Luis Puliafito, President
Provincial Sanitation and Water Agency (EPAS)
Mendoza, Argentina
Tom Randazzo, Vice President and General Manager
Nortru
Detroit, Michigan, US
Robert Regalado, Vice-president, Engineering
Allenco International
Longwood, Florida, US
Carlos Roberto, Environmental Coordinator
Association of Argentinean Metallurgical Industries (ADIMRA)
Buenos Aires, Argentina
Hector Tamargo, Coordinator of Environmental Department
Argentinean Industrial Union (UIA)
Buenos Aires, Argentina

Brazil

Constante Bombonato, Coordinator of Hydraulic Resources and Environmental Protection
São Paulo State Basic Sanitation Company (SABESP)
São Paulo, Brazil
Fábio Feldmann, Secretary of the Environment
State of São Paulo
São Paulo, Brazil

Maria Christina F. Carneiro, Assistant to the Infrastructure Director
National Economic and Social Development Bank (BNDES)
Rio de Janeiro, Brazil
Suely M. Carvalho, Director
Environmental Sanitation Technology Company (CETESB)
São Paulo, Brazil
Victor M. B. Coelho, Vice-President
Rio de Janeiro State Foundation for Environmental Engineering (FEEMA)
Rio de Janeiro, Brazil
Emilio Onishi, Chief, Department of Environment and Land Use
The São Paulo Federation of Industries (FIESP)
São Paulo, Brazil
José Antônio Pereira, Director of Sales
Environmental Sanitation (journal)
São Paulo, Brazil
Ricardo Rose, Commercial Specialist
U.S & Foreign Commercial Service, São Paulo
São Paulo, Brazil
Carlos Roberto Silvestrin, Executive Director
Tietê-Paraná Development Agency (ADTP)
São Paulo, Brazil
Eduardo Eugênio G. Vieira, President
Brazilian Association of the Chemical Industry (ABIQUIM)
São Paulo, Brazil
Christopher Wells, Executive Director
Business Commitment to Recycling (CEMPRE)
São Paulo, Brazil
Paulo Massato Yoshimoto, Superintendent
São Paulo State Basic Sanitation Company (SABESP)
São Paulo, Brazil

Chile

Robert Deverall, Senior Partner
Analytical Service Laboratories
Vancouver, BC, Canada
Gerardo Muñoz, Director of Environmental Control
Chilean Copper Corporation (CODELCO)
Santiago, Chile
Carlos R. Piña, Director of International Coordination
National Environmental Commission (CONAMA)
Santiago, Chile
Bill Schott, Sales and Marketing Manager
Kimre Inc.
Miami, Florida, US
Ramiro Trucco, Consultant
National Environmental Commission (CONAMA)
Santiago, Chile
Isabel Margarita Valenzuela, Environmental Specialist
US & Foreign Commercial Service
Santiago, Chile
Rene Saa Vidal, Executive Director
Forestry Institute (INFOR)
Santiago, Chile

Jaime Vivanco, Director of Department of Regulation and Control
Superintendency of Sanitation Services
Santiago, Chile
Malcolm Winsby, Environmental Specialist
Hatfield Consultants Ltd.
Vancouver, BC Canada

Colombia

Jaime F. George Cuevas Coordinador Ambiental Corporativo
Ecopetrol
Empresa Colombiana de Petróleos
Bogotá
Ernesto Guhl, Vice-Minister
Ministerio del Medio Ambiente
Santa Fe de Bogotá
Scott Whitney, Vice-president, Business Development
Ogden-Yorkshire
New Jersey, US

Mexico

Ing. Ricardo Gómez Castillo Gas y Petroquímica Básica y Protección Ambiental
Petróleos Mexicanos (PEMEX)
Col. Huasteca, Deleg. Miguel Hidalgo, México D.F.
Ray Choice President
Choice Environmental
Guadalajara Jalisco, México
Ing. Jaime Sancho y Cervera Director General de Infraestructura y Equipamiento
SEDESOL
Belén de las Flores México
Ing. Javier Galicia Guevara División de Contratos y Propiedad Intelectual
Instituto Mexicano del Petróleo
Coordinación de Comercialización
México D.F.
Ing. Héctor López Guerrero Gas y Petroquímica Básica y Protección Ambiental
Petróleos Mexicanos (PEMEX)
Col. Huasteca, Deleg. Miguel Hidalgo, México D.F.
Jesús Morales Garduño Subgerente de Proyectos de Desarrollo Urbano
Banco Nacional de Obras Públicas y Servicios Públicos, S.N.C.
Florida, México D.F.
Sean P. Kelley, Commercial Attaché
US Department of Commerce
Embajada de los EU
México D.F.
Lic. José Luis Samaniego Leyva Coordinador de Asuntos Internacionales
Secretaría del Medio Ambiente Recursos Naturales y Pesca
Fracc. Jardines en la Montaña México, D.F.
Ing. Jesús Campos López Gerente de Construcción
Comisión Nacional del Agua del Valle
Lic. David Martínez Serna Director de Proyectos Internacionales
Gobierno del Estado de Nuevo León
Secretaría de Desarrollo Económico
Monterrey N.L., México
Lic. Francisco Moreno
Sanifill

Ing. Nobuyuki Ohtomo C.C.T.V. Systems
Gumatsu, S.A. de C.V.
San Jerónimo Lídice
Ing. Carlos Sandoval Olvera Presidente
Consejo Nacional de Industriales Ecologistas (CONIECO)
Del Valle, México
Gerardo Rueda Rojas, Coordinador de Comunicación Ambiental
Fundación El Manantial
Centro de comunicación y educación ambiental
Peña Pobre Tlalpan
Ing. Jorge Sánchez, Director General, Hazardous Wastes
Instituto Nacional de Ecología
Cuauhtémoc, México
Ing. Ernesto Cangas Sánchez, Investigación y Desarrollo
Secretaría de Desarrollo Urbano y Obras Públicas
Subsecretaría de Ecología
Dirección de Planeación
Gobierno del Estado de Nuevo León
Monterrey, N.L.
Ing. Armando Trelles J, Coordinador de Desarrollo Profesional e Institucional
Instituto Mexicano de Tecnología del Agua (IMTA)
Jiutepec, México
Ing. Adolfo A. Ruesga Valadez Sub Director de Control Ambiental
Secretaría de Desarrollo Urbano y Ecología
Monterrey N.L.
Thomas Witt, Corporate Legal Department
Chemical Waste Management
Ing. Ernesto Yañez G, Asesor
Instituto para la Protección Ambiental de Nuevo León, A.C.

Venezuela

Alma L. Cedeño, Director for Health, Safety, and the Environment
Venezuelan Petroleum Company (PDVSA)
Caracas, Venezuela
Alma L. Cedeño G, Asesor Asuntos Ambientales Nacionales
Gerencia de Asuntos, Ambientales
Petróleos de Venezuela, S.A.(PDVSA)
Caracas, Venezuela
Ing. Jorge L. Rincón Cohen Gerente de Protección Integral
Maraven
División de Operaciones de Producción
Lagunillas-Estado Zulia-Venezuela
Wilson Johnston, International Division
Browning Ferris Industries
Houston, Texas, US
Haydee Franklin
Gerente de Asuntos Ambientales
Corpoven
Filial de Petróleos de Venezuela (PDVSA)
Caracas, Venezuela

Jorge Rodríguez Grau, PhD, Departamento de Ecología y Ambiente
Jefe Sección de Aguas
Intevep, S.A.
Centro de Investigación y Apoyo Tecnológico
Filial de Petróleos de Venezuela, S.A.
Los Teques, Edo. Miranda
Caracas, Venezuela
Pedro Misles
Presidente
HIDROANDES
Alejandro Silva, Project Manager
Palmaven
Caracas, Venezuela

United States

Eric Kenney, President
Hudson Industries
Hudson, Ohio

Appendix G: Exported Technologies

A small sample of environmental technologies successfully exported to Latin America by North American companies are listed below by target country. This is not an exhaustive list. Only companies that participated in GLOBE 96 and that reported exports to specific countries in Latin America are listed. Firms reporting exports to “Latin America” have not been included here, which intentionally highlights smaller firms that have more recently entered the Latin American market.

Air Purification Inc.: Argentina, Brazil, Chile

A manufacturer of high-tech filtration systems, Air Purification Inc. released the largest and most powerful version of their flagship product, the Rotorfilter®. In so doing, Air Purification Inc. continues on a course to make the company’s technology the basis of the most advanced and versatile air and water pollution control equipment by the end of the decade.

Altersys: Brazil

Altersys has reacted to the need for dependable, open and inter-operable automation and process management by developing its latest product, PCP Virgo. Building on the success of “Process Control Partner”, the first truly PC-based control system, released in 1988, PCP Virgo adds the full power of global object-oriented programming to PCP’s supervisory control, automation and process management. PCP Virgo now has a proven track record within food, mining, metal processing, bio-chemical and electrical industries.

BC Gas International Inc.: Brazil

BC Gas International Inc., a wholly-owned subsidiary of BC Gas Inc., is actively engaged in consulting and energy services marketing in countries throughout the world. The company can provide expertise in the distribution and utilization of natural gas and petroleum in regulated and non-regulated markets. It is a world leader in the development of new markets for natural gas and petroleum products including co-generation and natural gas vehicles, and has successfully completed projects to meet clients’ needs all over the world. Specific services that can be provided include project management, planning, feasibility studies, strategic analysis on a macro and micro level, detailed design, contract documentation design and preparation, project implementation, operational support and monitoring.

Cameron Yakima: Brazil

Cameron Yakima (CYI) strives to provide the broadest range of activated carbons and related products and services, with over two million pounds of carbon available to ship “next day.” Activated carbon’s ability to be recycled is one of its strongest assets. CYI’s reactivation service is capable of processing 40,000 pounds per day. Technical assistance and filtration equipment complete the CYI package. CIY builds custom closed-loop activated carbon systems for liquid and vapor purification in remediation, industrial process and potable water applications.

Censol Inc.: Argentina, Chile, Venezuela

Censol Inc. is a consortium of Canadian companies with expertise in air, water, wastewater and solid waste treatment. For decades, these companies have been providing solutions to environmental problems in Canada and in countries throughout the world. Now joining together as a group, and with local partners, Censol Inc. is offering its expertise to solve environmental problems in Latin America. The Canadian member companies include specialists in training, laboratory services, consulting engineers, design and project management teams, process equipment and manufacturers. With 1,000 employees and over US\$ 100 million in annual sales, Censol Inc. has the capacity to undertake large projects and the flexibility to carry out smaller ones efficiently.

Clean Burn Inc.: Argentina, Brazil, Chile

Clean Burn Inc. is the world leader in multi-oil furnaces for onsite recycling of used oils. The company is dedicated to producing and marketing the most reliable, highest quality equipment available. The company manufactures a complete line of multi-oil fired furnaces and boilers that burn used and waste oils, including crankcase, transmission and hydraulic, as well as standard fuel oil, to produce heat and hot water. All furnaces and boilers meet the requirements of the USEnvironmental Protection Agency (EPA) and provide a safe, economical and efficient means to dispose of used oil and produce clean, free heat or hot water. The company was formed in 1979 and was bought out by a small group of investors in 1988. It employs 50 people and has annual sales of over US \$ 10 million. All manufacturing, research and development is done in their factory in Leola, Pennsylvania, US.

¹ Corporate summaries and technology/service profile extracts are reprinted here from the GLOBE 96 Sellers Guide with the permission of the GLOBE Foundation of Canada.

EARTH TECH: Venezuela

EARTH TECH is a leading North American engineering firm, serving the public and private sector markets for water resources, air quality, remediation, infrastructure, facilities management and environmental science. The company serves government, commercial/industrial and municipal clients in the US and around the world. The company is a leading provider of contract operations and maintenance of water, wastewater and remediation treatment systems; remediation construction; and facilities engineering and management. In addition, it offers a wide range of engineering and environmental services related to transportation, air quality management, hazardous waste management, pollution prevention, risk assessment, environmental compliance, strategic environmental management, and solid waste management. EARTH TECH is also internationally recognized as an expert in air quality modelling and model development.

Elsag Bailey (Canada) Inc.: Chile, Venezuela

Elsag Bailey Process Automation is a global supplier of process control systems, field instrumentation products and professional services. Elsag's product offering includes: analyzers, controllers, distributed control systems, data acquisition and measurement systems, disinfection systems (ultraviolet and chlorine), flowmeters and indicators, level indicators, pH sensors, supervisory control systems, transmitters, temperature indicators, turbine controls and valve positioners, among others. The company also provides comprehensive professional services for installation, maintenance, operator training, process simulation, regulatory compliance process and plant optimization.

Goodfellow Consultants Inc.: Brazil, Colombia

Goodfellow Consultants Inc. is a recognized consulting firm in clean air technology and specializes in environmental engineering, occupational health and safety, and indoor air quality. Technologies are centred around clean air technology and include industrial pollution prevention, contamination control, workplace health and safety, occupational hygiene, integrated clean plant design, energy conservation and environmental management systems and regulatory permitting.

GCI offers services in feasibility and planning studies, safety and risk analysis, and project management, construction and commissioning. The company has developed advanced computer programs that are used to solve environmental problems effectively and efficiently. Fluid dynamic modelling and computational fluid dynamics provide efficient and cost effective solutions to environmental problems.

Hatfield Consultants: Chile

The Hatfield Group provides consulting services ranging from full-scale, multi-faceted environmental impact assessments and monitoring of industrial operations, to fisheries evaluation and management, aquaculture site assessment, facility design and operation, and institutional and human resource development. The sectors of expertise include: forestry, pulp and paper, oil and gas, petrochemicals, mining, hydroelectricity, and linear developments (highways, airports, pipelines, etc.). The group also provides environmental risk assessment and audit services to developing countries. They have extensive coastal planning and research capabilities, and they maintain their own aquaculture research and development farm. Additionally, the Hatfield Group has strong experience in remote sensing as well as institutional strengthening and human resource development programs in the technical areas outlined above.

HMS Energie Inc.: Brazil

HMS Energie markets proven, state-of-the-art water resources management tool and solutions which have been successfully applied in Hydro-Quebec's demanding environment. The company specializes in multi-objective river management systems, river basin modelling and simulation tools for hydrological, pollution and fisheries applications, as well as hydroelectric plan automation and productivity improvement solutions.

Hydron Systems: Colombia

Hydron Systems develops and markets an integrated range of products which are targeted towards the management of environmental data, with particular emphasis on water resources, urban water and meteorologic time-series data. The company has three main products. Hydron/TS is a software suite designed for acquiring, managing and analyzing time-series data. Hydron/WQ is for managing and reporting on discrete sampled water quality data that has been analyzed for various physical, chemical and biological parameters. Hydron/MA provides a mapping interface across the other Hydron products, and provides a range of display and manipulation facilities over a map base. All Hydron Systems' products are fully integrated.

IHS Environmental Information: Brazil

IHS Environmental Information Inc., publishers of ENFLEX(R) EHS databases and Earthlaw/ Environmental and Safety Libraries, provides current comprehensive coverage of American federal, state and international EHS regulations including the US Environmental Protection Agency (EPA), OSHA, DOT, NRC, Coast Guard, industry

standards, military publications, OSHA and NIOSH guidance publications. ENFLEX-EarthLaw provides all 50 titles in The Federal Register updated daily online. ENFLEX-EarthLaw offers exclusive features like RegChange regulatory updates, over 800 EHS-specific Subject Terms and a convenient Windows graphical interface. These databases are available on CD-ROM, online, magnetic media and the Internet. ENFLEX-EarthLaw databases are prepared by environmental and information professionals.

Inproheat Industries: Chile

Originally formed to install and service natural gas equipment, Inproheat rapidly expanded into the design and manufacture of proprietary energy systems. Since the 1960's, Inproheat has grown into a major combustion design engineering company. Services include: upgrading and converting existing energy systems from oil and coal to gas; providing turnkey low-NOx boiler systems; supplying proprietary submerged combustion solution heating systems utilizing oil and natural gas that are used in a wide range of applications; (i.e. water, dyes, copper mine solution heating and sludge pasteurization; supplying proprietary thermal oxidation systems for visible plume and odor control; (i.e. coffee roasters, rendering plants, fish smoke houses, foundries and food processing industries; and supplying proprietary heat treat furnaces for the steel and foundry industries.

Interbio: Argentina, Brazil

International Biochemicals (Interbio), a world leader in environmental biotechnology, manufactures and distributes formulated microbial products for industrial and municipal wastewater treatment, soil remediation, agriculture, aquaculture and institutional applications. The company has expertise in the following areas: industrial and municipal wastewater treatment; soil bioremediation; agriculture; aquaculture; industrial sanitation; and consumer product formulation. Services include: regulatory compliance consulting and assistance; emergency response to wastewater treatment system bioshocks; wastewater treatment efficiency optimization and cost reduction; operation assistance; and in-depth biological training. InterBio's International Standards Organization (ISO) 9,002-accredited quality assurance programs at its facilities in Houston, Texas, and Dublin, Ireland, assure customers of a reliable supply of high-quality, environmentally safe bacterial formulations.

Jacques Whitford: Argentina

Jacques Whitford is one of Canada's fastest-growing firms of consulting engineers and environmental scientists specializing in environmental engineering, geotechnical engineering, environmental sciences and planning, hydrogeology, materials engineering and research, air quality, information technologies, and environmental management systems. The company has received national recognition for its remediation technologies, in particular the Transportable Remediation Unit (TRU) and the Mobile Environmental Remediation System (MERS). These systems are first-response solutions to environmental contamination such as petroleum hydrocarbon-contaminated soil and groundwater. Jacques Whitford has over 450 professional engineers, scientists and technicians, operating out of 18 Canadian and one American offices in Freeport, Maine, and joint ventures in Moscow and Buenos Aires. Annual revenues are approximately US\$30 million.

Oboni & Associates Inc.: Chile

Oboni & Associates (O&A) is organized as a cluster of independent productivity centres in Canada and Switzerland and is 50 percent owner of G-O Partnership, a multinational operation with worldwide activities and offices in the US and Europe. O&A is organized in four operational divisions: environmental sciences; risk management; special foundations and shorings; and trenchless technologies, underground structures and tunnel design. O&A has worked for municipal, industrial, transport (road, train, pipes and power), petrochemical and mining clients. O&A can perform as either a specialized consultant or as a general engineer in English, French and Spanish and can effectively communicate with clients in Arabic, Italian, Japanese and German.

Philip Analytical Services Corp. — Colombia

Philip Analytical Services Corp. was formed in 1995 by the merger of Zenon Environmental Laboratories and Barringer Laboratories. The parent company, Philip Environmental Inc., is an integrated environmental services company specializing in waste management, by-product recycling, sewage and water treatment and technical services involving environmental testing, remediation and consulting. Philip Environmental Inc. is Canada's largest recycler of hazardous and nonhazardous industrial wastes, and one of Ontario's largest waste management companies. Currently, Philip Environmental Inc. is Canada's largest environmental laboratory network, and ranks in the top 15 in North America in terms of revenue. The major focus at Philip Analytical Services is on environmental testing, with services for testing a complete range of environmental samples, including solid wastes, effluents, receiving waters, ground waters, soils, sediments, plant, animal and fish tissues, air emissions and airborne particulates.

R&R Drilling Supply Ltd. — Argentina

R&R Drilling will design and supply remediation and sampling equipment for contaminated sites. They provide innovative solutions to save time and money for the petroleum, environmental and water well industries. Products include: treatment systems (air strippers, carbon absorbers and VCS units); groundwater sampling (bladder pumps, mini pumps and S.S. pumps); vadose zone monitoring devices; soil sampling devices; well casing and screen polyvinyl chloride (PVC), and stainless steel); and sealing materials (bentonite).

Sphag Sorb (Canada) Inc. — Argentina

Sphag Sorb (Canada) Inc. is a privately owned Alberta company formed in 1991 to market environmental products for its parent company, Lakeland Peat Moss Ltd. The Sphag Sorb group of companies was established to manufacture and market an environmentally friendly organic industrial absorbent from Canadian Sphagnum peat moss. Sphag Sorb is a powerful, non-toxic, industrial grade absorbent that encapsulates hydrocarbons, polychlorinated biphenyls (PCBs), heavy metals, pesticides and other organics, on both land and water. Once absorbed, contaminants will not leach, but will remain encapsulated within the peat.

Steffen Robinson & Kirsten (SRK) — Chile

SRK employs more than 400 people in 16 permanent offices on five continents. The company has an office in Santiago, Chile. SRK recognizes that prosperity depends on the responsible and sustainable development of natural resources and manufacturing industries. SRK uses emerging technology and a concern for the future to discover and apply effective solutions to engineering and scientific challenges. SRK offers clients a diversity of expertise including: environmental baseline studies; licensing and environmental impact evaluations; geology; groundwater and contaminant migration; geotechnical engineering; hydrological and hydraulic engineering; water pollution control; acid rock drainage prediction and control; mining engineering and feasibility studies; tailings impoundments and waste dump design; industrial waste treatment and disposal; solid and hazardous waste management; and underground storage tank management.

USTest Inc. — Argentina, Brazil, Chile, Colombia, Venezuela

USTest Inc. is the leading multinational manufacturer of ultrasonic precision testing and environmental management equipment for Underground Storage Tanks (UST) and retail petroleum facilities. The USTest 2000 Precision Testing System and the USTest 2001 Automatic Tank Gauge provide their owners with risk management, site management, remote communication and governmental compliance capability. The company also offers services in conjunction with the sale of its products. These include precision tank testing, site maintenance, cathodic protection engineering and training services. USTest equipment is third party certified as exceeding US Environmental Protection Agency (EPA) standards, UL Listed and European CENELEC approved for intrinsic safety.

Wastewater Technology Centre — Brazil

The Wastewater Technology Centre provides services that address pollution prevention, pollution control, site remediation, residue management needs and environmental analysis. The Centre promotes responsible environmental stewardship through the development, application and commercialization of effective environmental protection systems and know-how providing cost-effective solutions for industry and government. The company's pollution prevention expertise is directed towards industrial process improvement and product recovery. Their pollution control expertise is used to optimize water and wastewater treatment plants and to effectively manage related infrastructure. Their site remediation expertise provides innovative solutions to contaminated soils, sediments and groundwater treatment. Their residue management group offers clients twenty years experience in sludge management and waste containment. The Centre and its clients are well served by their environmental chemistry laboratory which provides specialized environmental analysis and quality control consulting.

Zembik Open Air Protection Inc. — Argentina, Colombia, Chile

Zembik Open Air Protection Inc. is a manufacturing firm distributing an innovative, high quality, instant portable shelter. The Zembik shelter provides protection for and from the environment. It can be set up in a recreational setting and the same shelter may be converted into a greenhouse, an ice fishing hut or a gazebo. In an industrial setting, the Zembik serves as housing for activities such as oil-spill cleanups, emergency relief measures, training and diving operations, fiber optic splicing, forensic operations, and others. These shelters are the only type of protection that operate on a dual action pivot system, which allows them to be set up instantly and with great ease. They are easily transported on the back of a full-sized half-ton truck. The pivots are made of high density polyethylene and are attached to a skeleton frame of high quality zinc coated steel. Materials of the consumer's choosing wrap the frame to make the protection unit complete.