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Environmental Markets in Central America



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CONTENTS

EXECUTIVE SUMMARY

CHAPTER 1 REGIONAL OVERVIEW

- 1.1 Political Trends, Economic Growth, and Urbanization
- 1.2 Major Environmental Issues
- 1.3 Environmental Market Opportunities

CHAPTER 2 COUNTRY PROFILES

- 2.1 Belize
- 2.2 Costa Rica
- 2.3 El Salvador
- 2.4 Guatemala
- 2.5 Honduras
- 2.6 Nicaragua
- 2.7 Panama

CHAPTER 3 WATER DELIVERY

- 3.1 Market Needs
- 3.2 Market Opportunities
- 3.3 Strategic Market Considerations

CHAPTER 4 WATER POLLUTION CONTROL

- 4.1 Market Needs
- 4.2 Market Opportunities
- 4.3 Strategic Market Considerations

CHAPTER 5 WASTE MANAGEMENT

- 5.1 Market Needs
- 5.2 Market Opportunities
- 5.3 Strategic Market Considerations

CHAPTER 6 AIR POLLUTION CONTROL

- 6.1 Market Needs
- 6.2 Market Opportunities
- 6.3 Strategic Market Considerations

CHAPTER 7 GREEN ENVIRONMENTAL MARKETS

- 7.1 Market Needs
- 7.2 Market Opportunities
- 7.3 Strategic Market Considerations

CHAPTER 8 RENEWABLE ENERGY

- 8.1 Market Needs
- 8.2 Market Opportunities
- 8.3 Strategic Market Considerations

CHAPTER 9 ENERGY EFFICIENCY

- 9.1 Market Needs
- 9.2 Market Opportunities
- 9.3 Strategic Market Considerations

APPENDIX A – CONTACT LIST

BIBLIOGRAPHY

EXHIBITS

EXECUTIVE SUMMARY

- ES-1 Annual Environmental Market
- ES-2 Summary of Environmental Market Potential by Country and Sector

CHAPTER 1 REGIONAL OVERVIEW

- 1-1 Net Tourism Revenues
- 1-2 Import Tariffs of CACM Countries
- 1-3 Projected Population Shift: Urban vs. Rural Population
- 1-4 Range of Population Sizes in Central American Cities
- 1-5 Ranking of Major Environmental Problems
- 1-6 Comparison of Environmental Market Opportunities in Central America

CHAPTER 2 COUNTRY PROFILES

- 2-1 Comparison of Country Statistics

CHAPTER 3 WATER DELIVERY

- 3-1 Population with Access to Potable Water
- 3-2 Estimated Level of Investment Needed to Achieve 100% Coverage for Potable Water
- 3-3 Key Water Utilities in Central America
- 3-4 Finding Innovative Solutions to Extend Water Supply Systems
- 3-5 Sources of Water Supply
- 3-6 Disinfection Systems for Potable Water in the ANDA Network
- 3-7 System Losses of Central American Water Utilities
- 3-8 Selected Donor-Supported Water Delivery Projects
- 3-9 Water Sector Privatization in Select Countries
- 3-10 Market Outlook for the Water Delivery Sector

5

CHAPTER 4 WATER POLLUTION CONTROL

- 4-1 Population with Access to Sanitation Services
- 4-2 Key Water Utilities in Central America
- 4-3 Existing Municipal Wastewater Treatment Facilities
- 4-4 Selected Donor-Supported Sanitation and Wastewater Projects
- 4-5 Environmental Impacts of the Coffee Industry
- 4-6 Market Outlook for Wastewater Control and Prevention Technologies

CHAPTER 5 WASTE MANAGEMENT

- 5-1 Estimated Solid Waste Generation in the Greater Metropolitan Area of Guatemala City
- 5-2 Projected Growth in Urban Populations
- 5-3 Projected Growth in Solid Waste Generation
- 5-4 Plastic Wastes in the Agro-Industrial Sector
- 5-5 Volume of Solid Waste and Types of Disposal Sites
- 5-6 Composition of Solid Wastes: Tegucigalpa
- 5-7 Market Outlook for the Waste Management Sector

CHAPTER 6 AIR POLLUTION CONTROL

- 6-1 Sources of Air Emissions
- 6-2 Vehicle Emissions and Catalytic Converter Requirements
- 6-3 Suspended Particulates from Vehicles in Costa Rica
- 6-4 ProEco Clean Air Program
- 6-5 Air Pollution Technology Opportunities
- 6-6 Petroleum Refining Capacity in Central America
- 6-7 Utility-Owned Oil-Fired Generating Units > 30 MW
- 6-8 Industrial Sector Activity in Costa Rica
- 6-9 Market Outlook for Air Pollution Control Technologies and Services
- 6-10 Decision Makers for Air Pollution Control Opportunities

CHAPTER 7 GREEN ENVIRONMENTAL MARKETS

- 7-1 Deforestation in Central America
 - 7-2 Central American Wood Production by Type
 - 7-3 Fertilizer and Pesticide Use in Central America
 - 7-4 Selected Donor-Supported Natural Resource Projects
 - 7-5 Market Outlook for Green Environmental Markets
 - 7-6 Decision Makers for Green Environmental Market Opportunities
- 

CHAPTER 8 RENEWABLE ENERGY

- 8-1 Population with Access to Electricity
- 8-2 Per Capita Electricity Consumption
- 8-3 Peak Generating Capacity Needs
- 8-4 Capacity and Generation Mix
- 8-5 Public Sector Renewable Energy Projects
- 8-6 Ongoing Private Renewable Energy Projects
- 8-7 New Renewable Energy Opportunities in Costa Rica
- 8-8 Status of Power Sector Privatization in Central America
- 8-9 Market Outlook for the Renewable Energy Sector
- 8-10 Technical Potential for Renewable Energy
- 8-11 Electricity Generation Power Price Markers
- 8-12 Technical Support Network for Renewable Energy/Energy Efficiency
- 8-13 Private Power Sector Regulation in Central America

CHAPTER 9 ENERGY EFFICIENCY

- 9-1 Energy Consumption by Sector and Fuel Source
- 9-2 Energy Efficiency Target Market
- 9-3 Energy Efficiency Opportunities
- 9-4 Regulation-Mandated Energy Efficiency in Costa Rica
- 9-5 Market Outlook for Energy Efficiency
- 9-6 Oil Prices in Central American Countries
- 9-7 Electricity Prices by Sector

7

ACRONYMS AND ABBREVIATIONS

ANDA	Administración Nacional de Acueductos y Alcantarillados (El Salvador)
AWEA	American Wind Energy Association
AYA	Instituto Costarricense de Acueductos y Alcantarillados (Costa Rica)
BOD	biochemical oxygen demand
BOO	build-own-operate
BOOT	build-own-operate-transfer
BOT	build-operate-transfer
Btu	British thermal unit
BUN	Biomass Users Network
CACM	Central American Common Market
CEL	Comisión Ejecutiva Hidroeléctrica del Río Lempa (El Salvador)
CESCCO	Centro de Estudios y Control de Contaminantes (Honduras)
CFA	Corporación Financiera Ambiental, S.A.
CFL	compact fluorescent lamp
CO	carbon monoxide
COD	chemical oxygen demand
COHDEFOR	Honduran Forestry Development Corporation
CONAMA	Comisión Nacional del Medio Ambiente (Guatemala / El Salvador)
CRA	comparative risk analysis
DOE	Department of Environment (Belize)
DSM	demand-side management
EACA	Empresas Ambientales de Centroamérica
EEAF	Environmental Enterprises Assistance Fund
EIA	environmental impact assessment
EMPAGUA	Empresa Municipal de Agua de la Ciudad de Guatemala (Guatemala)
ENEE	Empresa Nacional de Energía Eléctrica (Honduras)
ESCO	energy service company
FTAA	Free Trade Area of the Americas
GNP	gross national product
GDP	gross domestic product
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (Germany)
GW	gigawatt
GWh	gigawatt hour
ICAITI	Central American Institute for Research and Industrial Technology
ICE	Instituto Costarricense de Electricidad (Costa Rica)
IDAAN	Instituto de Acueductos y Alcantarillados Nacionales (Panama)
IDB	Inter-American Development Bank
IFC	International Finance Corporation
INAA	Instituto Nicaragüense de Acueductos y Alcantarillados (Nicaragua)
INFOM	Instituto Nacional de Fomento Municipal (Guatemala)
INRENARE	Instituto Nacional de Recursos Naturales Renovables (Panama)

IPP	independent power project
IRHE	Instituto de Recursos Hidráulicos y Electrificación (Panama)
ISDEM	Instituto Salvadoreño de Desarrollo Municipal (El Salvador)
ISO	International Organization for Standardization
JI	Joint Implementation
kgoe	kilogram oil equivalent
MARENA	Ministerio del Ambiente y los Recursos Naturales (Nicaragua)
MINAE	Ministerio del Ambiente y Energía (Costa Rica)
MBOE	million barrels of oil equivalent
MW	megawatt
NAFTA	North American Free Trade Agreement
NGO	nongovernmental organization
NRECA	National Rural Electricity Cooperative Association
O&M	operations and maintenance
PAHO	Pan American Health Organization
PRIDE	Project in Development and the Environment
PV	photovoltaic
REPSO	Renewable Energy Project Support Office
SANAA	Servicio Autónomo Nacional de Acueductos y Alcantarillados (Honduras)
SEDA	Secretaría de Estado en el Despacho del Ambiente (Honduras)
SEMA	Secretaría Ejecutiva del Medio Ambiente (El Salvador)
SETSSA	Servicios Técnicos de Ingeniera, SA de CV (El Salvador)
SMC	sugar mill cogeneration
TSP	total suspended particulates
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
WASA	Water and Sewerage Authority (Belize)
WHO	World Health Organization
WTO	World Trade Organization
WWT	wastewater treatment

EXECUTIVE SUMMARY

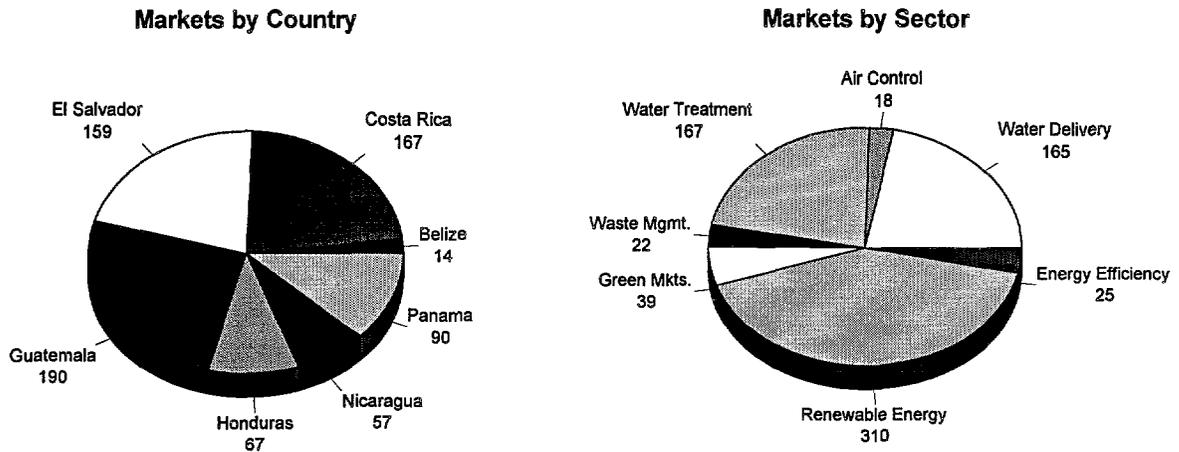
The countries that comprise Central America are emerging as an important regional environmental market. This decade has witnessed the resolution of domestic conflicts in Nicaragua, El Salvador, and Guatemala; democratically-elected governments now prevail in every Central American country. As a result, the region is experiencing an unprecedented level of peace and stability that is allowing the region to focus on economic growth and the many infrastructure investment needs that have long been ignored. Multilateral development bank funding, enormous unmet needs in the environment sector, and a growing concern for the environment should create a potential annual market for environmental products and services of \$744 million per year over the next five years. Regulatory reform, continued economic growth, and increasing urbanization will create an even larger market in the next decade.

This large environmental market should create important opportunities for environmental technology and service companies, private investors, and other organizations actively involved in environmental markets. This report highlights the potential environmental market opportunities in Central America, which have historically received less attention than neighboring markets in Mexico and South America. The report thus provides private companies and other organizations an initial framework for evaluating environmental market opportunities in Central America in more detail.

BEST MARKET SECTORS: BASIC ENVIRONMENTAL INFRASTRUCTURE

The most important environmental market opportunities are those that will help address the region's enormous needs for basic environmental services such as clean, renewable energy power plants, water delivery systems, and water pollution control technologies. Nearly one-half of the region's 33 million people do not have access to electricity. One-third of the population lacks water and sanitation services. These three sectors represent environmental markets of over \$640 million per year, or over 90% of the region's total environmental market (see Exhibit ES-1). The three largest markets — Guatemala, Costa Rica, and El Salvador — account for nearly three-quarters of the region's total estimated near-term environmental market.

EXHIBIT ES-1
ANNUAL ENVIRONMENTAL MARKET
(\$ Millions)
Total Market = \$744 Million



Source: Hagler Bailly, 1997

Water Delivery

There is a market potential of about *\$165 million per year* for urban water delivery system expansion and rehabilitation, storage and treatment facilities, and metering and other ancillary services. These estimated expenditures will supply only a portion of the region's enormous needs for extending water distribution networks, improving water quality, increasing water storage capacity, and enhancing water supply management. To extend coverage to the 10.4 million people who do not have water delivery access would require an estimated \$1.4 billion in capital investments.

Sources of Opportunities. Most water delivery sector opportunities are expected to be publicly funded. The largest single source of funds will be multilateral development banks, which have outstanding commitments to lend nearly \$200 million for water delivery in Central America, mostly for large-scale water delivery and treatment projects. Public projects undertaken without multilateral development bank funding will be mostly small-scale systems in rural areas or for incremental expansion and rehabilitation of existing systems. Guatemala will account for about 40% of short-term demand;¹ Costa Rica, El Salvador, and Nicaragua together account for another 40% of estimated short-term water delivery demand (see Exhibit ES-2).

¹ Because Japanese donor funding is expected to finance many water delivery projects in Guatemala, opportunities may be limited to Japanese companies.

EXHIBIT ES-2
SUMMARY OF ENVIRONMENTAL MARKET POTENTIAL BY COUNTRY AND SECTOR
(Millions US\$ per Year)

<i>Country</i>	Water Delivery	Water Pollution Control	Waste Mgmt.	Air Control Markets	Green Envir. Markets	Renewable Energy	Energy Efficiency	Total
Belize	2.4	8.0	0.5	1.5	2.0	0.0	0.0	14
Costa Rica	18.5	24.0	2.5	4.9	8.0	103.9	5.6	167
El Salvador	26.0	35.5	8.0	2.2	8.0	74.3	5.2	159
Guatemala	70.0	36.0	6.0	4.5	6.0	60.6	7.2	190
Honduras	13.4	21.0	0.5	1.4	2.5	26.2	2.0	67
Nicaragua	21.4	20.0	3.0	1.5	2.5	7.0	2.0	57
Panama	13.0	23.0	2.0	1.5	10.0	37.9	2.8	90
Total	165	167	22	18	39	310	25	744

Source: Hagler Bailly, 1997

Best bets for U.S. companies in the water delivery market over the next five years include:

- ▶ feasibility studies
- ▶ system design
- ▶ small- and medium-scale water treatment facility engineering and construction
- ▶ rural water system construction
- ▶ metering and other ancillary equipment.

Other Opportunities. Ongoing water sector restructuring in countries such as El Salvador, Honduras, and Panama will create short-term technical advisory opportunities and long-term privatization opportunities involving large-scale system acquisition, rehabilitation, management, operation, and maintenance. Small-scale, privately-owned water systems will be needed at tourist facilities.

Water Pollution Control

Demand for siting, design, construction, and equipment for water pollution control facilities will create a potential market estimated at **\$167 million per year**. High levels of investment are needed to meet the needs of 11.5 million people who have no sanitation services. Few municipalities have wastewater treatment facilities; few industries treat their wastewater.

Sources of Opportunities. Public funding will finance the majority of all market opportunities in this sector. Planned donor commitments of \$375 million, an average of \$75 million per year, account for nearly half of the sector's demand and will primarily support large-scale sewerage and treatment

projects for large- and medium-size cities. Domestic public funding will help support smaller sanitation and treatment projects in rural areas. International private companies responding to public relations concerns are likely to be adding wastewater treatment plants or other water pollution control technologies each year. Demand should be spread fairly evenly throughout the region, with all countries except Belize accounting for over \$20 million per year.

Best bets for U.S. companies in the Central American water pollution control market include:

- ▶ siting, design, and construction of large, donor-funded sewerage and municipal wastewater treatment projects
- ▶ pumps, pipes, filters, and other equipment
- ▶ small-scale industrial wastewater treatment facilities
- ▶ monitoring equipment
- ▶ low-cost alternative treatment technologies.

Privatization opportunities for system rehabilitation and management should emerge in the long term.

Renewable Energy

Renewable energy is the largest single environmental market in Central America. Anticipated annual market demand is **\$310 million**. The region has significant power needs. About 15 million people do not have access to electricity; Central American countries will need to add about 2.6 GW of electricity capacity over the next ten years. Small renewable energy projects will satisfy a large portion of total market demand because they will serve the region's need for a diverse mix of small and reliable generating plants with low operating costs. Renewable energy is a cost-effective alternative to fossil fuel plants in a region that lacks indigenous fossil fuel resources and gas pipeline infrastructure.

Sources of Opportunities. Market demand over the next five years will be fairly evenly divided between public and private funding for active projects and new projects. The best renewable energy markets over the next five years should be in Costa Rica, El Salvador, and Guatemala.

Best bets for U.S. companies include:

- ▶ private ownership/operation of small hydro, geothermal, and sugar mill cogeneration projects
- ▶ rural photovoltaic projects
- ▶ engineering, design, procurement, construction, and rehabilitation of public hydroelectric projects.

OTHER MARKET SECTORS

The remaining four sectors examined in this report account for only about 10% of the total estimated environmental market demand: waste management, air pollution control, green environmental markets, and energy efficiency. The lack of a strong regulatory framework and public funding limits short-term opportunities. Central America does, however, have significant unmet needs in each of these sectors. Pressures to solve these problems should create long-term opportunities.

Waste Management

Estimated demand for solid waste management services is *\$22 million per year*. El Salvador accounts for about one-half of market demand due to significant multilateral funding. Less than half of all solid waste is collected in Central America and much less than half is properly disposed. Moreover, the volume of solid waste generated should double in the next 20 years. The region needs increased waste collection mechanisms, new and rehabilitated landfills, incineration facilities, and alternative waste management programs, including recycling and composting. The lack of regulatory enforcement and the public controversy surrounding solid waste management will limit short-term opportunities for U.S. companies. Profitable opportunities will be donor-funded and will be limited to consulting services, vehicles and equipment, transfer stations, and alternative waste processing techniques such as composting.

Air Pollution Control

The air pollution control market in Central America is estimated at *over \$18 million per year*. Guatemala and Costa Rica account for two-thirds of market demand. The best bets for U.S. companies are for ambient air quality monitoring, vehicle emissions testing, and select industrial facility monitoring and control equipment. There is limited donor funding for programs in this sector, and many of these programs may not be open to U.S. firms.

Energy Efficiency

There is a potential annual market of about *\$25 million per year* for energy-efficient equipment and services, mostly in El Salvador, Guatemala, and Costa Rica, where there is potential for about \$100 million per year in industrial and commercial sector energy savings. This \$25 million *market* potential is much less than the region's *technical* potential for energy savings. The energy savings potential is about \$300 million per year in the industrial and commercial sectors alone. The market potential is limited by several factors: the low priority historically given to energy efficiency; the ability of the region to implement many simple energy efficiency measures on its own at low or no cost; the region's history of subsidized energy prices; and the lack of regulation-driven DSM in most countries. The energy efficiency market should expand in the next decade as countries in the region continue to reform energy prices and give greater priority to energy efficiency.

In the near term, the “best bets” for U.S. companies are for sales and installation of energy-efficient industrial motors and commercial lighting. Opportunities for energy audits and other energy-saving services are beginning to emerge in countries such as El Salvador.

Green Environmental Markets

There is a potential green environmental market of *\$39 million per year* in sustainable agricultural and forestry and related advisory services. These services will help Central American countries address their “green” environmental problems, i.e., deforestation, soil erosion, and excessive use of harmful pesticides that have resulted from unsustainable forestry and agricultural practices. Sustainable forestry and farming methods offer the best hope for helping the region solve these green environmental problems, which are a significant concern in the region, contributing to water and other forms of pollution. The \$39 million market potential should result from new donor funding programs and the increasing profitability of sustainable forestry and farming methods. The current regulatory environment is suppressing further market growth by not allowing sustainable agricultural and forestry practices to compete on a level playing field with unsustainable methods. A larger potential market may develop in the next decade if the region adopts reforms that address these inequities.

STRATEGIC CONSIDERATIONS

U.S. companies seeking to do business in Central American environmental markets need to be aware of several factors that will affect all of the above environmental sectors:

- ▶ diffuse decision making authority
- ▶ changing regulatory environments
- ▶ constrained ability to pay
- ▶ growing community involvement and public pressure
- ▶ variable competitiveness of renewable energy and energy efficiency.

Decision Makers

The decision making authority in nearly all Central American countries for environmental matters is regionally and administratively diffuse. Particularly in the water and sanitation sectors, central government agencies often have overlapping responsibilities and unclear lines of authority. Administrative power is increasingly decentralized, with municipal, local, and regional governments gaining more control over environmental product and service issues. The extent of local authority remains unclear, however. Moreover, municipalities often lack experience making procurement decisions and rarely have sufficient capital to purchase environmental infrastructure.

Suggested Strategies. Companies will often need to contact many levels of government to complete a project. The lines of authority will likely be clearer on large donor-funded projects and projects in large urban areas. Even in donor-funded transactions, separate government ministries may be responsible for equipment procurement subject to multilateral guidelines. Companies also need to recognize that most donor-funded projects will be one-time deals; industrial and other projects may offer a better avenue for ongoing business opportunities.

Regulatory Environment

Central American countries, with a few exceptions, have yet to enact water, solid waste, air, and other environmental regulations and standards. The weak regulatory environment constrains opportunities in many markets because it creates no incentives for environmental management. These regulatory incentives are the factors that traditionally drive environmental markets in most countries. Most countries, however, are beginning to develop an environmental regulatory framework that will lead to standards in the future.

Most countries are liberalizing their power sectors, and water sector liberalization is being contemplated. In the long term, these changes will create more opportunities. For now, the uncertainty about the exact intent of new policies and the future direction of reform creates uncertainty that can complicate business development.

Suggested Strategies. New regulations and stricter enforcement may soon dramatically expand market opportunities in each of the environmental sub-sectors. Companies should, therefore, position themselves to take advantage of emerging opportunities by actively following the development and implementation of new regulations. Companies also may wish to investigate donor-funded opportunities or invest resources to explore opportunities in advance of further regulatory changes.

Ability to Pay

Central American countries are still relatively poor: 1995 average per capita GNP was about \$1,400. Annual per capita GNP is as low as \$390 in Nicaragua and \$600 in Honduras. The ability to pay for services in the water, sanitation and waste management sectors is particularly poor because of low rates charged for services and a poor record of collection. Power sectors are relatively better off, but electricity tariffs are still subsidized in some countries. These "ability to pay" issues complicate market expansion and create credit problems for larger projects in need of financing.

Suggested Strategies. Companies need to focus attention where the ability to pay for services is well defined such as donor-funded projects, industrial sector projects for large international companies, and private power projects with adequate security packages. Even private projects may require multilateral credit support (e.g., financing from the IFC or the private sector arm of the IDB).

Community Involvement and Public Pressure

Community involvement and public pressure are factors in many sectors. Green market projects require some level of community involvement and support to be successful. Public pressure will play a key role in determining many opportunities (e.g., air pollution control on visible pollution sources). Local support is readily available for renewable energy projects.

Suggested Strategies. Companies need to take advantage of local support and involvement wherever it is available. Companies should be apprised of how local public pressure may create specific opportunities.

Competitiveness of Renewable Energy and Energy Efficiency

Renewable energy and energy efficiency both face competition directly or indirectly from fossil fuel and other power resources. Fortunately, most of the strategic considerations affecting their ability to compete are favorable: renewable energy resources are often cost competitive, there is a large resource base for renewable energy, and energy prices have been rising and are increasingly favorable to energy efficiency projects. Some strategic considerations, however, do not favor renewable energy and energy efficiency, including power sector restructuring that may create competitive markets in which prices are determined hourly. (In other countries, competitive markets have led to lower prices which makes obtaining a fair return on capital for renewable and energy efficiency projects difficult.)

Suggested Strategies. Renewable energy companies need to carefully compare their projects' costs with the those of available alternatives. In countries where governments are considering power sector unbundling, the cost of alternatives may be lower. Energy efficiency companies should consider targeting industrial sector energy consumers who may be shouldering a disproportionate share of a country's power cost burdens.

CHAPTER 1 REGIONAL OVERVIEW

After decades of civil war, peace has finally been restored to Central America. Peace agreements were signed in Nicaragua in 1990, in El Salvador in 1992, and finally in Guatemala in December 1996. Peace and political stability have stimulated the regional economy: the region's combined gross domestic product is now more than \$47 billion, up from \$26.3 billion in 1990.¹ With most countries striving to achieve annual GDP growth rates of 4-5%, the outlook for continued economic growth is generally optimistic.

As a result of increased prosperity and political stability, Central American countries are now able to turn their attention to the environmental problems facing the region. Central American governments, and the public in general, are increasingly aware of the extent of the region's environmental degradation and the need to address it. As Central Americans enjoy the benefits of improved economies and greater democracy, they will demand cleaner water and air, and greater protection of their natural resources.

This report provides environmental technology and service companies, private investors, and other organizations actively involved in environmental markets with an initial framework for evaluating environmental market opportunities in Central America. The smaller markets of Central America have historically received less attention than neighboring markets in Mexico and South America. But there is a strong need for environmental technologies and services that is directly related to the challenges many Central American countries face with respect to deteriorating environments and growing human health problems. These factors, combined with the improving economic and political conditions, suggest that Central America offers promising environmental market opportunities.

The report focuses on the seven countries of Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. Bordered on the north by Mexico and the south by Colombia, Central America covers an area of 523,774 km². Although Central America is only three-fourths as large as the state of Texas, it is home to nearly twice as many people. The region's 1995 population was 32.7 million. It is projected that by 2025, its population will grow by more than 50% (or 1.5% per year) to 51 million.

The following three sections outline the major political, economic and social trends in Central America, the major environmental issues facing the region, and the most promising environmental market opportunities.

¹ International Monetary Fund. 1996. *International Financial Statistics*, Washington, D.C.

1.1 POLITICAL TRENDS, ECONOMIC GROWTH, AND URBANIZATION

Current political, economic, and social trends point to an attractive business climate for environmental technologies and services. The political climates are, arguably, more stable now than at any time in the last two decades; the regional economy has rebounded after the economic crises of the 1980s, and the region's population is more mobile and is seeking more favorable employment opportunities and lifestyles. The main trends discussed in this section are as follows:

- ▶ increasing political stability and decentralization of authority
- ▶ greater economic prosperity and openness
- ▶ urbanization.

The convergence of these trends has created the necessary conditions to support an emerging environmental market.

Political Trends

Major political trends are transforming Central America. There are two primary trends in Central America with implications for the environment: the achievement of peace and democracy and the decentralization of authority to the regional and municipal levels.

- ▶ ***Peace and Democracy.*** Since the early 1990s, the countries of Central America have made substantial progress in creating a peaceful and politically stable region. The civil wars that marred the previous two decades are largely a thing of the past. The signing of a peace accord in Guatemala in December 1996 marked the end of a long period of conflict in that country. Now, for the first time since the 1960s, there is no significant civil strife in any Central American country. In addition, over the past few years, various Central American countries have taken important steps toward establishing democratic regimes. Peace and political stability have allowed these countries to restructure their economies and to focus on environmental issues.
- ▶ ***Decentralization.*** Over the last three years Central American political leaders have begun to decentralize political, administrative, and fiscal responsibility. In many cases this process stems from peace negotiations and agreements between the governments and rebel forces. Panama recently changed its law to allow for the direct election of mayors at the local level; previously, mayors were politically appointed by the central government. Most countries are undergoing reforms to allow municipalities to assess property taxes. These tax revenues are essential for meeting the growing demand for services, including the provision of drinking water, sewage collection and treatment, and garbage collection. Costa Rica, Nicaragua, and Guatemala have delegated responsibility for these services to the municipalities. A key outcome of this process is the emergence of new decision makers at the local level.

Economic Growth

Central American economies have improved substantially in the first half of this decade. During the 1980s, poor economic performances resulted in an average annual per capita income loss of 1.5% for the region. In the 1990s Central American countries began implementing various economic reform measures to stabilize and improve their economies. Between 1990 and 1994 the region experienced a real annual economic growth rate of more than 4%. Partly as a result of renewed economic growth, foreign direct investment is again flowing into the region. Foreign direct investment totaled \$547 million in 1993, a fourfold increase from 1986.

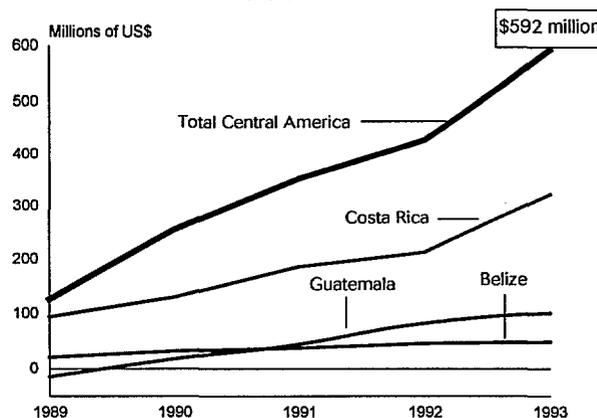
External debt burdens have declined in the 1990s, improving the capacity of Central American governments to finance environmental improvement programs through debt or other financial instruments. The average external debt fell from 100% of GDP in 1989 to around 80% in the early 1990s. Most of the countries have undergone some type of debt restructuring scheme approved by their international creditors. Agreements with the Paris Club have provided additional debt relief. In a number of cases, international creditors have approved more than \$80 billion in debt-for-nature swaps, whereby the country's external debt is forgiven provided the government takes certain steps to improve the environment or converts the debt into local currency for investment in environmental programs.

There are several encouraging signs for future growth potential and employment creation. The first is growth in nontraditional exports such as fresh flowers, ornamental plants, melons, strawberries, pineapples, grapefruit, palm oil, and light manufacturing. These nontraditional exports increased 15% during the same period. Traditional exports such as coffee and sugar, however, increased only 2% from 1990-1992. The continued expansion of nontraditional exports should reduce Central America's vulnerability to external shocks to some degree.

The growth of eco-tourism has also provided a significant boost to the economies of many of the countries in the region. As Exhibit 1-1 illustrates, tourism revenues have increased dramatically in the last few years. The primary beneficiaries of this growth have been Costa Rica, Belize, and Guatemala, which together accounted for 80% of the region's tourism revenues in 1993. Revenues from tourism to Costa Rica increased no less than 50% every year during the five-year period 1989-1993, increasing from \$94 million in 1989 to \$322 million in 1993.

An important part of the region's economic recovery is the effort Central American countries have made to build outward-looking macroeconomic and sectoral frameworks. To support this effort, the countries in the region have defined two important areas for coordination: economic integration and trade.

EXHIBIT 1-1
NET TOURISM REVENUES
(1989-1993)



Source: Inter-American Development Bank

- ▶ **Economic Integration.** The efforts by Central American countries to integrate their economies and manage regional trade are creating a framework that will allow environmental companies to approach the region as one large market rather than seven individual markets. As an economically integrated region, Central America's GDP of \$47 billion is more than three times that of the region's largest single economy, Guatemala. A key element of the region's economic integration is to create bigger markets that will be better able to attract foreign investment. The freer flow of goods and services between countries will also facilitate doing business in the region, stimulating economic growth. This growth will help these countries to alleviate poverty and unemployment, and acquire more environmental goods and services. Transportation, infrastructure systems, and the capital markets are some of the key areas targeted for regional integration.

- ▶ **Regional Trade.** Two important initiatives are shaping trade conditions in the region: the Central American Common Market (CACM) and the Free Trade Area of the Americas (FTAA). Under the first initiative, CACM, Central American countries have agreed to lower their tariffs to uniform levels. The agreed common external tariff now ranges from 5% to 20% (see Exhibit 1-2). With the recent entry of Panama and Honduras, CACM now encompasses all seven countries in the region. In addition, the members of CACM actively use export promotion schemes to diversify and increase exports.

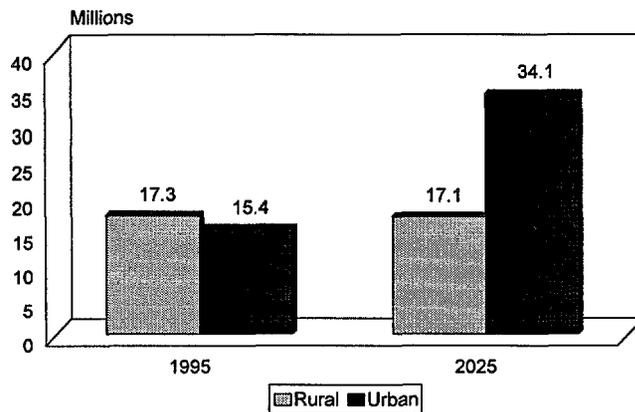
EXHIBIT 1-2 IMPORT TARIFFS OF CACM COUNTRIES	
Capital goods not produced domestically ²	1-5%
Raw materials and finished goods not produced domestically	5%
Production inputs produced domestically	10%
Capital goods produced domestically	15%
Finished goods produced domestically	20%

Source: El Industrial, "Situación Actual del Arancel en Centroamérica." 1996

The proposed FTAA would encompass 34 countries in the Western Hemisphere. If the FTAA is established, numerous regional trade pacts that currently exist would be harmonized under an umbrella free trade agreement. The resulting regional block might resemble a "NAFTA of the Americas." Central American countries would benefit from the FTAA for two reasons. First, the regional trading blocks to which many countries outside Central America currently belong (e.g., NAFTA) threaten to diminish the market's attention to the small economies of Central America. Secondly, as members of the FTAA, Central American countries would enjoy larger markets for their exports and would be able to import goods at a lower cost.

² The tariffs in this category vary by country: 1% - El Salvador, Guatemala, and Nicaragua; 3% - Costa Rica; 5% - Honduras.

EXHIBIT 1-3
Projected Population Shift
 Urban vs. Rural Population



Source: World Resources Institute

Urbanization

Central America is experiencing a significant shift in population distribution as more and more residents move to cities (see Exhibit 1-3). Urban areas offer more employment opportunities, higher incomes, greater access to social services and education, and often the promise of a better quality of life. Central America's urban population has doubled between 1975 and 1995, from 7.7 million to 15.4 million. The region's urban population is projected to more than double again by 2025, reaching 34.1 million. Exhibit 1-4 lists the major cities in Central America according to population size.

EXHIBIT 1-4 RANGE OF POPULATION SIZES IN CENTRAL AMERICAN CITIES	
Number of Residents	City
Greater than 1,000,000	Guatemala City, Guatemala San Salvador, El Salvador
500,000 - 1,000,000	Tegucigalpa, Honduras Managua, Nicaragua Panama City, Panama
250,000 - 500,000	San José, Costa Rica San Pedro Sula, Honduras
150,000 - 250,000	Alajuela, Costa Rica San Miguel, El Salvador Santa Ana, El Salvador León, Nicaragua San Miguelito, Panama
100,000 - 150,000	Goicoechea, Costa Rica Cartago, Costa Rica Desamparados, Costa Rica Mejicanos, El Salvador Nueva San Salvador, El Salvador Chinandega, Nicaragua Masaya, Nicaragua David, Panama Colón, Panama

Source: USAID. 1996. *Informe sobre el Análisis Comparativo de Riesgos en Centroamérica: Volume I*. Washington, D.C., p. I-3

Urbanization has long-term implications for the structure of these countries' economies. The role of agriculture has decreased, while export-oriented agro-industries, manufacturing, and tourism have grown. This structural shift is likely to continue. Moreover, Central American countries will find it increasingly difficult to manage their natural resources and provide the necessary infrastructure to protect the environment as urban populations grow and demand more goods and services. Urbanization is straining the region's ability to maintain an adequate level of environmental services (e.g., water delivery, wastewater treatment, solid waste collection, air pollution control). Urban areas, for example, generate more than twice the solid waste per resident as rural areas.

The concentration of population growth in urban areas means that the projected 50% increase in total population by 2025 will more than double the total volume of solid waste generated in Central America.

1.2 MAJOR ENVIRONMENTAL ISSUES

Central America faces serious threats to its environment but lacks the institutional, technical, financial, and human resources to effectively address the situation. The region is just beginning to address its myriad environmental problems. Uncontrolled pollution and degradation have negatively affected the region's natural resources and biodiversity. In addition, many citizens lack basic water, sanitation, and waste services that would help to control pollution.

Central American governments have begun to create the institutional and legal frameworks that will allow them to protect the environment more effectively. But they face challenges here as well. Environmental management efforts are constrained by unclear institutional structures, the lack of environmental legislation, and weak enforcement efforts.

Overview of Environmental Problems

The principal environmental concerns in the region include deforestation, water pollution, solid waste, pesticides, and air pollution. Many of Central America's environmental problems are due to the lack of infrastructure that would otherwise prevent much of the pollution. This lack of infrastructure includes minimal sewerage systems, wastewater treatment facilities, garbage collection vehicles, landfills, and air pollution controls.

Many of the region's environmental problems are interrelated with issues of health and disease. Infectious diseases such as cholera, diarrhea, gastroenteritis, and hepatitis are associated with inadequate potable water and sanitation services. Air pollution contributes to respiratory illnesses. Excessive or improper use of pesticides affects the health of agricultural workers. The high incidence of environment-related health problems lends an added urgency to the need to address environmental degradation.

Deforestation is arguably the principal environmental problem facing Central American countries. Central America's deforestation rate is about twice the global average for tropical forests (much of Central America's forest cover is tropical). Several of the countries are losing between 70,000 and 90,000 hectares per year of forests. Several factors contribute to these high rates of deforestation: harvesting wood for fuel and energy production, clearing land for agriculture production and cattle ranching, and over-exploiting timber resources. The impacts of deforestation include soil erosion, watershed degradation, loss of biodiversity, and changes in climate patterns. Deforestation has also affected watersheds, disrupting the local water cycles and causing water shortages.

A recent USAID-funded project worked with communities in each Central American country to rank the major environmental problems faced by the region (setting aside deforestation and other “green” issues). The project conducted a comparative risk analysis (CRA) to prioritize environmental problems; the results are presented in Exhibit 1-5. The rankings reflect the combined judgement of environmental professionals from each country and are based only in part on an analysis of quantitative data. Each problem is discussed briefly below.

EXHIBIT 1-5 RANKING OF MAJOR ENVIRONMENTAL PROBLEMS					
Country	Wastewater	Potable Water Contamination	Solid Waste	Air Pollution	Pesticides
Belize	✓✓✓	✓	✓✓	—	—
Costa Rica	✓✓	—	—	✓✓✓	✓
El Salvador	✓✓✓	—	✓	—	✓✓
Guatemala	✓✓✓	—	✓✓	—	✓
Honduras	✓✓✓	—	✓✓	—	✓
Nicaragua	✓✓✓	—	✓✓	—	✓
Panama	✓	—	✓✓✓	—	✓✓
First-highest priority: ✓✓✓		Second-highest priority: ✓✓		Third-highest priority: ✓	

Source: USAID. 1996. *Comparative Risk Assessment for Central America: Executive Summary*. Washington, D.C.

Wastewater. The inadequate collection and treatment of wastewater is a primary cause of water pollution in Central America. More than 11.5 million people, or 35% of the region’s population, do not have access to sanitation services. Moreover, wastewater that is collected is routinely discharged without any treatment. As a result, virtually every river passing through a major urban area is severely polluted and most major lakes are on the verge of dying. Due to the lack of monitoring, the extent of water pollution in Central America is unknown. However, anecdotal evidence suggests water pollution levels are very high.

Solid Waste. More than 17,000 metric tons of solid waste are generated every day in Central America, of which less than half is collected and disposed of properly. Population growth, urbanization and increasing affluence are spawning ever greater volumes of waste. The sheer quantity of waste is only part of the problem. Solid wastes are typically disposed without any efforts to sort wastes; because hospital and hazardous wastes are not disposed separately, surrounding areas are easily contaminated. In addition, many landfills in Central America do not meet international sanitation standards; thus, seepage from such landfills is contributing to groundwater contamination.

Air Pollution. Air pollution is a growing concern in Central America, particularly in urban areas. High levels of air pollution are seriously affecting human health, with high incidences of respiratory illnesses reported in many areas. The principal sources of air pollution are motor vehicles, industry, waste incineration facilities, land clearing operations, and wood burned as fuel. In most Central American countries, approximately 70% of air pollution is from motor vehicles.

Pesticides. The improper and intensive use of pesticides is a major source of environmental contamination in Central America. The agro-industry is an important sector in the economy and a large contributor to environmental contamination. Excessive pesticide use affects surface and groundwater sources, and aerial spraying is spreading pesticides to population centers in rural areas.

Implementation Issues in Environmental Management

Political and policy constraints affect environmental management efforts in Central America. In most countries the institutional structure supporting environmental management is underdeveloped or simply does not exist. Financial resources and the technical capacity to adequately implement environmental programs or policies are also insufficient. The problem of inadequate institutional resources is compounded by the current trend towards decentralization which is increasingly delegating responsibility for the implementation and enforcement of environmental policy to regional offices.³ These regional offices often suffer from an even more pronounced lack of funding and technical expertise to carry out their mandates. The main impediments to improved environmental management in Central America include the following:

- ▶ unclear delineation of responsibilities
- ▶ lack of implementing regulations
- ▶ lax enforcement of existing regulations
- ▶ lack of appropriate incentives to minimize pollution.

Unclear Delineation of Responsibilities. The environmental management systems in all Central American countries are characterized by multiple agencies with overlapping responsibilities for environmental protection and natural resource management. The result often is ineffective management or duplication of effort. Several countries have tried to remedy this situation by creating one environmental agency, either a ministry, a department within a ministry, or an institution located in the executive branch of the government. However, previously existing agencies retain certain legislative mandates, and thus the lines of authority remain unclear.

Lack of Implementing Regulations. Belize, Costa Rica, Guatemala and Honduras have passed general environmental laws to provide a basis for environmental legislation. Similar laws are pending in El Salvador, Nicaragua, and Panama. Due to the historical absence of such a framework law (and even

³ The initial efforts to decentralize environmental management responsibilities have been in Panama, Costa Rica, Guatemala and, most recently, Nicaragua.

with such a law), Central American countries have tended to introduce environmental legislation through individual ministerial decrees, resulting in an overall legislative framework that is not clear or well-integrated. A more serious barrier to improved environmental management is the general lack of comprehensive implementing regulations and standards. Regulations also tend to focus on end-of-pipe pollution and do not provide economic incentives for clean production or pollution prevention.

Lax Enforcement. The enforcement of environmental laws and regulations is weak in Central America. This is due in part to the newness of some of the laws and regulations and to the relative weakness of the implementing institutions. Also, the legal communities in Central American countries have limited experience with environmental laws. Thus, the legal procedures for imposing penalties or prosecuting polluters are still not clearly defined. Enforcement is also difficult because most of the environmental agencies charged with enforcing environmental laws are understaffed and lack the proper monitoring equipment to establish the extent of violations. Most of the countries have only a limited number of regional monitoring stations and laboratories.

Lack of Appropriate Incentives. Central American countries are just beginning to integrate market-based incentives into their regulatory frameworks as a means of controlling pollution. For example, most consumers have no incentive to consume less water because few water utilities use meters to monitor consumption. In addition, water tariffs have historically been subsidized so that consumers do not pay the true cost for water consumption. Wastewater fees typically represent just a percentage of the water bill rather than being based on a “polluter pays” principle. Some countries are considering eliminating subsidies for such services as potable water in an effort to encourage conservation.

While these impediments will affect the market in the short term, there is an effort in all Central American countries to overcome these obstacles. Those countries that do not have environmental laws or regulations are currently in the process of drafting them. Also, most countries are consolidating authority for environmental management and strengthening their environmental institutions. These efforts will help to drive the long-term market for environmental technologies and services.

1.3 ENVIRONMENTAL MARKET OPPORTUNITIES

Central America is a promising market for environmental companies. The recovery of the regional economy, new-found political stability, and the tremendous need to address environmental contamination create the necessary conditions for the emergence of an environmental market. Controlling environmental contamination and creating the basic infrastructure to prevent pollution will require enormous amounts of investment — easily on the order of several billion dollars. Both donor financing and private sector capital will finance these investments. There are immediate and longer-term market opportunities.

Major Market Drivers

Unlike the United States or other developed countries, the Central American environmental market is not driven by regulation. Most Central American countries have yet to develop a strong institutional and legal framework to enforce environmental regulations. As these institutions and laws are developed, the enforcement of environmental regulations will play a greater role in shaping the environmental market. However, several other key drivers are already propelling the growth of an environmental market. These are discussed below.

Targeted Donor Assistance. Responding to increased levels of environmental awareness among their constituents, international donor agencies are placing greater emphasis on protecting the environment. This translates into greater funding levels for environmental projects in donor-assisted countries. At the same time, international donor agencies are promoting greater roles for the private sector in areas traditionally managed by public institutions. The following chapters highlight the numerous donor-funded projects currently underway or in the pipeline.

Internationalization. The most important forces driving industrial pollution control are international and market forces that affect Central American companies competing in the global marketplace. Central American companies that are either owned by a multinational parent company or have multinational firms as customers are beginning to be required to maintain environmental standards that correspond to those of their customers' home country. One limitation on this driver, however, is that it will likely affect only the larger businesses in a country. In Costa Rica, for example, over 80% of registered industrial enterprises have fewer than 20 employees. These companies are less likely to be trading globally and have minimal financial resources to invest in pollution control or prevention technologies.

Public Pressure. Costa Rican law entitles citizens to bring complaints against the government or private entities, including environmental-related complaints. Honduran law is similar; in addition, the Honduran Government has established an ombudsman office to handle citizen complaints for a variety of social issues. Many of the environmental-related complaints brought by Honduran citizens are related to land-use issues and incursions on nature reserves. Community protests, for example, succeeded in temporarily closing coffee processors due to heavy pollution.

Voluntary Agreements. In an effort to improve industrial pollution control, several Central American governments have coordinated with industry groups to establish voluntary environmental improvement programs. Costa Rica's coffee sector and Guatemala's sugar sector have worked through their industry associations to commit to environmental improvement programs approved by the governments. One example of voluntary agreements is the ECO-O.K. Certification Program that was developed by the Rainforest Alliance. ECO-O.K. works with producers of agricultural products in various Central American countries to reduce the environmental impacts of agricultural production. Agricultural producers that meet specified environmental standards are awarded an ECO-O.K. seal of approval. The producers can use this seal of approval in advertising to target environmentally-conscious consumers in the United States, Europe, or other markets.

Best Opportunities

The most promising market opportunities in the region are in water delivery, water pollution control, and renewable energy (see Exhibit 1-6). The lack of adequate water delivery and water pollution control infrastructure affects the basic living conditions and health of the region's population. It is also a main cause of environmental degradation to the region's water bodies, groundwater resources, and coastal resources. For these reasons international donor agencies are funding numerous infrastructure improvement projects. This report identifies more than \$550 million of donor funding in each of the water delivery and water pollution control sectors. The enactment of water standards and wastewater discharge standards also should spur more activity in the industrial and municipal markets. Market opportunities in the renewable energy market are driven by the significant need for power, which could be met in a cost-effective manner by renewable energy. The most promising market opportunities in each country are discussed below.

Belize. Belize already has a rather well-developed infrastructure system and has a long history of environmental management. Thus, its environmental problems are not as serious as those of other Central American countries. Its small population limits all types of environmental market opportunities. On the other hand, Belize's regulatory environment is more developed than most countries in the region and its eco-tourism market is important to the country's economy. The best market opportunities in Belize will be in water delivery (rehabilitation of urban systems and extension of rural systems), water pollution control, and solid waste management.

Costa Rica. Costa Rica is a promising market overall, in part because its population enjoys a higher standard of living than residents of other countries in the region. Basic infrastructure systems are good and industry and the general population have a greater ability to pay for pollution control measures. Clean products and pollution prevention technologies and measures are being adopted by Costa Rican industry. The country has also begun to focus on air pollution which is a lower priority for other Central American countries. Costa Rica represents the best market for environmental energy services (i.e., renewable energy and energy efficiency) because of its strong long-term power needs, specific set-asides for renewable energy, and large potential energy efficiency market.

El Salvador. El Salvador's near-term environmental markets will be in the water delivery and water pollution control sectors; medium-term opportunities will exist for air pollution control. El Salvador will receive several hundred million dollars in donor funding to finance environmental improvement projects. The government is also accelerating privatization efforts, which should result in additional market opportunities.

29

**EXHIBIT 1-6
COMPARISON OF ENVIRONMENTAL MARKET OPPORTUNITIES IN CENTRAL AMERICA
(1997-2002)**

	Water Delivery	Water Pollution Control	Waste Management	Air Pollution	Green Markets	Renewable Energy	Energy Efficiency
Belize	○	◐	○	○	○	○	○
Costa Rica	◐	●	○	◐	◐	●	◐
El Salvador	●	●	◐	○	◐	●	◐
Guatemala	●	●	◐	◐	◐	●	◐
Honduras	◐	◐	○	○	○	●	○
Nicaragua	◐	◐	◐	○	○	◐	○
Panama	◐	●	○	○	◐	●	○
Central America	●	●	◐	◐	◐	●	◐

Strong opportunity (*market size > \$25 million*): ● | Moderate opportunity (*market size = \$3-25 million*): ◐
 Limited opportunity (*market size < \$3 million*): ○

Source: Hagler Bailly, 1997

Guatemala. Guatemala offers promising market opportunities in nearly every market segment. As the region's most populous country, Guatemala's need for basic infrastructure is enormous. Access to basic services, including water, sanitation, and electricity, is limited. The country also generates large volumes of solid waste, much of which is disposed of improperly. With assistance from international donor agencies, Guatemala is beginning to address these problems. Guatemala's market opportunities are limited primarily by uncertainty over the depth of economic reform and implementation of the peace accord.

Honduras. Honduras is one of the poorer countries in the region; thus, its ability to finance environmental improvement programs is limited. Short- to medium-term opportunities exist in providing water delivery, water pollution control, and environmental energy systems, although current economic and structural reform measures will impact the timing of these opportunities. Renewable energy is an attractive solution to the severe power shortages that persist in Honduras.

Nicaragua. Initial Nicaraguan environmental market opportunities will be in the water delivery, water pollution control, and environmental energy markets. Nicaragua has the lowest levels of coverage for water and sanitation services in the region. The country's highly inefficient use of energy should create a market for energy efficiency investments. Short-term opportunities are constrained by Nicaragua's extremely high level of external debt, which is currently five times its GDP. Therefore, development of environmental markets in Nicaragua will occur in the medium- to long-term.

Panama. Market opportunities in Panama will include more opportunities for maintenance and rehabilitation than in other Central American countries. Panama invested heavily in basic infrastructure in the 1970s and 1980s, so that constructing new infrastructure is not a pressing need. However, investment levels declined in the late 1980s, creating a backlog of investments for maintenance and rehabilitation. This is particularly true in the urban water delivery sector. In terms of magnitude of need, Panama's water pollution control market is very promising.

CHAPTER 2 COUNTRY PROFILES

Despite the relatively small geographic size of Central America, the seven countries are very diverse with distinct cultural and political traditions as well as economic differences. Together, these countries cover 524 thousand square kilometers and have a population of nearly 33 million people and a total GDP of \$47 billion. The level of social and economic development in each country varies widely.

Central America includes thinly populated countries such as Belize with a population of 215,000 and small, densely-populated countries such as El Salvador, the smallest country in terms of area but second largest in terms of population.¹ It also includes larger countries such as Guatemala, with nearly one-third of the region's population and GDP (the largest in the region in these two respects), and Nicaragua, the largest in area and the country with the highest percentage of urban residents (79% of the country's 4.5 million people). Population growth rates range from a low of 1.4% in Panama to a high of 2.8% in Nicaragua. Urban populations will continue to expand in each country.

The region also varies significantly in terms of wealth. Belize, Costa Rica, and Panama are middle income countries with per capita incomes of about \$2,600.² Nicaragua and Honduras are poor countries, with per capita incomes of \$400 and \$600 respectively. Exhibit 2-1 on the following page provides several comparisons of country statistics, including land size, population, and GDP.

Agriculture is a mainstay for these countries, although all of the countries are promoting diversification within the agricultural sector and the economy overall. In recent years the production of non-traditional agricultural crops has increased, lessening the vulnerability of the region to external commodity shocks (e.g., fluctuations in coffee prices). Costa Rica, El Salvador, Guatemala, and Honduras rely increasingly on industries located in export processing zones, while Belize and Costa Rica have promoted their countries as eco-tourism destinations. Panama is the dominant country in providing services such as international banking and shipping.

The Central American countries face, for the most part, a common set of environmental problems (see the discussion of key environmental issues in Chapter 1). There are some differences, however, in terms of the priorities assigned to the different environmental problems, the approaches to dealing with them, and the progress made to date. Guatemala, for example, must confront a possible explosion in its

¹ Unless otherwise noted, the source for population statistics cited in this chapter is: World Resources Institute. 1996. *World Resources 1996-1997 The Urban Environment*. New York: Oxford University Press. The source for land size statistics is: Central Intelligence Agency. 1996. *The World Factbook 1996-1997*. Brassey's: Washington, D.C.

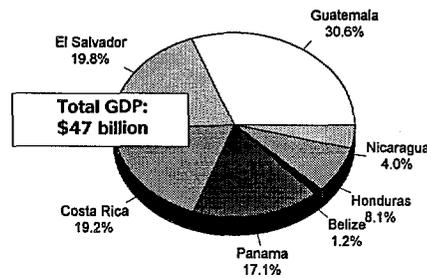
² Unless otherwise noted, the source for statistics on GDP, annual growth, GNP per capita, and total debt as a percentage of GDP is: World Bank. 1996. *Trends in Developing Economies 1996*. Washington, D.C.

urban population that will seriously strain the country's urban infrastructure. Costa Rica has placed a fairly high priority on preserving its natural environment and biodiversity, in part to attract the eco-tourist trade. Honduras faces diminished water flows that are creating scarcities of potable water and water for irrigation and energy generation.

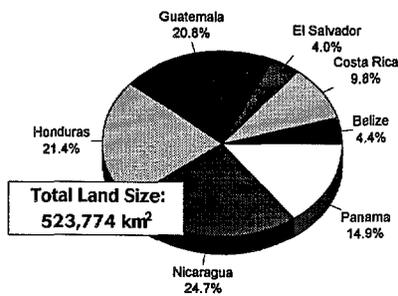
The following sections present individual country conditions to provide a framework to evaluate environmental market conditions within each country.

**EXHIBIT 2-1
COMPARISON OF COUNTRY STATISTICS**

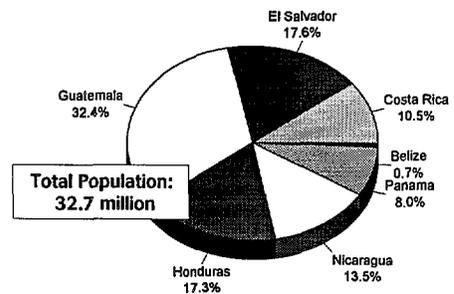
1995 GDP



Land Size

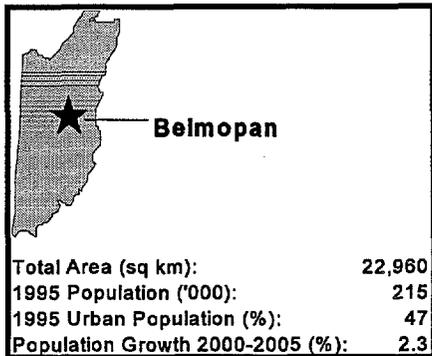


Population Size



Sources: World Resources Institute; World Bank

2.1 BELIZE



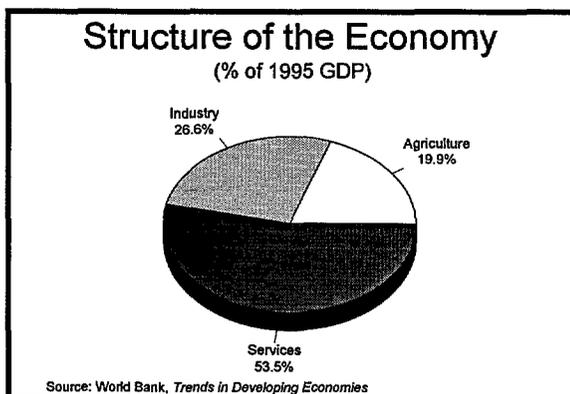
Belize, the second-smallest and least-populated country in Central America, gained its independence from Britain in 1981. The decades of British rule have had a lasting influence: the official language of Belize is English and the government structure follows the British model. The largest population group is the Creoles, descendants of the black slaves and British pirates who first settled Belize. One-third of the population are *metizos* (people of mixed Spanish and indigenous blood). This ethnic makeup sets the tiny country apart from its neighbors, and Belize often identifies more with the Caribbean countries than with Central America. Increasingly, however,

Belize is developing stronger ties with the other Central American countries. After a devastating hurricane in 1961, the capital was moved from Belize City to Belmopan.

Current Economic Situation

From the mid-1980s to early 1990s, Belize maintained high economic growth rates exceeding 10% on average, largely spurred by the expansion of agriculture, tourism, and construction. Due to a deteriorating macroeconomic climate and less favorable export climate, real GDP growth fell sharply in 1993 and is only slowly recovering. The government has committed to a structural adjustment program that should sustain moderate growth rates on the order of 3-5% per year over the medium term.

Belize's free market economy is based primarily on agriculture, although tourism is an increasingly important sector of the economy, particularly as a source of foreign exchange earnings. In 1994, the number of tourists visiting Belize reached 118,000, a 10% increase over the previous year. Industrial production is based mainly on agricultural products such as sugar cane, citrus, and bananas. Although sugar cane accounted for 31.6% of exports in 1994, diversification away from sugar will reduce cane production in the near future. Citrus product exports are also a major source of revenue for Belize.



Economic Data	
1995 GDP (US\$ millions):	592
1985-1995 Average Annual Growth (%):	7.9
1995 GDP Growth Rate (%):	1.6
1995 GNP Per Capita (US\$):	2,630
1995 Total Debt as % of GDP:	30.9

One of the goals of the government's current economic strategy is to improve the incentive framework for private sector investment. The government established an advisory and coordinating body that has the authority to approve or reject capital development projects that do not fit with Belize's development plans. Belize also wants to foster a capital market that will enable more local enterprises to raise money through equity issues or debt instruments. The local market is currently limited to Belize treasury bills, Central Bank construction bonds, defense bonds, and trading of Belize Electricity Limited shares. The current administration is also curtailing government borrowing for capital development projects, which has slowed the economy.

Specific Environmental Issues

Relative to the other countries in Central America, Belize's environmental situation is not as critical. Unlike other Central American countries, for example, Belize has made significant investments in basic

<p>Planned Donor Programs ▶ Belize City Infrastructure Project (WB)</p>
--

infrastructure and has preserved a large portion of its original rainforest. Belize has also taken measures to strengthen environmental management throughout the country, which has positioned Belize well to deal with current and

future environmental issues. However, as a result of the relatively small size of the economy, Belize has a limited ability to generate capital for the large-scale environmental protection projects that need to be undertaken, and must depend on increasingly limited donor funding.

Agriculture and agro-processing are key sources of Belize's environmental problems. The expansion of the agricultural sector has recently led to increasing deforestation as forests are converted to farmland. Estimates by the World Resources Institute indicate that the rate of deforestation during the 1980s was about 0.7% per year, a figure comparable to the average deforestation rates in other countries of Central America where the pressures to convert forests are much greater. Runoffs from agro-processing industries are contaminating rivers and underground water sources. For example, the two sugar refineries in Belize each produce more than 2,500 gallons of liquid wastes per hour when processing the sugar cane. This waste, which has a high organic load and large quantities of spent lubricants, is discharged into the nearby rivers without adequate treatment.

Environmental Institutions and Regulations

Belize created the Department of the Environment (DOE) in 1989, but it was not legally established until 1992 when the first Environmental Protection Act (EPA) was enacted.³ The DOE, a department of the Ministry of Tourism and Environment, has broad regulatory and enforcement authority for the prevention and control of environmental pollution, conservation and management of natural resources, and environmental impact assessments. The DOE is also responsible for coordinating the activities of the National Environmental Appraisal Committee, which comprises the Ministry of Health, the

³ Information for this section is drawn from the World Bank's *Belize Environmental Report*, 1996.

Commission for Water Management, the Coastal Management Agency, the Department of Fisheries, the Land Use Authority, and other private sector and nongovernmental (NGO) groups. The Water and Sewerage Authority (WASA) is responsible for water delivery and wastewater treatment throughout the country.

The EPA is a comprehensive environmental protection law that provides the government with the authority to control environmental pollution. The first implementing regulations issued under the EPA were guidelines for performing environmental impact assessments (EIAs). More recently, the DOE issued effluent regulations for industrial pollution control. Under these regulations, industry must pay for a license to discharge effluents, monitor its effluents, and establish yearly improvement goals that are monitored by the DOE. Since the regulations were established in early 1996, 33 industries have purchased this license. However, the license fee is not yet linked to the amount of pollution the industry generates.

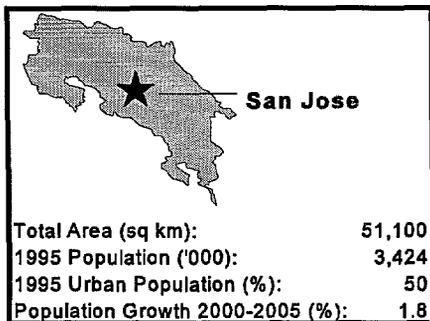
Relevant Legislation

- ▶ Environmental Protection Act (1992)
- ▶ EIA Regulations (1995)
- ▶ Effluent Limitation Regulations (1995)
- ▶ Pollution Regulations (1996)

Relevant Institutions

- ▶ Department of Environment
- ▶ Ministry of Health
- ▶ National Environmental Appraisal Committee
- ▶ WASA
- ▶ BEL

2.2 COSTA RICA

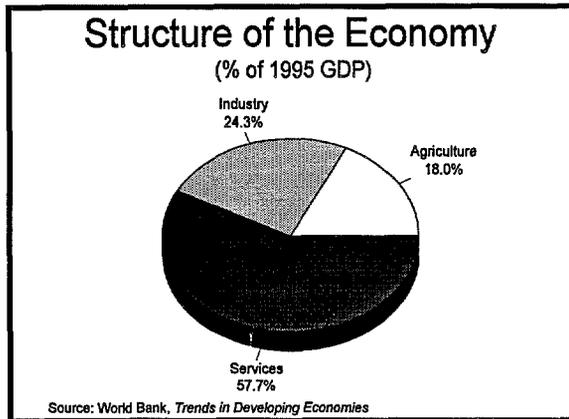


Costa Rica's tropical rainforests and diverse wildlife are known around the world and are a principal reason why this country has become a major eco-tourism destination. Over the past two decades, Costa Rica has maintained peace and democracy despite the turmoil of its neighbors. As a result, Costa Rica stands apart from other countries in the region in several ways. The country has fostered a high literacy rate, excellent social services, and an extensive infrastructure for the provision of electricity, potable water, and telecommunications to all but the most remote areas. Costa Rica also lacks the extremes of wealth and poverty that characterize other Central American countries.

Current Economic Situation

Costa Rica has a relatively stable and progressive economy. Its per capita income of \$2,590 is the third highest among Central American countries, which compares favorably with other lower-middle income countries as defined by World Bank classifications. Costa Rica is reaping the benefits of a growing eco-tourism market and efforts to promote the export of "nontraditional" goods (i.e., goods other than traditional exports of coffee, bananas, and sugar).

Agriculture dominates Costa Rica's economy. Although industry surpasses the agricultural sector in terms of overall percent of GDP, agriculture accounts for over 60% of exports, much of which are



Economic Data	
1995 GDP (US\$ millions):	9,200
1990-1995 Average Annual Growth (%):	4.7
1995 GDP Growth Rate (%):	2.5
1995 GNP Per Capita (US\$):	2,590
1995 Total Debt as % of GDP:	40

coffee and banana exports. Overall, the country is trying to diversify its agricultural export base to reduce its dependence on coffee and bananas. Nontraditional exports such as flowers and ornamental plants, strawberries, melons, and pineapples account for a growing share of the agricultural market. The major industrial sectors include food processing, metal products, wood products, and textiles. Approximately 92% of industrial activity is concentrated in four central provinces: San José, Alajuela, Cartago, and Heredia. Much of this industrial activity is located in the metropolitan area of San José. Several industrial parks, located in Puntarenas, Limón, and other nearby cities, also contribute to the industrial base.

The economy began to suffer in the 1980s when foreign loans used to finance the impressive social programs began to come due. Inflation soared and manufacturing declined. Austerity measures helped to stabilize the economy, and by the early 1990s the economic outlook had improved. Tight fiscal and monetary policies have contributed to slower economic growth rates in 1995 and 1996. However, if the stabilization policies are maintained, GDP growth rates could climb to 5-6% over the next few years.

Specific Environmental Issues

While tourism — particularly eco-tourism — is a major boon to Costa Rica's economy, the impact of tourism on the environment is growing. The tourism industry is constructing major resorts along the coast, often without regard for environmental laws and the ecological sensitivity of the region. Urbanization is also contributing to a deteriorating environment and is straining the country's capacity to provide basic environmental services. The country also is struggling to maintain high levels of coverage for potable water and sanitation as the urban population grows. Deforestation continues to be

a major concern: although Costa Rica has done much to preserve the rain forest through an extensive network of nature preserves that account for 25% of the country's total area, deforestation outside the national parks is occurring at a rate faster than in the Amazon.

Planned Donor Programs

- ▶ Tárcoles River Watershed Management Program (IDB)
- ▶ National Parks Protection and Management Program (IDB)

Environmental Institutions and Regulations

Costa Rica has one of the oldest traditions of environmental protection in the region. Until recently, however, the statutes relating to environmental protection were scattered throughout the laws governing public health, natural resources, and wildlife. At the end of 1995 Costa Rica passed a comprehensive environmental law. The law created the Ministry of Environment and Energy (MINAE), replacing the Ministry of Natural Resources, Energy and Mines. The new law consolidates within the ministry many environmental functions previously managed by other agencies. It also attempts to clarify the respective environmental responsibilities of various government agencies. An Environmental Controller's Office established within MINAE is charged with enforcing Costa Rica's environmental regulations. Since the office is understaffed, it currently deals only with water issues; however, there are plans to expand the office's focus to air issues and environmental impact analysis in the future. The Costa Rican Institute of Water and Sewerage Systems (AYA) provides water and sewerage services in San José and approximately 80% of the rest of the country.

Costa Rica has or is in the process of enacting standards in several areas. There are standards for water quality, and a commission is currently developing industrial effluent standards for discharges into sewer systems and bodies of water. The enforcement of these standards is backed by provisions for sanctions, including both fines and criminal penalties. Fines are fairly low, however, and, in the case of industrial effluents, most companies tend to simply pay the fines rather than control their discharges. Costa Rica does not yet have air quality standards for fixed sources.

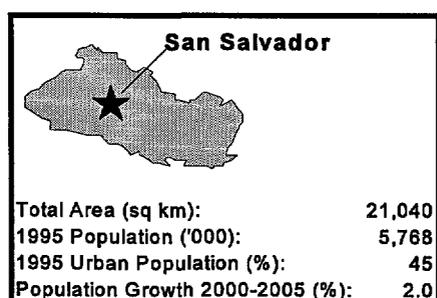
Relevant Legislation

- ▶ Organic Environmental Law (1995)
- ▶ Wildlife Law (1992)

Relevant Institutions

- ▶ Ministry of Environment and Energy
- ▶ Environmental Controllers Office
- ▶ Ministry of Health
- ▶ AYA
- ▶ ICE

2.3 EL SALVADOR



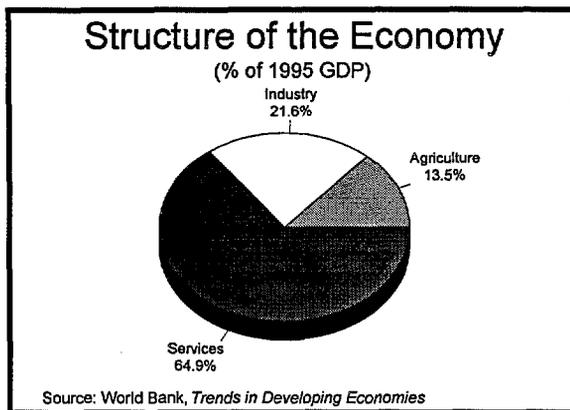
El Salvador is the smallest country of Central America in terms of total area, but has the greatest population density in the region. Following a decade of civil strife that left the economy of El Salvador in serious disarray, the country has attained some degree of stability and economic growth. Historically, the majority of the land has been held by a few families. Although there is an emerging middle class, the wealth of the country continues to be held by about 2% of the population, while the rest of the population lives in poverty.

Current Economic Situation

El Salvador began a comprehensive economic adjustment program in 1989 that has paid off in high economic growth rates in the early 1990s. During the 1992-1995 period, GDP grew at a fairly

consistent rate of about 6.8% per year. The new government elected in mid-1994 is continuing efforts to consolidate peace, maintain the macroeconomic stabilization program, and deepen the structural reform process. Key initiatives include further trade liberalization, the acceleration of privatization efforts, and improved export competitiveness. Given these measures, El Salvador is expected to maintain a GDP growth rate close to 5%.

Agriculture is the main source of employment and exports, with coffee accounting for 40% of exports. However, rapid economic growth in El Salvador has been spurred by the growth of the maquila industry (light manufacturing of products for export). El Salvador has five major free trade zones that have attracted significant investment in maquila or clothing assembly industries. Approximately 50,000 workers were employed in maquila firms at the end of 1994. Within the manufacturing sector, apparel assembly is the fastest growing segment.



Economic Data	
1995 GDP (US\$ millions):	9,500
1985-1995 Average Annual Growth (%):	4.1
1995 GDP Growth Rate (%):	6.3
1995 GNP Per Capita (US\$):	1,580
1995 Total Debt as % of GDP:	24

Specific Environmental Issues

El Salvador's current environmental management efforts are focused on mitigating the impact of existing problems. Recent estimates indicate that almost 75% of the country's land suffers from soil erosion, 98% of the original woodlands have been cut down, and between 70-90% of the country's rivers are polluted with sewage, agricultural runoff, industrial waste, and sediment. The extent of water contamination places serious constraints on El Salvador's available water supply at a time when demand

- Planned Donor Programs**
- ▶ Water and Sewer Program (IDB)
 - ▶ Program for the Decontamination of Critical Areas (IDB)

for water is growing. Contamination also affects the coastal areas that would otherwise offer significant potential for tourism development. In the southern part of the country, the agricultural lands are suffering from overuse of agricultural chemicals, especially in cotton farming. In addition, the years of civil strife and the resulting

migration to urban areas have put intense pressure on El Salvador's cities' basic infrastructure for distribution of potable water and wastewater collection and treatment. Air pollution from mobile sources is also a serious problem in major urban areas.

Environmental Institutions and Regulations

El Salvador's Bureau of Economic Protection (SEMA) was created in 1991 to serve as the executive secretariat of the National Environmental Council (CONAMA), which was established at the same time. SEMA is responsible for defining and implementing the National Strategy for the Environment, formulating environmental regulations, and coordinating environmental initiatives with municipal authorities. However, SEMA is a young institution facing serious constraints on its ability to carry out these responsibilities. The government is currently reviewing SEMA's institutional mandate to determine whether SEMA should be made a ministry or be moved to the executive branch. Perhaps a more serious constraint on SEMA is its small staff, which currently comprises fewer than 50 people. In 1994, the government ratified the National Environmental Strategy and Action Plan, and SEMA is implementing the plan with support from the Inter-American Development Bank. ISDEM (municipal coordination), ANDA (water quality), and SANAM (air quality) are other agencies that have sectoral responsibilities for environmental management.

Relevant Legislation

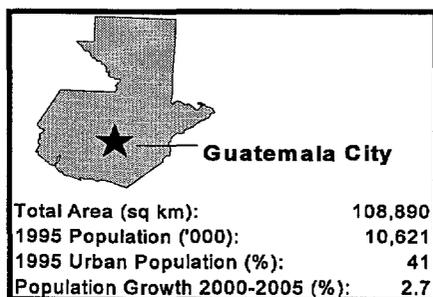
- ▶ Environmental Protection Act (pending)

Relevant Institutions

- ▶ SEMA
- ▶ CONAMA
- ▶ Salvadoran Institute for Municipal Development
- ▶ ANDA
- ▶ CEL

El Salvador's National Assembly is currently considering a water law and an environmental protection act which will establish the structure and functions of a National Environmental Management System. The environmental law was drafted with the participation of both private citizens and industry to ensure the widest possible base of support once the law is implemented. The law requires that implementing regulations be drafted within 120 days of passage. Until the law is passed and regulations are implemented, SEMA is following international environmental standards. The new law will likely require that all newly-established industries conduct an environmental impact assessment. Established industries will be encouraged through various incentive programs to voluntarily report emissions or discharges of waste.

2.4 GUATEMALA



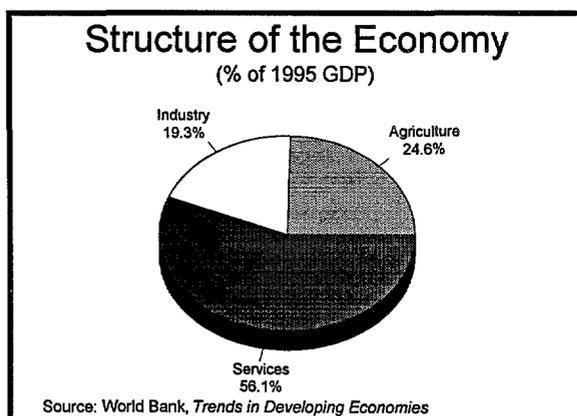
Poor economic performance and years of civil strife have taken a toll on Guatemala. Guatemala's society is highly stratified. Over 75% of the population lives below the poverty line with limited education, health services, and employment opportunities. Indigenous people make up 42% of the population, one of the highest percentages in the hemisphere. Sixty percent of the population lives in rural areas, in more than 20,000 communities that typically have fewer than 500 residents. A peace agreement was signed in December 1996, ending one of the longest civil wars in Central America.

Current Economic Situation

Guatemala is the largest economy in Central America, accounting for nearly one-third of the regional GDP. In the 1980s economic growth slowed due to external economic factors, an unsuccessful import-substitution policy, and civil unrest. Attempts at macroeconomic stabilization in the late 1980s were unsuccessful, leading to a severe fiscal crisis. In 1991, the government introduced reforms and economic stabilization policies that were relatively successful in reducing inflation and strengthening the country's external situation. The main components of the structural reforms were trade liberalization, modernization of the financial sector, rationalization of public utility rates, and increased spending on social services.

The political situation also stabilized in 1995, giving an additional boost to the economy. In late 1994 a tax reform package was passed that is expected to help the country rebuild its tax base. Inflation fell to 8.6% and GDP grew approximately 5% in 1995. Although GDP is expected to continue to grow at about 5%, this will depend in large part on the government's ability to maintain a stable macroeconomic environment and support the peace process.

Agriculture is a major contributor to Guatemala's economy, particularly as a source of export earnings. Exports of coffee and sugar, as well as nontraditional exports such as winter fruits, vegetables, and cut flowers, have grown. While coffee is the single largest export product, the agricultural sector is diversifying so that nontraditional products account for most of the growth in the agricultural sector. Demand by the United States for produce such as baby vegetables, snap peas, and berries has stimulated the production of these products. Key industrial sectors include food processing, textiles, garment manufacturing, and metal finishing.



Economic Data	
1995 GDP (US\$ millions):	14,670
1985-1995 Average Annual Growth (%):	3.6
1995 GDP Growth Rate (%):	4.9
1995 GNP Per Capita (US\$):	1,340
1995 Total Debt as % of GDP:	21

Key Environmental Issues

Guatemala faces some of Central America's most severe urban contamination problems. Over two million people — nearly 20% of the total population — live in the metropolitan Guatemala City area. Yet only 60% of this area currently has access to sewerage systems, and only about half of the solid waste generated is collected. The number of residents in this area is projected to climb to 3.3 million by

2000, further straining an already inadequate environmental infrastructure. Moreover, most urban growth is taking place in informal or marginal settlements of the city where sanitation services are virtually nonexistent.

Planned Donor Programs

- ▶ Guatemala City Environmental Program (IDB)
- ▶ Rehabilitation of waste treatment plants in Guatemala City (Japanese assistance)
- ▶ Sustainable Development of Petén (IDB)

A major area of concern is Lake Amatitlán located south of Guatemala City. About 60% of

the nation's heavy industry is located in the metropolitan area, one-third of which is located in the southern part of the city near Lake Amatitlán. The lake receives most of the wastewater discharges, both municipal and industrial, from the southern part of the metropolitan area and is currently on the verge of eutrophication.

Environmental Institutions and Regulations

The National Environmental Commission (CONAMA) was created in 1986 to coordinate activities related to the formulation and application of national environmental policy. Overall, Guatemala's ability to manage its environmental problems suffers from poorly defined lines of authority and areas of responsibility. The Guatemala Environmental Action Plan concluded that in order to provide effective environmental services, it would be necessary to develop local capacity to manage these services, and to engage communities in environmental planning and service delivery.⁴

CONAMA is affiliated with the Office of the President and is responsible for drafting environmental legislation and standards. The agency suffers, however, from limited political support and a small budget. CONAMA also has no capacity to monitor pollution, nor does it have the authority to sanction polluters. If a complaint is brought against a company for environmental pollution, CONAMA will send an inspector to audit the company's procedures and present the results to the company. If the company

Relevant Legislation

- ▶ Environmental Protection and Improvement Law (1986)

Relevant Institutions

- ▶ National Environmental Commission (CONAMA)
- ▶ Ministry of Health
- ▶ Lake Amatitlán Authority
- ▶ Ministry of Agriculture
- ▶ INDE
- ▶ EEGSA

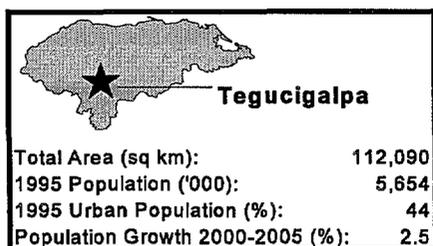
⁴ Comisión Nacional del Medio Ambiente, Guatemala. *Plan de Acción Ambiental*. November 1995.

does not take the recommended actions, CONAMA must work with the Ministry of Health, which has the authority to fine polluters.

The principal environmental legislation is the Law for Environmental Protection and Improvement, which was promulgated in 1986. There are currently no standards to accompany the law, although wastewater standards for discharges into the Lake Amatitlán region are being developed under the auspices of the Lake Amatitlán Authority. These standards will likely be issued in early 1997. However, industry has not been involved in this process, indicating that the standards could face delays or other problems in implementation. All new private and public companies are required to conduct environmental impact assessments which are then evaluated by a technical advisory committee consisting of members from relevant agencies.

The Guatemala City Municipal Water Company (EMPAGUA) is responsible for water delivery and wastewater services in Guatemala City and surrounding areas. In other areas, the municipalities are responsible for providing these services.

2.5 HONDURAS



Honduras is the second largest country on the Central American Isthmus and third most populous. Since U.S. companies discovered the banana growing potential of the region in the 19th century, the United States has been an important influence on Honduran political and economic development. Nevertheless, Honduras remains one of the least developed countries in the Western Hemisphere with high rates of illiteracy and malnutrition. Much of the foreign assistance funneled into the

country during the last decade — especially from the United States — was linked to the war along the Honduras-Nicaragua border and did not support the development of the productive sector.

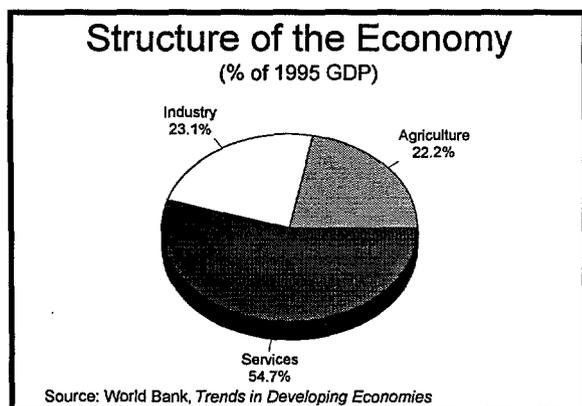
Current Economic Situation

Honduras is the second poorest country in Central America, with a 1995 per capita GDP of only \$600 and an economy that is less than half the size of that of Costa Rica, El Salvador, or Panama. This small economy is highly sensitive to changes in its external economic environment due in part to its dependence on donor assistance and a few export commodities and the country's heavy debt burden. However, the economy is growing at a healthy pace: the growth rate for 1996 is projected to be 4%. In addition, Honduras has taken important steps to improve the overall macroeconomic environment, including reducing trade barriers and liberalizing prices and interest rates.

In 1994 the most severe energy crisis in the nation's history plunged the Honduran economy into recession. Honduras already faced energy shortages due to unreliable thermal electric generating plants. Three consecutive years of drought caused water levels at the country's primary hydroelectric facility to decline substantially. The Francisco Morazan (El Cajón) dam accounts for approximately 50% of Honduras' 500 MW energy output. Yet, by August 1994, El Cajón was generating only 70 MW (the dam has a capacity of 300 MW). Energy rationing led to 14-hour blackouts during the second half of 1994.

Although only 25% of Honduras' land is suitable for cultivation, agriculture is a critical sector for the Honduran economy, accounting for almost 40% of GDP and 80% of merchandise exports. The principal export crops are bananas, coffee, and shrimp. A prolonged drought in the past few years has hurt agricultural production and unfavorable prices in international markets have reduced export earnings.

Manufacturing and mining account for 25% of the nation's GDP. Manufacturing has traditionally been dominated by agro-industries, but production of electrical appliances and leather goods is growing. The majority of industry is located in the metropolitan areas of Tegucigalpa and San Pedro Sula.



Economic Data	
1995 GDP (US\$ millions):	3,900
1985-1995 Average Annual Growth (%):	3.4
1995 GDP Growth Rate (%):	3.6
1995 GNP Per Capita (US\$):	600
1995 Total Debt as % of GDP:	113.6

Specific Environmental Issues

In recent years diminished water flows in the summer, caused by lower than average precipitation and watershed destruction, have created scarcities of potable water to meet urban needs and shortages of water for irrigation and energy generation. The use of chemical fertilizers and pesticides, particularly

in coffee and banana production, has contaminated both water and soils. The lack of adequate sewage treatment facilities has contaminated the major rivers in Honduras. Inadequate handling of solid wastes and the failure to treat industrial and hospital wastes have also increased water and soil contamination.

Planned Donor Programs

- ▶ Environmental Development Project (WB)
- ▶ Sanitation Sector Reform (IDB)

Unplanned urban settlements and lack of financial resources have contributed to poor water quality, inadequate sanitation, and deficient solid waste management.

Environmental Institutions and Regulations

In 1993 the Honduran Government enacted the General Environmental Law that establishes a system for environmental management. The law created the Ministry of the Environment (SEDA), which is responsible for formulating environmental policy and coordinating studies, plans, and projects related to environmental management in Honduras. SEDA's functions also include providing technical assistance to sector agencies and municipalities, evaluating environmental impact assessments, coordinating land use planning (in conjunction with the Planning, Budget, and Natural Resources offices), and carrying out environmental awareness and education programs. A major focus of SEDA's activities has been the preparation of implementing regulations and regulations for environmental impact assessments. However, despite SEDA's wide-ranging responsibilities, by law its staff cannot exceed 35 persons. In addition, there are numerous agencies with environmental responsibilities, making SEDA's coordination role difficult to fulfill.

Relevant Legislation

- ▶ General Environmental Law (1993)
- ▶ General Environmental Regulation
- ▶ Health Code
- ▶ Law of the Municipalities

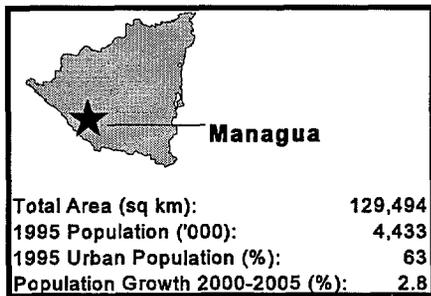
Relevant Institutions

- ▶ SEDA
- ▶ Ministry of Health
- ▶ Ministry of Natural Resources
- ▶ SANAA
- ▶ ENEE

The Environmental Law establishes a substantial legal framework for managing the environment. Under this law, both existing and new industries must conduct environmental impact assessments. The law also provides for the use of fines and tax incentives to control pollution and contamination. A recently enacted law created a Public Prosecutor's Office, thus increasing the potential for judicial enforcement of environmental laws. However, environmental regulations have only recently been enacted or are in the process of being drafted. Regulations that set out the guidelines for environmental impact assessment already exist, while regulations for wastewater discharges are being drafted now under the auspices of the National Committee for Water Quality. Air quality regulations are also under discussion. A national research laboratory, CESCO, has developed a program for conducting studies on environmental pollution and recommending solutions, and another program for industrial audits.

The National Autonomous Water and Sewage Service (SANAA) provides water and sewerage services throughout the country except in San Pedro Sula where the municipality has responsibility. There is an effort underway to devolve these responsibilities to the municipalities throughout the country.

2.6 NICARAGUA

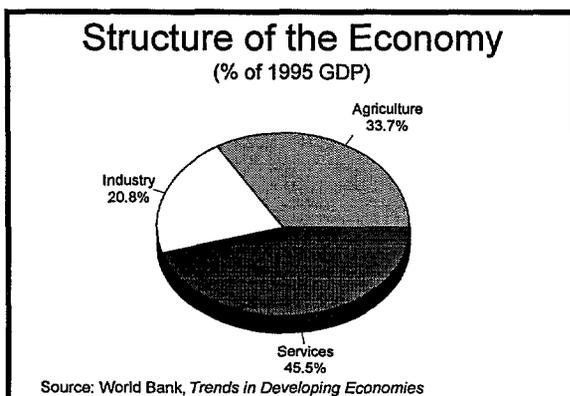


Nicaragua has only recently emerged from a long period of civil war, first between the Sandinistas and the Somoza regime that began in the late 1970s, and then between the Contras and the Sandinista government during the 1980s. In the 1990s Nicaragua finally gained relative political stability which was reaffirmed by the recent elections in October 1996. Its population is increasingly urban, with over 60% living in the capital city. A major earthquake destroyed most of the center of Managua in 1972, and the majority of this area has not been rebuilt.

Current Economic Situation

Nicaragua's economy is rebounding from the economic and financial crisis of the late 1980s. In 1994 the economy grew at approximately 3.2%, the highest rate since 1983. The economy was even stronger in 1995 with a growth rate of 4%. The country has nearly completed the transition to a market-based economy. By the end of 1994, the government had privatized 340 state enterprises inherited from the previous administration. The government also has reduced tariffs, eliminated most non-tariff barriers, and greatly relaxed foreign exchange controls. Continued economic improvement is expected through the second half of the 1990s.

The mainstay of the economy is agriculture, which accounted for 33% of GDP in 1994. Coffee, cotton, sugar, beef, and bananas are the primary agricultural exports. The manufacturing sector has suffered from a lack of investment and the emigration of skilled personnel as a result of the internal strife. During the 1990s, the manufacturing sector shifted production from textiles and metals made for the domestic market to goods such as soft drinks, processed foods, alcoholic beverages, and cigarettes. Re-export operations have also expanded.



Economic Data	
1995 GDP (US\$ millions):	1,900
1985-1995 Average Annual Growth (%):	-1.3
1995 GDP Growth Rate (%):	4.2
1995 GNP Per Capita (US\$):	390
1995 Total Debt as % of GDP:	502

Specific Environmental Issues

Some initial efforts were made in the 1980s to protect Nicaragua's rainforests and preserve watersheds. The predecessor to the Ministry for Natural Resources and the Environment (MARENA) established one of the region's largest protected natural areas. The civil war also had some unintended ecological benefits: as people relocated out of combat zones, huge tracts of agricultural land returned to their natural state, allowing wildlife to prosper. Forest lands also remained uncut.

Planned Donor Programs

- ▶ Rehabilitation of Electrical Distribution Systems (IDB)
- ▶ Water and Sanitation (WB)

Today, the standing forests are again under pressure as the government's hopes for economic recovery are focused on exploiting the country's abundant forest resources. The migration of people to cities has also placed enormous pressure on Managua's and other

urban areas' underdeveloped infrastructure. The growth of Managua's population is also threatening the fragile ecosystems in the Lake Managua watershed. Lake Managua is beginning to exhibit signs of eutrophication resulting from deforestation and water contamination — the former caused by poorer urban residents cutting wood for fuel, and the latter caused by discharges of municipal and industrial wastewater into the lake.

Environmental Institutions and Regulations

The primary agency responsible for environmental management in Nicaragua is MARENA. The Ministry's mandate is to coordinate the implementation of the Environmental Action Plan, which was formulated in 1993. MARENA is also responsible for preparing the country's environmental policies and drafting legislation and accompanying regulations, including the legislation for environmental impact assessments. The General Law for the Environment and Natural Resources, which is currently pending before the National Assembly, will strengthen the role of MARENA. The new law will require environmental permits based on an environmental impact assessment program. A number of other studies currently underway will support the drafting of a national water law and a proposal for an institutional structure for resource management. The National Water Authority (INAA) provides water and sewerage services nationwide, although consideration is being given to creating regional water companies.

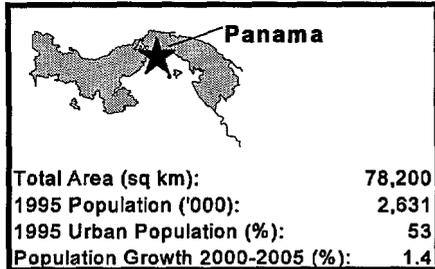
Relevant Legislation

- ▶ General Law for the Environment and Natural Resources (pending before the National Assembly)

Relevant Institutions

- ▶ MARENA
- ▶ Ministry of Health
- ▶ Ministry of Agriculture
- ▶ Ministry of Fisheries

2.7 PANAMA



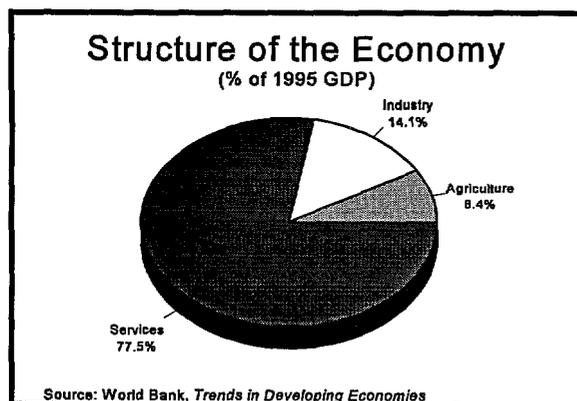
Due to its unique geographic location, Panama has followed a different development path than its neighbors. The Transisthmian Railroad initially established Panama as a major point of exchange of goods coming from the Atlantic and Pacific Oceans. Later the Panama Canal ensured that Panama would maintain its role in international trade. Panama will assume control of the Panama Canal in 1999 under terms outlined in the 1977 Canal Treaty. Following the U.S. invasion of Panama in 1989 to oust Manuel Noriega, Panama has struggled to establish a stable democracy.

Current Economic Situation

Although the Panamanian economy is one of the most stable and prosperous in the region, it is highly segmented between a dynamic, internationally-oriented services sector and the domestic sector which suffers from low productivity. Unlike other countries in Central America, Panama's economy is based primarily on a well-developed services sector that accounts for 70% of GDP. This sector includes offshore and domestic banking, insurance, government, and the Panama Canal.

Distortions were introduced into the economy in the 1970s that led to a severe economic crisis in the 1980s. Macroeconomic reforms led to economic growth, but growth has fallen off from the high levels achieved in the early 1990s. GDP grew an estimated 3.5% in 1995, down from 9.6% in 1991. Economic growth in 1996 is estimated at only 2.4%, and is projected to be 4.3% over the period 1996-2000.

The Panamanian Government is pushing economic policy reforms designed to liberalize the trade regime, privatize state-owned enterprises, and foster job creation. One key reform, which should facilitate Panama's accession to the World Trade Organization (WTO), removes some of the market-fixing mechanisms that protected Panamanian industry from foreign competition. With the support of



Economic Data	
1995 GDP (US\$ millions):	8,200
1985-1995 Average Annual Growth (%):	2.5
1995 GDP Growth Rate (%):	3.5
1995 GNP Per Capita (US\$):	2,720
1995 Total Debt as % of GDP:	98

the IDB, the government is preparing a bill that would permit private participation in the water and sanitation sector, including refuse collection. However, the slowdown in the economy will likely limit any progress the government makes in privatizing the state-owned electric and water utilities.

Specific Environmental Issues

In comparison to many developing countries, Panama's infrastructure is fairly well developed. However, there remains a significant need for public sector investment in sewer and water treatment systems, as well as other infrastructure systems such as roads and health facilities. Public investment in health and water supply fell from \$32 million to \$7 million in the late 1980s, largely as a result of the withdrawal of donor funding.⁵ Consequently, a large backlog of needed investments exists in Panama.

It has been estimated that the cost of cleaning up the Bay of Panama alone will exceed \$1 billion. At present, semi-treated sewage flows directly into the bay at one of its most picturesque points, damaging prospects for tourism development and contaminating a significant supply source.

Planned Donor Programs

- ▶ Electricity Expansion Program (IDB)
- ▶ Potable Water Supply Optimization (IDB)
- ▶ Sanitation and Environmental Protection of Panama City (IDB)

Environmental Institutions and Regulations

Panama's main environmental regulatory agency is the National Institute for Renewable Natural Resources (INRENARE) which was created in 1986. This agency is responsible for designing and implementing policies for the conservation and development of natural resources. There is a wide range of other institutions with environmental responsibilities. In addition to INRENARE, the National Environmental Commission and the Ministry of Health have responsibilities in the area of pollution control. The Ministry of Health is responsible for policy formulation, regulation, and program monitoring in the areas of water supply and sanitation. The National Water and Sewerage Authority (IDAAN) provides water and wastewater services to communities of over 1,500 people. Environmental legislation is pending before the Panamanian Congress.

Relevant Legislation

- ▶ Environmental legislation is pending

Relevant Institutions

- ▶ National Institute for Renewable Natural Resources (INRENARE)
- ▶ Ministry of Planning and Political Economy
- ▶ Ministry of Health
- ▶ National Environmental Commission
- ▶ IRHE

⁵ World Bank. *Staff Appraisal Report: The Republic of Panama Rural Health Project*. December 1994. p. 1.

CHAPTER 3

WATER DELIVERY

Central American countries have placed a priority on supplying potable water to their populations. However, with limited government resources, Central American countries have been unable to keep up with growing demand for drinking water. Although most urban centers and some rural communities have water delivery systems, more than 10 million people still require connections to water networks or other sources of potable water. In virtually all Central American countries there is a need to construct new water delivery systems and rehabilitate existing systems, construct and upgrade water purification facilities, and improve water management. These needs present the basis for promising market opportunities in each of the key water sector segments: distribution systems, storage systems, and water purification systems. In the near term many of these opportunities will be driven by multilateral and bilateral donor programs that seek to address water sector needs. Additional market opportunities are emerging to provide small water supply systems for private companies. The growth of eco-tourism will be a major driver in this segment. Many Central American countries are undergoing reforms that will reshape the water sector, including providing options for private sector participation in the water delivery market. In the long term, privatization should create market opportunities.

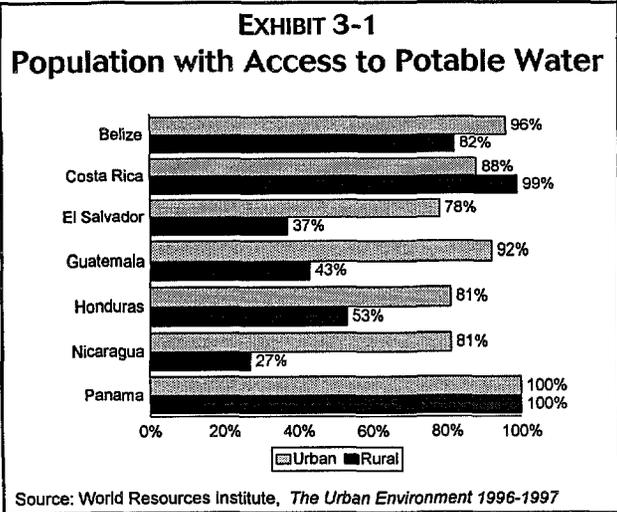
3.1 MARKET NEEDS

The market for improving access to potable water in Central America can be broken down into four market segments:

- ▶ extending water distribution networks in urban and rural areas
- ▶ improving water quality
- ▶ increasing water storage capacity and developing new sources
- ▶ enhancing water supply management.

Extending the Coverage of Water Delivery Services

The most critical and urgent need in Central America's water sector is to extend water delivery systems to the entire population. Approximately 10.4 million individuals in the region — nearly one-third of the population — are not covered by existing water supply systems. Rural residents account for the majority of those residents without access to potable water. In Guatemala alone, more than 3.5 million

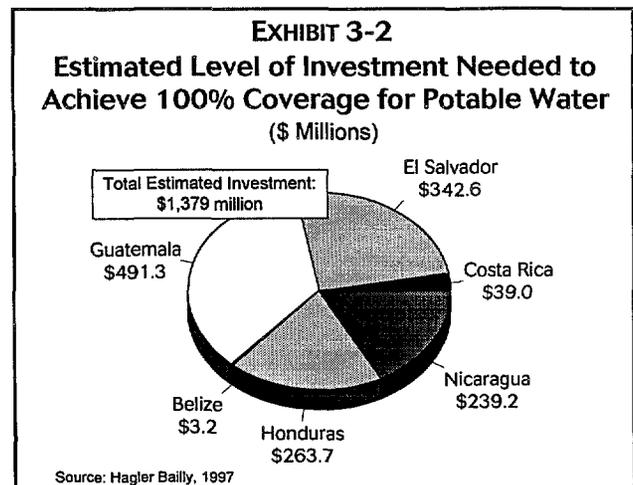


rural residents lack access to water supply systems. Exhibit 3-1 illustrates the percentage of the urban and rural population with access to potable water.¹

Expanding water systems to provide access to drinking water for all citizens in Central American countries would cost an estimated \$1.4 billion.² A majority of these investment needs are concentrated in Guatemala, El Salvador, Honduras, and Nicaragua, as shown in Exhibit 3-2. There are other estimates of the level of investment individual Central American nations would have to make in order to provide water services to all residents. For example, USAID,

CARE International, and the Pan American Health Organization estimated that to achieve 100% coverage of urban and rural water supply (and also urban and rural sanitation) services in El Salvador, this country alone would need to invest nearly \$700 million.

There are several key water utilities in each country that are responsible for a large portion of water delivery services. These utilities, their primary service areas, and the responsibilities of these utilities are presented in Exhibit 3-3. Central American water utilities typically have wide service areas for both water supply and sanitation services. The exception is Guatemala: the key utility listed in Exhibit 3-3 is EMPAGUA, which serves only the metropolitan Guatemala City area.



¹ The figures for Exhibit 3-1 are drawn from the World Resources Institute's *The Urban Environment 1996-1997*. The World Health Organization collected much of the data in 1994. The WHO defines "access to safe drinking water" as access to piped water or a public standpipe within 200 meters of a dwelling or housing unit. In rural areas reasonable access is defined as a family member being able to fetch water without spending a disproportionate part of the day doing so. Other sources reviewed for this report provide contradictory statistics, showing lesser or greater levels of access to potable water.

² This figure is based on an estimated cost of \$180 per urban resident and \$120 per rural resident to provide access to potable water. The authors of this study have assumed that the per capita costs are representative for the entire region. The per capita costs are drawn from a report by the Pan American Health Organization, *Análisis Sectorial de Agua Potable y Saneamiento en Guatemala*.

50

EXHIBIT 3-3 Key WATER UTILITIES IN CENTRAL AMERICA			
Country	Utility	Service Area	Comments
Belize	Water & Sewerage Authority (WASA)	Country-wide service authority including rural areas; currently operates 9 urban water systems and serves approximately 120,000 residents	Monitors the amount and quality of water supplied and monitors effluent discharges from sewage treatment plants in Belize City and Belmopan.
Costa Rica	Costa Rican Institute of Water and Sewage Systems (AYA)	Complete jurisdiction in San José, responsible for approximately 80% of country	Provides water and sewerage services
El Salvador	National Water Supply and Sewage Administration (ANSA)	Urban areas of 2,000+ residents and rural communities of less than 300; 72 municipalities operate their own water systems	Provides water and sewerage services; in the process of restructuring this entire sector, including ANSA
Guatemala	Guatemala City Municipal Water Company (EMPAGUA)	Guatemala City and surrounding areas	Provides water and sewerage services
Honduras	National Autonomous Water and Sewage Service (SANAA)	Country-wide except for the city of San Pedro Sula	Provides water and sewerage services; in the process of devolving this responsibility to municipalities
Nicaragua	National Water Authority (INAA)	Country-wide (creation of regional water companies is under consideration)	Provides water and sewerage services
Panama	National Water and Sewerage Authority (IDAAN)	Communities of 1,500+ residents	Provides water and sewerage services; controls water quality at point of exit from treatment plants in urban systems

51

Urban Coverage. In general, Central America's urban population has good access to water systems, with coverage ranging from 78% in El Salvador to 100% in Panama. However, rapid population growth in the major cities is straining the ability of water utilities to maintain current coverage levels, much less extend service to all residents (see the discussion of urbanization in Chapter 1). For example,

city planners in Guatemala City estimate that 400,000 of the 1.2 million inhabitants currently are not connected to the water distribution system. The metropolitan population is growing at an annual rate of 3.8%, straining the water utilities' ability to provide adequate water services. Many urban residents who do not have connections to a municipal water distribution system live in the poorer areas on the outskirts of the cities. They must obtain water from private vendors, often at a substantially higher cost than the utility would charge for water from the distribution system. For example, residents of Tegucigalpa pay private vendors 77 times more for water than they would pay if they received water from the municipal system.³ Some communities are solving these access problems through innovative low-cost solutions such as the one described in Exhibit 3-4.

EXHIBIT 3-4
FINDING INNOVATIVE SOLUTIONS
TO EXTEND WATER SUPPLY SYSTEMS

The community of Chinautla, an informal settlement on the fringes of Guatemala City, organized itself and asked the water utility to install a single-source water tank to meet the community's water needs. Each family then built its own pipe to the central source. The community association receives one bill from the water company and divides the cost among the residents. While this solution is more expensive for the families than if they were directly connected to the water supply network, it is still far less expensive than obtaining water from private vendors. Other communities in Guatemala City are following this example.

Source: World Resources Institute, *The Urban Environment 1996-1997*, p. 107.

Access to a water distribution system does not always ensure adequate supply. Many residents

suffer frequent service disruptions, sometimes lasting up to several days, and must purchase water from private vendors to fulfill their needs. In some instances, residents only have water for several hours per day. As a result, many families invest in storage tanks and pumps to ensure an adequate supply of water during system interruptions. This problem is particularly acute in Tegucigalpa where, because of the hilly terrain, households located at higher elevations often do not receive water during peak hours. Belize is a notable exception: its urban water systems provide 24-hour service.

Rural Coverage. Access to potable water in rural areas is significantly lower, ranging from 27% in Nicaragua to 100% in Panama. The low population density in most rural areas means provision of water delivery infrastructure is costly. In many cases rural water systems are fairly rudimentary, consisting of a well with an electric submersible pump that pipes water into a distribution network.

³ World Bank and Inter-American Development Bank. 1995. *Honduras: Reforming Public Investment and the Infrastructure Sectors*. Washington, D.C., p. 24.



Improving Water Quality

Municipal water delivery programs in Central America historically have focused primarily on providing access to water. Ensuring that the water supply meets international drinking water standards has been a secondary concern. However, as the quality of surface and groundwater deteriorates and water supplies tighten, the need to ensure the safety of drinking water before delivery will grow. As illustrated in Exhibit 3-5, the major source of drinking water is surface water, although Costa Rica, Panama, and Nicaragua also rely heavily on groundwater. In many areas, surface waters are contaminated with municipal and industrial effluents and agricultural runoff, and groundwater is affected by seepage from industrial wastes and landfills.

EXHIBIT 3-5 SOURCES OF WATER SUPPLY		
Country	Urban	Rural
Belize	70% surface water; some use of groundwater; desalinization in San Pedro only	primarily groundwater
Costa Rica	both surface and groundwater	primarily groundwater
El Salvador	primarily surface water	primarily surface water
Guatemala	70% surface water; 30% groundwater	primarily surface water
Honduras	primarily surface water	primarily surface water
Nicaragua	both surface and groundwater	80% groundwater
Panama	primarily groundwater	primarily groundwater

Source: Pan American Health Organization

There are few water treatment systems in Central American countries, and existing systems have limited capacity. Of the nearly 200 water systems in the ANDA network in El Salvador, over one-quarter have no equipment for water treatment (see Exhibit 3-6). The most common forms of treatment in these systems are chlorine gas and hypochlorite.⁴ In Costa Rica, only 81% of water customers are connected to systems that have water treatment facilities, and in Honduras, among the 59% with access to water service, only 17% are receiving treated water. Very few rural systems include provisions for water treatment. For example, less than 25% of Panama's rural water supplies receive any treatment. Because water quality sampling is neither systematic nor frequent, water quality standards cannot be enforced and residents are not ensured a safe supply of drinking water.

⁴ Chlorine gas is a more effective treatment than hypochlorite, but it is also more expensive.



EXHIBIT 3-6 DISINFECTION SYSTEMS FOR POTABLE WATER IN THE ANDA NETWORK						
Zone	Disinfection with Chlorine Gas		Disinfection with Hypochlorite		No Disinfection	
	Number of Systems	Number of Domestic Connections	Number of Systems	Number of Domestic Connections	Number of Systems	Number of Domestic Connections
Middle Metropolitan	5	32,439	14	41,241	—	—
Upper Metropolitan	6	30,004	4	8,271	—	—
Lower Metropolitan	5	29,780	4	5,659	1	900
Central	13	10,901	39	20,506	33	3,237
West	4	23,144	21	25,653	—	—
East	3	4,579	22	20,460	21	2,824
TOTAL	39	130,846	104	121,790	55	6,961

Source: Pan American Health Organization, 1994. *Análisis del Sectorial Agua Potable y Saneamiento en El Salvador*. Sectoral Analysis Series, No. 4. Washington, D.C.

Increasing Water Storage Capacity and Developing New Sources

Water shortages are increasingly common in Central America. To address current and potential water shortages, Central American countries will need to develop new sources of drinking water and increase their water storage capacity. Although no data are available on the current water storage capacity of major metropolitan areas and other cities, anecdotal evidence suggests that Central American cities are struggling to meet the growing demand for water.

In some cases, the growth in urban areas is straining water resources. For example, in the Guatemala City metropolitan area, water demand is currently 5.1 m³ per second while water supplied reaches only about 4.2 m³ per second. Although the city is developing additional water supplies and estimates that supply will increase to 5.2 m³ per second in 1998, increases in demand are projected to reach 5.9 m³ per second in 1998.

Central American cities are faced with the task of identifying and exploiting new water supplies, which are often further from urban areas. This substantially increases the costs of supply. In 1993 the water utility in El Salvador constructed a pipeline from the Río Lempa to San Salvador to meet increasing demand for water. This pipeline now provides 20% of the public water supply for San Salvador. However, the supply of water in metropolitan San Salvador is still estimated at 25% of demand despite efforts to tap new sources.

Enhancing Water Supply Management

Poor water supply management is exacerbating water shortages throughout Central America and threatens the long-term water supply. Poor management is manifested in widespread water losses and maintenance problems within the delivery system. It is estimated that in all of Latin America, water

EXHIBIT 3-7 SYSTEM LOSSES OF CENTRAL AMERICAN WATER UTILITIES	
Utility	Estimated System Losses
WASA (Belize)	57%
ANDA (El Salvador)	39%
EMPAGUA (Guatemala)	48%
IDAAN (Panama)	50%
SANAA (Honduras)	50%

losses cost between \$1-1.5 billion in foregone revenue each year.⁵ Better water management programs are needed to stem system losses and improve water delivery service to customers.

Exhibit 3-7 illustrates the extent of system losses experienced by Central American utilities. Management enhancements that would minimize water losses and waste due to unrecorded usage and illegal taps include installing metering equipment, performing preventative maintenance on supply systems, and providing conservation incentives to customers.

- ▶ **Installing metering equipment.** While the amount of water that is lost due to unrecorded usage or illegal taps has not been quantified, the problem is thought to be significant. In fact, it is estimated that as much as one-half of the water not accounted for results from unrecorded usage or illegal taps. The lack of meters or meter errors due to antiquated equipment contributes to unrecorded usage. Illegal taps divert water between the point of production and delivery to customers.
- ▶ **Performing preventive maintenance.** Maintenance issues are more easily identified. Central American utilities often lack financial resources to perform routine maintenance on water systems, and systems deteriorate until repairs become unavoidable. For example, in Tegucigalpa the water utility is unable to maintain adequate pressure in the water system to provide water to residents living at higher elevations in Tegucigalpa's mountainous terrain. The loss of water pressure is directly related to leaks in the system as a result of poor maintenance.
- ▶ **Providing conservation incentives.** There is little incentive for households or industries to conserve water. While most utilities in the region have water rates based on consumption, many households do not have meters and therefore are assessed a flat rate that provides no incentive for conservation. Even where meters exist, water is usually priced much lower than the actual costs of providing the water. Industries often obtain water directly from rivers or wells without paying any fees for using these resources.

⁵ World Resources Institute, 1996. *World Resources The Urban Environment 1996-1997*, New York: Oxford University Press, p. 108.

3.2 MARKET OPPORTUNITIES

The market for water delivery infrastructure is one of the larger environmental markets in Central America, totaling \$825 million over the next five years. Donor funding has supported the development of much of the current infrastructure and will continue to be instrumental in the near future. Current sector reform programs and privatization efforts will influence the development of this market over the medium and long term and will create additional opportunities. Market opportunities fall into three categories:

- ▶ publicly-funded initiatives
- ▶ private-sector initiatives
- ▶ privatization.

Publicly-Funded Initiatives

Because rehabilitating and expanding water supply distribution networks will be an ongoing priority throughout Central America, public funds will continue to be dedicated to these projects. Efforts by the water utilities to improve the water supply systems will be supported in large part by multilateral and bilateral funding agencies. Exhibit 3-8 lists all projects currently in multilateral donor pipelines. Costa Rica, El Salvador, Nicaragua, and Panama are the primary recipients of this type of assistance. Donor-funded initiatives target both the rehabilitation of existing water systems and the construction of new systems. In Honduras, donor support is focused primarily on reforming the institutional aspects of the water sector. Investment opportunities will likely follow this restructuring.

- ▶ **Belize.** The 10-year expansion plan for Belize's water sector calls for a total investment of \$27.3 million, of which WASA and the government will provide 62% of the funding. The proposed investment plans will extend WASA's water delivery infrastructure, provide more rural water systems, and expand the Belize City water treatment plant. There are currently no planned donor-funded projects to assist with the development of Belize's water sector.
- ▶ **Costa Rica.** The Costa Rican water utility, AYA, plans to improve water distribution and storage and to expand its distribution network with funding provided by the IDB and the World Bank. One main component of the IDB's \$30 million program will target water system losses by acquiring and installing water meters. Construction of new water tanks will increase AYA's storage capacity.
- ▶ **El Salvador.** El Salvador's water sector is currently undergoing restructuring that will involve the devolution of responsibilities to local municipalities. This restructuring will affect investment levels and programs in the near future. The IDB is supporting the restructuring process with its Water and Sewer Program. The IDB program will enable El Salvador to develop water source management plans and to consider pre-investment plans for future infrastructure expansion.

EXHIBIT 3-8 SELECTED DONOR-SUPPORTED WATER DELIVERY PROJECTS			
Country	Principal Donor	Project Description	Estimated Expenditures in Water Supply System (US\$ Millions)
Costa Rica	IDB	Sanitation and Drinking Water for Intermediate-Size Cities: Rehabilitate and expand drinking water systems	30.0
	WB	Second Water Supply and Sewerage Project: Improvements in water distribution, water storage; loss reduction program; water metering	28.8
Subtotal:			58.8
El Salvador	IDB	Water and Sewer Program: Construction of water works	31.0
Subtotal:			31.0
Honduras	IDB	Sanitation Sector Reform: Reform and modernization of the water supply institutional structure	25.0
	Subtotal:		
Nicaragua	WB	Water and Sanitation: Expansion of water supply services	15.0
Subtotal:			15.0
Panama	IDB	Potable Water Supply Optimization: Rehabilitation of water supply systems in Panama City and other urban centers; reduction of unaccounted-for water usage	60.0
Subtotal:			60.0
Total Cost of Projects:			189.8

Source: World Bank and Inter-American Development Bank

- ▶ **Guatemala.** Donor assistance from the Japanese will provide EMPAGUA with \$36 million to develop new wells in the metropolitan Guatemala City area. Additional Japanese funding will support water source development in the area of Antigua. This assistance will help Guatemala progress toward its goal of providing 90% coverage of potable water.
- ▶ **Honduras.** Honduras is currently restructuring its water sector with support from the IDB. A key component of the reform is to transfer responsibility for water services from SANAA to municipalities. The project will include a revision of the regulatory structure governing the water sector and measures to strengthen the new institutions charged with providing these services. These reforms will also allow for private sector participation, particularly in San Pedro Sula and Tegucigalpa. Due to this reform process, SANAA has made few investments in the water distribution systems and is unlikely to embark on any major projects until the process is complete. USAID is also supporting a project to identify potable water needs in 25 medium-

sized cities and 7 large ones; however, investments in these projects are not likely to be made for several years.

- ▶ **Nicaragua.** Nicaragua has established a national plan for water resources management; an ambitious goal included in the plan is to supply potable water to 100% of the population by 2000. Nicaragua also plans to develop the necessary infrastructure to supply water to areas with few water resources and to rehabilitate existing water systems in several cities. The IDB is providing funding to Nicaragua to increase the coverage of water delivery services, particularly in rural areas, and to improve the quality of water. Regional water companies will be responsible for implementing the planned infrastructure expansions, but some activities such as billing, collections, and maintenance may be carried out by the private sector.
- ▶ **Panama.** The IDB is supporting the rehabilitation and upgrade of Panama City's and other cities' water supply systems. A major focus of the program is to reduce water system losses. A second IDB program which is designed to strengthen public sector agencies should improve the management capacity of Panama's water utility, IDAAN.

Private Sector-Funded Projects

There is a growing market for small water supply systems for private companies. For example, tourism is growing in each country, particularly in Belize, Costa Rica, and Guatemala. Private developers are responding to this growth by constructing new hotels or resorts and by upgrading existing facilities to provide more modern conveniences. There are other examples of private sector-funded projects. In Belize a private company constructed and now operates a desalinization plant in San Pedro. The company has a contract to sell water to WASA for a 10-year period. Large private companies such as breweries usually have their own private wells or water supply systems.

Privatization

As in other areas of infrastructure development, there is an emerging trend in Central America toward the privatization of services in the water sector. This trend is likely to create market opportunities for water system rehabilitation and operation in the long term. Privatization is attractive for two reasons. First, private investment is viewed as an alternative to the multilateral development banks, whose support is likely to decrease over the next several years. The World Bank, for example, is no longer funding large-scale water projects but rather is encouraging greater private participation. Second, privatization is a means to achieve greater efficiency and reduce overhead costs.⁶ The range of privatization options in the water market will include straight operations and maintenance (O&M) contracts, build-operate-transfer schemes (BOTs), concessions, and full ownership.

⁶ Public water supply companies are typically overstaffed. Whereas water companies in the U.S. and Europe employ about 1 to 3 staff per 1,000 connections, employee/customer ratios in Latin America average 7 to 10 per 1,000 connections.

Other Latin American countries already have experience with privatization. One of the more notable examples is a \$4 billion, 30-year concession in Buenos Aires. A consortium led by France's Lyonnaise des Eaux signed a contract with Aguas Argentinas in 1993 to provide water and sewerage services to nine million residents. This model is likely to be followed in many other countries in South and Central America.

As shown in Exhibit 3-9, discussions on water sector privatization are underway in several countries. For example, the water utility in Guatemala has privatized the billing system and is currently considering contracting out its water metering program. Larger scale projects are in the planning stages. Overall, privatization is clearly a long-term opportunity and its viability will likely depend on the success of privatization efforts in the power and telecommunications sectors.

There are a number of barriers to market entry through privatization. First, although reforms in Central American water sectors are likely in the next several years, the exact nature of those reforms are not yet known. The course of reforms will have a significant impact on the viability of privatization projects. Second, the current use of tariff subsidies and difficulties with bill collection put potential revenues at risk. Third, the wholesale cost of funds on capital markets and the high cost of legal and bank advisory services make small transactions — and Central American water sector projects will likely be relatively small — uneconomical on an individual basis.

EXHIBIT 3-9 WATER SECTOR PRIVATIZATION IN SELECT COUNTRIES		
Country	Progress to Date	Comments
El Salvador	BOT projects under consideration	N/A
Guatemala	Billing process now managed through concessions; meter installation and reading will follow	Future progress will be slow due to labor opposition
Honduras	Discussions on concessions for San Pedro Sula system	Full privatization unlikely; this system is creditworthy and the government is unlikely to relinquish it
Panama	Considering a \$20-30 million BOT bulk water supply and treatment system; some discussion of water sector restructuring	Restructuring could lead to divestiture of assets and creation of new entities to supply water

Market Summary

The market for water delivery technology and services is estimated at approximately \$165 million per year over the next five years. Short-term opportunities will be primarily publicly-funded initiatives and will be more significant in countries receiving donor funding such as Guatemala, El Salvador, Costa Rica, and Nicaragua. Guatemala's market is estimated to be the largest; however, much of the planned donor funding is supported by the Japanese, which will limit opportunities for U.S. firms. Other opportunities exist to provide small-scale water supply systems for private users such as resorts that

require high quality water. In the long term, sector reform and privatization will create additional opportunities for operating and managing water delivery systems. Exhibit 3-10 presents the market outlook and best bets for each country.⁷

EXHIBIT 3-10 MARKET OUTLOOK FOR THE WATER DELIVERY SECTOR				
Country	Market Potential (avg. annual US\$ millions)	Market Conditions		Best Bets
		Outlook	Rationale	
Belize	2.4	○	▶ no donor funding ▶ limited investment potential from WASA	▶ feasibility and design ▶ monitoring
Costa Rica	18.5	◐	▶ some donor funding ▶ extensive existing infrastructure	▶ rehabilitation of systems ▶ storage systems ▶ systems for small and medium-sized cities ▶ metering
El Salvador	26	●	▶ limited donor funding ▶ feasibility studies underway ▶ water sector undergoing restructuring	▶ design ▶ rural systems ▶ small-scale water treatment
Guatemala	70	●	▶ large-scale donor funding (mostly Japanese)	▶ siting and design ▶ metering ▶ water treatment
Honduras	13.4	◐	▶ limited donor funding ▶ undergoing structural reform of water sector ▶ USAID supporting feasibility studies for medium-sized cities	▶ systems for small and medium-sized cities ▶ water treatment
Nicaragua	21.4	◐	▶ limited donor funding ▶ large unmet needs particularly in rural areas	▶ rural systems ▶ feasibility studies ▶ siting and design
Panama	13	◐	▶ donor funding	▶ system rehabilitation
TOTAL	164.7	●		
<p>Strong opportunity (market size > \$25 million): ● Moderate opportunity (market size = \$3-25 million): ◐ Limited opportunity (market size < \$3 million): ○</p>				

Source: Hagler Bailly, 1997

⁷ The estimates presented in Exhibit 3-10 and in similar exhibits in the following chapters are based on an analysis of projects in the pipeline, likely government spending, donor funding, and potential industry investments for each country.

3.3 STRATEGIC MARKET CONSIDERATIONS

In evaluating the water delivery market, companies doing business in Central American countries need to consider the following strategic factors:

- ▶ ***The key decision makers with regard to water delivery systems.*** Each Central American country has multiple actors with sometimes overlapping responsibilities for the water sector. In some countries there are efforts to redirect sector responsibilities to clarify the lines of authority and to improve management efficiency.
- ▶ ***The regulatory environment in the water sector.*** Central American governments are also attempting to create a legal and regulatory environment that provides the correct incentives for efficient water management.
- ▶ ***Ability to pay.*** Government agencies, municipalities, water utilities and customers have a limited ability to pay for more extensive water services.

Decision Makers

In Central American countries, the responsibility for providing water services is generally shared among several institutions. The lines of authority among these institutions often are not clear, leading to overlapping responsibilities. These entities range from national water utilities and the municipalities to the environmental and public health ministries or departments, as described below.

- ▶ ***National water utilities.*** In all countries there is at least one major water utility that has responsibility for water supply in the main metropolitan area and other principal cities (see Exhibit 3-2).
- ▶ ***Municipalities/regional governments.*** For those urban areas not serviced by a water utility, the municipality or (in some cases) the regional government entity generally has responsibility for water delivery.
- ▶ ***Government ministries.*** Health ministries often exercise some oversight of the water sector with regard to water quality standards or may be responsible for the provision of water services in rural communities not serviced by a main utility. Other government ministries with a role in the water sector might include the public works, planning, or environmental/natural resources ministries.

The trend toward decentralization is making municipalities and regional offices increasingly responsible for service provision. For example, Honduras' Municipality Law (*Ley de Municipidades*) mandates that municipalities be responsible for providing water and wastewater services. This law shifts SANAA's responsibility for providing water delivery services to municipalities. (SANAA will remain responsible only for Tegucigalpa.) However, because SANAA is prohibited by a different law from transferring its

assets to a third party, at present, SANAA can only delegate service operation and maintenance responsibilities to the municipalities.⁸

Regulatory Environment

Three countries have already passed or are currently considering water laws:

- ▶ Honduras has established drinking water standards under its Water Law.
- ▶ El Salvador's law is being drafted.
- ▶ In February 1994 Panama's Ministry of Health issued regulations establishing national water quality standards.

Laws and regulations governing the water sector are enforced to varying degrees. The institutions or agencies responsible for enforcing environmental legislation generally lack the human and financial resources to adequately monitor compliance. Water utilities or government ministries suffer from shortages of trained technical personnel and laboratory facilities to monitor water pollution. The underdeveloped legal framework and lack of enforcement mean that projects can experience administrative delays or become burdened in the bureaucratic process.

Ability to Pay

There is a critical mismatch in the water delivery market between the decisionmakers and paying customers. Decisionmakers, including government agencies, municipalities, and water utilities, recognize the need to invest in the water sector, but have a very limited capacity to do so. High levels of external debt and the numerous demands on public money constrain the ability of Central American governments to make substantial investments in public works infrastructure such as water delivery systems. Municipalities similarly are not able to finance large investments in the water sector. Water utilities have historically not charged their customers tariffs that cover the costs of providing water services. In metropolitan Guatemala City, customers accounting for 74% of water consumption receive subsidized tariffs. Honduras has among the highest costs of providing service and the lowest tariffs. Even when tariffs cover the full cost of securing and distributing water, there are no additional funds to finance system expansions.

Consumers generally are willing to pay for expanded or improved water services, particularly if they must invest in storage tanks or buy water from other sources. However, they have no direct decision making authority with regard to new projects.

⁸ World Bank, *Honduras: Reforming Public Investment and the Infrastructure Sectors*. p.18.

Tariff reform will go a long way toward addressing the “ability to pay” issue. Several countries have already raised tariffs to bring them more in line with actual costs. This process will eventually create a market that is attractive to the private sector.

Suggested Strategies

The following strategies may help companies to manage the strategic considerations outlined above.

- ▶ Companies will often need to contact many levels of government to complete a project. For large projects funded by multilateral agencies, the executing agency is often the water utility. A separate government ministry may be responsible for equipment procurement subject to the multilateral agency’s guidelines.
- ▶ Companies may need to budget additional time and money to accommodate potential bureaucratic delays in project negotiation and development. In addition, companies need to actively follow the development and implementation of new regulations.
- ▶ Companies may require government guarantees for privatization and other opportunities that do not have multilateral development bank funding. Companies will need to monitor changes in individual utilities’ tariffs and the ongoing tariff reform process in the region.
- ▶ Companies need to consider the trade-offs among several factors in deciding upon donor-funded and other opportunities. Donor-funded projects represent the largest single portion of the water delivery market and are characterized by relatively clear decision making authority and strong “ability to pay”. However, donor-funded projects are typically one-time deals and offer few chances for replication. Identifying and evaluating the relatively few private project opportunities may be difficult and time consuming. However, many private customers are creditworthy. Also, the experience companies obtain from one private project may lead to opportunities with other customers.

CHAPTER 4

WATER POLLUTION CONTROL

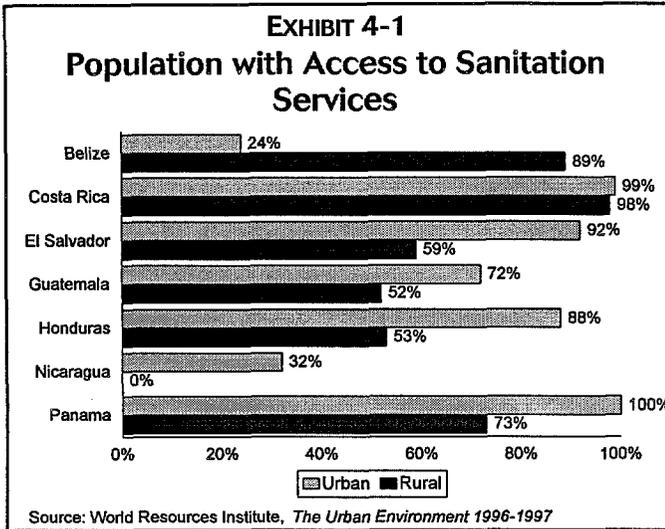
Water pollution is a serious problem affecting all of Central America. Virtually every river passing through a major urban area is severely polluted, and many of the major lakes — which serve as fishing areas, potential sources for drinking water, and recreational centers — are on the verge of dying. Water-borne diseases are a leading cause of death throughout Central America, particularly for infants. Much of this contamination comes from the discharge of untreated municipal and industrial waste into the region's waterways, although soil erosion and agricultural runoff laden with nutrients and pesticides are also contributing factors. Due to the lack of monitoring, the extent of degradation is unknown, but estimates of the degree of degradation resulting from water pollution run high.

Investments in wastewater treatment have lagged behind those for water delivery systems, reflecting the region's historical priorities. As water quality deteriorates, however, addressing water pollution has become a higher priority in all Central American countries. Near-term market opportunities will include expansion of sewerage systems, renovation of wastewater systems, and some construction of wastewater treatment plants. Many of these investments will be supported by bilateral and multilateral donors. Other near-term opportunities are emerging to provide industrial water pollution prevention and control technologies to larger-sized industrial facilities, particularly multinationals, and those facilities located in very polluted areas. The privatization of wastewater services is under consideration in many of the Central American countries, but market opportunities arising from privatization are long-term opportunities.

4.1 MARKET NEEDS

In all of the Central American countries there is a notable lack of infrastructure to effectively collect and treat water pollution from both domestic and industrial sources. The most pressing needs for water pollution control infrastructure fall into three market segments:

- ▶ extending sewerage systems for municipal and industrial wastewater
- ▶ building or upgrading municipal wastewater treatment facilities
- ▶ installing industrial wastewater treatment facilities.



Extending Sewerage Systems for Municipal and Industrial Wastewater

A major goal for all Central American countries during the next decade will be to extend sanitation services to the entire population. Currently, more than 11.5 million Central Americans, or 35% of the region's population, do not have access to sanitation services (3.7 million in urban areas and 7.8 million in rural areas).

Sanitation services are defined as connection to sewerage systems, septic tanks, latrines, communal facilities, or other such facilities.

Access to these services varies widely among

the countries as well as between urban and rural areas within each country (see Exhibit 4-1).¹ Overall, 76% of urban residents have access to sanitation services. Costa Rica and Panama maintain the highest level of coverage for sanitation services — 100% in urban areas — while Nicaragua provides services to only 32% of the urban population. Coverage in rural areas is considerably lower, at only about 55% region-wide. This lack of services directly affects water quality in rivers, lakes, and other water bodies and threatens water supplies. For example, in Managua wastewater is discharged directly into Lake Xolotán, which is the principal water supply for the city.

To meet the needs of both medium and large cities, Central American water utilities must extend their sewerage systems to a larger portion of the population (see Exhibit 4-2 for a list of the key utilities in each country that are responsible for providing sanitation services). Sewerage systems are effective mechanisms for collecting domestic wastewater, and in some cases industrial wastewater, to channel sewage away from population centers to a central wastewater treatment facility. The extent of sewerage systems, however, is limited

EXHIBIT 4-2
KEY WATER UTILITIES IN CENTRAL AMERICA

Country	Utility
Belize	Water & Sewerage Authority (WASA)
Costa Rica	Costa Rican Institute of Water and Sewage Systems (AYA)
El Salvador	National Water Supply and Sewage Administration (ANDA)
Guatemala	Guatemala City Municipal Water Company (EMPAGUA)
Honduras	National Autonomous Water and Sewage Service (SANAA)
Nicaragua	National Water Authority (INAA)
Panama	National Water and Sewerage Authority (IDAAN)

¹ The figures for Exhibit 4-1 are drawn from World Resources Institute's *The Urban Environment 1996-1997*. Most of the data were collected by The World Health Organization (WHO) in 1994. The WHO defines "access to sanitation services" in urban areas as connections to public sewers, or disposal by household systems such as pit privies, pour-flush latrines, septic tanks, communal toilets, and other such facilities. In rural areas reasonable access is defined as disposal by pit privies, pour-flush latrines, and other similar facilities.

65

throughout Central America. In most countries, only the main urban centers have sewerage systems, but even these systems lack sufficient infrastructure to fully meet the needs of the current population — much less the demands of growing populations — and are in varying states of disrepair. (Exhibit 4-2 lists the key utilities in each country that are responsible for providing sanitation services.) Expanding and upgrading the sewerage systems in major urban areas will be a first priority, followed by installing systems in secondary cities. The conditions of specific countries' overall sewer systems are discussed below.

- ▶ **Belize.** Of Belize's total population with access to sanitation systems, only 18% are served by sewerage systems. Sewage collection systems exist in Belize City and Belmopan, and a new sewer system is under construction in San Pedro. There are 4,567 connections in the Belize City sewer system, covering only 65% of the total potential users. In addition, the sewer pipes are located below the groundwater tables, resulting in contamination of the groundwater.
- ▶ **El Salvador.** Only 59% of the urban population is connected to a sewerage system. ANDA, El Salvador's water and sewerage utility, operates only 81 sewer systems in El Salvador, leaving 181 municipalities without such systems. There are no sewerage systems in rural areas.
- ▶ **Guatemala.** In Metropolitan Guatemala City, 54% of the residents have access to the city's sewerage system.² A full 20% of Guatemala City's population discharges their wastewater into natural drains, contaminating both surface and groundwater.
- ▶ **Honduras.** Only 25% of residences are connected to a sewerage system.³ Honduras' main sewage pipes run parallel to the Río Choluteca and its tributary. Because the pipes are broken in various places, much of the wastewater flows directly into the river.
- ▶ **Nicaragua.** Sewerage systems exist primarily in Managua; seven cities in the Pacific Zone and two cities in the North-Central Zone also have sewerage systems. These connections cover approximately 39% of the urban population, but only 19% of the total population.
- ▶ **Panama.** Sixty-seven percent of Panama's urban population is served by sewerage systems. Rural areas have no such systems.

Building or Upgrading Municipal Wastewater Treatment Facilities

Currently, only a small percentage of the residential and industrial wastewater collected by municipal systems is treated before being discharged into the region's waterways. For example, Guatemala only

² USAID. 1993. *Planning for Urban Environmental Health Programs in Central America*. WASH Reprint: Field Report No. 420. Washington, D.C., p. 15.

³ Pan American Health Organization. 1993. *Situación Actual del Sector Agua y Saneamiento de Honduras: Coberturas*. Tegucigalpa, Honduras.

treats an estimated 4% of all wastewater produced in the country. The metropolitan areas of San José, San Salvador, Tegucigalpa, and Managua do not currently treat any of their wastewater. A few treatment plants can be found in each of the Central American countries, but for the most part, those that do exist are in disrepair, operating below capacity, or are not functioning at all.

To address this problem, Central American countries urgently need to install new municipal wastewater treatment facilities or rehabilitate existing ones. As Exhibit 4-3 illustrates, the region lacks the facilities needed to treat its wastewater. Metropolitan Guatemala City has 20 small treatment plants that were built in the last decade. Many of these are either not currently functioning or are operating below full capacity.⁴ The treatment plant in Belmopan, Belize, also is not functional and about 95% of the raw sewage from 4,000 people is discharged into the Belize River.⁵

EXHIBIT 4-3 EXISTING MUNICIPAL WASTEWATER TREATMENT FACILITIES		
Country	Capital City	Other Locations
Belize	Nonfunctional plant in Belmopan	2 facultative lagoons in Belize City providing 80-85% BOD removal; new plant under construction in San Pedro
Costa Rica	No facilities	5 small plants in the province of Guanacaste
El Salvador	No facilities	31 small treatment facilities, many of which are not functioning or are functioning below capacity
Guatemala	18 small plants, many non-operational or in need of repairs	Approximately 15 plants and stabilization lagoons; most are functional
Honduras	1 facility that is in poor condition	11 small treatment plants
Nicaragua	No facilities	8 systems with stabilization lagoons

Installing Industrial Wastewater Treatment Facilities

Treatment of industrial wastes in Central America is not widespread. Although the region is not heavily industrialized, some of the major industries are very water-intensive and generate large quantities of wastewater. The primary source of industrial water pollution in the region is the agro-industry, including coffee processing, sugar milling and refining, and citrus production. While effluents from these industries typically do not contain toxic or hazardous materials, they are laden with organic materials. Other key industrial sectors in the area include food processing, beverages, textiles, leather tanning, paper, chemicals, and metal finishing. For the most part, Central American countries do not have regulations limiting effluent discharges; where regulations do exist, enforcement is generally weak. Therefore, industry has had little incentive to install costly treatment systems. As a result, most industrial waste does not receive any treatment. For example:

⁴ Pan American Health Organization. 1995. *Análisis Sectorial de Agua Potable y Saneamiento en Guatemala*. Sectoral Analysis Series, No. 4. Washington, D.C., p. 77.

⁵ World Bank. 1996. *Belize Environmental Report*. Washington, D.C. Annex IV, p. 5.

- ▶ *Costa Rica.* Only about 10% of the 400 industrial facilities in the San José metropolitan area treat their wastewater.
- ▶ *El Salvador.* In San Salvador, 69% of industrial wastes are discharged into the sewerage system, while the rest is discharged directly into waterways or pluvial drains. Of the wastewater discharged into the city's sewerage system, only 4% of industrial wastes receive any form of pre-treatment.
- ▶ *Honduras.* Only one-third of Honduran industrial facilities pre-treat wastewater before discharging it into the municipal collection system. The only state-owned facility that has a complete treatment system is the National Brewery.

4.2 MARKET OPPORTUNITIES

Throughout the region, public and private investment in water pollution control historically has been low. But severe levels of water contamination are putting increased pressure on municipalities and the industrial sector to address this environmental problem. The market for water pollution control and prevention technologies and services is estimated to equal the water delivery market at approximately \$835 million over the next five years. Market opportunities fall into three categories:

- ▶ publicly-funded initiatives, most of which will be funded by international donor assistance and are likely to target municipal needs
- ▶ private-sector financed projects, primarily for industrial facilities
- ▶ privatization in the municipal sector.

Publicly-Funded Initiatives

In most cases the countries or municipalities do not have sufficient financial resources for the large investments required to meet their sewerage and wastewater treatment needs, especially when faced with pressing investment needs in other equally-important sectors. To a large degree, this market is driven by donor funding. Exhibit 4-4 highlights the major projects in the pipeline for sewerage and wastewater treatment. Many of these projects are combined with improvements in water supply and treatment. In addition to donor funding, each government and the respective water utilities and municipalities will continue to fund, at generally low levels, investments in sewerage and treatment.

EXHIBIT 4-4			
SELECTED DONOR-SUPPORTED SANITATION AND WASTEWATER PROJECTS			
Country	Principal Donor	Project Description	Estimated Expenditure for Water Pollution Control (US\$ Millions)
Belize	IBRD	Belize City Infrastructure Improvement: Improvements in Belize City's storm drains	10.0
	Subtotal:		10.0
Costa Rica	IDB	Sanitation and Drinking Water for Intermediate-Size Cities: Rehabilitation of sanitary infrastructure	25.0
	IDB	Tárcoles River Watershed Management Program: Construction of water treatment systems and other related infrastructure	38.0
	WB	Second Water Supply and Sewerage Project: Rehabilitation of sewerage system, interconnectors, and pumping stations in San José; installation of collectors in other cities	4.0
	Subtotal:		67.0
El Salvador	IDB	Critical Areas of Decontamination: Develop alternative treatment processes & extension of sewerage systems for selected urban areas; industrial pollution control	14.0
	IDB	Water and Sewer Project: Construction of sanitation works country-wide	31.0
	Subtotal:		45.0
Guatemala	IDB	Guatemala City Metropolitan Area Environmental Program: Modernize 7 existing wastewater treatment plants; assess options for new facilities and alternative solutions for marginal urban areas	20.0
	Subtotal:		20.0
Honduras	IDB	Sanitation Sector Reform: Modernization of the sanitation sector with emphasis on increasing participation of the municipalities and private sector	25.0
	IDB	Sewerage Project for Puerto Cortes: Install a sewerage system for Puerto Cortes.	18.0
	Subtotal:		43.0
Nicaragua	WB	Water and Sanitation: Rehabilitation and expansion of sanitation services in Managua, particularly in low-income areas	15.0
	IDB	Lake Managua Environmental Improvement Program: Reconstruction of 45 km of sewerage systems, 7 interceptors and the construction of facultative lagoons	35.6
	Subtotal:		50.6
Panama	IDB	Sanitation and Environmental Protection of Panama City: Improvements to the sewerage planning of the capital	140.00
	Subtotal:		140.0
Estimated Expenditures of Donor Funding Projects:			375.6

Source: World Bank and Inter-American Development Bank

69

- ▶ **Belize.** Although Belize received support from various donors in the 1980s to expand water and sanitation services, donor funding currently supports only the development of a sewerage system in San Pedro and improvements to the storm drainage infrastructure in Belize City. From 1995 to 2005 Belize estimates it will spend \$14.7 million on sanitation facilities. Of this amount, \$3.1 million is to be invested in public sewage systems; the remainder will finance latrines and septic tanks. The Social Investment Fund, established with funds from the World Bank, may be used for developing rural sanitation projects.
- ▶ **Costa Rica.** A major IDB-funded river basin protection project is in the pipeline for the Tárcoles Water Basin. Phase 1 of this project includes provisions for the construction of several wastewater treatment facilities in the San José metropolitan area.
- ▶ **Guatemala.** EMPAGUA recently completed a Master Sewerage Plan with funding from the Japanese government that calls for the construction of two large treatment plants to serve metropolitan Guatemala City. One of the plants would be located in the northern part of the city and the other in the southern part. The estimated cost for each is more than \$50 million. The IDB is also supporting a project to modernize several existing facilities and undertake sanitation projects in marginal urban areas.
- ▶ **El Salvador.** The water and wastewater sector is undergoing a complete restructuring that includes the privatization of ANDA and the delegation of services to municipalities. An IDB-funded project proposes extending the sewerage systems. ANDA also plans to rehabilitate several collection systems in San Salvador.
- ▶ **Honduras.** The IDB financed several studies to assess the options for wastewater treatment systems in Tegucigalpa. These studies determined that Tegucigalpa will need to invest \$100 million to adequately address water pollution; however, these projects will unlikely be ready for investment for several years. Honduras is also looking at the need for sewer systems and treatment plants in smaller cities. It is unlikely that there will be any investment in this sector without country-wide economic reforms.
- ▶ **Nicaragua.** The Master Sewerage Plan for Managua, funded by the IDB, identified approximately \$35.6 million in direct investments needed for the reconstruction of 45 km of collection systems, the construction of 19 km of interceptors to direct flows to treatment plants, and the construction of 67 hectares of facultative lagoons. The construction of these treatment lagoons will be financed through parallel funding from GTZ, the German donor assistance agency, and has a direct investment cost of \$20.9 million.
- ▶ **Panama.** The IDB is planning to fund improvements to the sewerage system of Panama City. This program could result in \$140 million in investment in the sanitation sector.

Private Sector-Funded Projects

Near-term market opportunities exist for privately-financed projects. Promising market opportunities in the industrial sector are likely to be found in the following sub-sectors:

- ▶ water-intensive agro-industries such as coffee, sugar, and citrus
- ▶ water-intensive industries such as bottling, breweries, and textiles
- ▶ industry sectors that have signed agreements with governments or other authorities to make environmental improvements
- ▶ export-oriented companies.

Industries in Central America will increasingly be forced to address their environmental wastes by installing water pollution control systems and adopting cleaner production technologies. The most important factor in the long term will be improved regulatory enforcement by government agencies. But there are more immediate pressures driving Central American industries to install water pollution control systems. Many companies are being pressured by international parent companies or buyers of Central American exports that are concerned about their own image among consumers to improve their environmental management practices. In Costa Rica, for example, a thread manufacturer recently invested more than \$1 million in a treatment system in order to satisfy an important potential client's demand for improved environmental management. In some areas, pressure is coming from other productive sectors that are being adversely affected by the contamination stemming from another industry. For example, shrimp farmers in Honduras have complained that wastes from several sugar mills are reducing the shrimp harvest.

Industry throughout the region is also undertaking a variety of independent initiatives to address environmental wastewater problems. Costa Rica, for example, has a voluntary program jointly coordinated by the Ministry of Health and the Ministry of Environment and Energy under which more than 100 companies submitted plans to reduce their wastewater discharges. Various sectors are also signing agreements with the government to reduce their discharges. The Costa Rican coffee industry, which is a major contributor to water pollution in the Tárcoles water basin, has signed a pact to reduce its discharges of organic material by 80% (see Exhibit 4-5). Another example of a possible future industrial wastewater treatment project is an El Salvadoran industrial park's recent consideration of a \$200,000-300,000 compact water treatment plant with a capacity of 145,000 gallons per day that would serve textile factories.

EXHIBIT 4-5
ENVIRONMENTAL IMPACTS OF THE COFFEE INDUSTRY

One of the leading export crops throughout Central America is coffee. Coffee generates \$1.8 billion in export revenues for the region. But the coffee industry is also a significant source of water pollution. The processing of coffee cherries to extract the coffee bean generates both liquid and solid wastes that are typically not treated or disposed of properly.

Central American coffee producers generally use a wet method to process coffee. (Coffee can also be processed by a dry method.) In the wet method, machines remove the pulp of the ripe coffee cherries to expose the bean's protective coat of parchment. The beans are then soaked and fermented in large tanks to remove the covering, which is then washed away with water until the beans are clean. The wet processing method requires large quantities of water for depulping and washing the bean, and generates wastewater laden with organic material. The final product actually consists of only 20% of the original coffee bean; the rest is discharged as waste. The environmental impact of the coffee processing industry is further compounded by the seasonality of the industry. The harvesting season, which runs from November to March, corresponds to Central America's dry season, when rivers are running low from minimal rainfall. The result is increased concentrations of organic contamination in the rivers.

Costa Rica has one of the highest per-unit water consumption levels among Central American coffee processors, consuming 8-16 m³ of water per metric ton of cherries. Overall, Costa Rica has 129 coffee processors which produce an estimated 360,000 metric tons of pulp waste and approximately 10 million m³ of wastewater, which together result in an organic load of 30,000 metric tons of COD per year. Only 10% of Costa Rica's processing plants have installed wastewater treatment plants. However, through the Coffee Institute, the industry has signed an agreement with the government to reduce its discharges. By 1997, the industry should have reduced its generation of BOD, COD, and suspended solids by 80%.

The Río Grande de Tárcoles watershed in Costa Rica is one area seriously affected by the coffee industry. Coffee processing contributes approximately 68% of the BOD loading in this watershed (see the table below).

**Principal Sources of Organic Pollution
of the Río Grande de Tárcoles Watershed**

Pollution Source	Kg BOD/day	Population Equivalent	% Contribution
Domestic Wastewater	40,485	750,000	14
Industry	51,031	950,000	18
Coffee Processing	191,500	3,500,000	68

Source: *La Cuenca del Río Grande de Tárcoles: Con Miras Hacia el Futuro*. Seminar Proceedings. Municipality of San José, Costa Rica, 1992. p. 61.

Privatization

Most Central American countries are in the early stages of considering private sector investment in water pollution control; market opportunities will thus arise from privatization are thus long term. But there is increasing interest in granting concessions for the private operation of wastewater collection

and treatment systems and also build-own-operate-transfer (BOOT) projects. Privatization of water utilities is also a possibility, although probably not in the immediate future. Private companies have already entered the market as providers of wastewater treatment in residential areas that do not have access to the municipal sewer system. In Costa Rica, the IDB is financing a project to facilitate private investment in infrastructure. While this project is focusing first on the electricity sector, it is anticipated that the project will also set procedures for awarding concessions for water and sewerage works.

Several countries are taking steps to allow private companies to manage municipal sanitation services in part or in whole. The largest obstacle is the issue of whether the population will be able to pay for these services at a level that will be financially attractive for private investors. Guatemala's utility, EMPAGUA, has contracted with private companies to administer such functions as the distribution of water bills and reading of meters. Guatemala's government also is interested in exploring private sector involvement in the construction of the two treatment plants in Guatemala City (mentioned above). In Belize, WASA has the sole authority to supply sewerage services in declared service areas; however, WASA can choose to contract with private companies to provide these services. Costa Rica's AYA is considering granting concessions to private companies to construct wastewater treatment facilities. Panama is leading the region in efforts to privatize its water utility; however, privatization of the national water utility, IDAAN, will require special legislation.

Privatization may move Central American countries toward alternative solutions to control water pollution where the private sector may be more adept in maximizing the region's limited capital resources. In many cases, extending sewage systems is simply not cost effective, particularly for rural areas and in some of the marginal urban areas. Other forms of collection and treatment of wastewater may be more suitable. Examples of alternatives include septic tanks for neighborhoods, smaller diameter sewage pipes, bio-filters, and subterranean filters with swamp plants. Alternatives that generate economic benefits should also be considered. One example is creating a market for residual sludge or algae produced by oxidating lagoons.

Market Summary

The estimated annual market potential for water pollution control and prevention technologies and services is approximately \$167 million per year over the next five years, making it one of the larger environmental markets in Central America (see Exhibit 4-6). A primary market driver in the municipal sector will be donor funding: with the exception of Belize, each country has sanitation sector investments that will be supported by donor funding. In fact, the largest potential markets are in El Salvador and Guatemala where major donor-funded projects are in the pipeline. There are also market opportunities for industrial wastewater prevention and control technologies. These opportunities will become more significant as the Central American countries develop and promulgate water pollution regulations. Privatization efforts will affect this market in the medium to long term.

EXHIBIT 4-6 MARKET OUTLOOK FOR WASTEWATER CONTROL AND PREVENTION TECHNOLOGIES				
Country	Market Potential (avg. annual US\$ millions)	Market Conditions		Best Bets
		Outlook	Rationale	
Belize	8	◐	<ul style="list-style-type: none"> ▶ limited donor funding tied to existing projects ▶ decreased public spending ▶ little industry 	<ul style="list-style-type: none"> ▶ pumps ▶ small-scale WWT packages
Costa Rica	24	●	<ul style="list-style-type: none"> ▶ potential San Jose wastewater treatment (WWT) ▶ some sewerage rehabilitation ▶ strengthening industrial regulations and enforcement 	<ul style="list-style-type: none"> ▶ instrumentation, pumps, filters ▶ integrated industry WWT packages ▶ clean technology
El Salvador	35.5	●	<ul style="list-style-type: none"> ▶ donor funding for sewerage system rehabilitation and expansion ▶ strong privatization movement ▶ industrial growth (maquiladoras) ▶ new environmental legislation 	<ul style="list-style-type: none"> ▶ siting and design ▶ clean technology ▶ monitoring equipment ▶ alternative treatment tech.
Guatemala	36	●	<ul style="list-style-type: none"> ▶ donor-funded WWT plant rehabilitation ▶ plans to construct 2 treatment plants in Guatemala City ▶ large unmet needs (especially rural areas) ▶ Lake Amatitlan Region problems 	<ul style="list-style-type: none"> ▶ siting, design, and construction ▶ pumping/pipeline system design ▶ instrumentation ▶ package treatment facilities ▶ small-scale industry WWT ▶ clean technology
Honduras	21	◐	<ul style="list-style-type: none"> ▶ donor-funded institutional restructuring underway ▶ WWT funding in intermediary cities ▶ identified needs in Tegucigalpa ▶ large potential; but sewerage/WWT spending likely to await reforms ▶ effluent standards being considered 	<ul style="list-style-type: none"> ▶ siting and design ▶ small-scale integrated WWT packages for medium-sized cities
Nicaragua	20	◐	<ul style="list-style-type: none"> ▶ donor-funded Lake Managua clean-up ▶ sewage systems construction ▶ weak enforcement of industry regulations 	<ul style="list-style-type: none"> ▶ siting and design ▶ pumps, filters ▶ alternative treatment for rural areas
Panama	23	●	<ul style="list-style-type: none"> ▶ sewerage expansion capital (donor) ▶ better coverage in urban areas ▶ little industry ▶ environmental regulation in limbo 	<ul style="list-style-type: none"> ▶ siting and design ▶ alternative treatment ▶ pumps, filters
TOTAL	167.5	●		

Strong opportunity (market size > \$25 million): ● | Moderate opportunity (market size = \$3-25 million): ◐
 Limited opportunity (market size < \$3 million): ○

Source: Hagler Bailly, 1997

4.3 STRATEGIC MARKET CONSIDERATIONS

The strategic considerations that influence water delivery projects also affect new water pollution control and prevention opportunities: decision makers, the ability to pay for water pollution control, and the regulatory environment. There are a few key differences, however, as discussed below.

- ▶ Private companies present an alternative market segment with greater purchasing power than the municipal market.
- ▶ Regulations, which typically create water pollution control opportunities in most markets, have been absent in most Central American countries.
- ▶ “Ability to pay” issues may be both more and less critical in the pollution control arena than in the water delivery sector, depending on the type of opportunity.

Decision Makers

The decision makers influencing water pollution control opportunities are the same as for water delivery with the exception of private sector opportunities. Private companies will make decisions about new industrial wastewater treatment facilities in response to more stringent regulations and enforcement or market pressures they may face from within Central America or from overseas influences.

The group of agencies and organizations with responsibility for both donor-funded opportunities and/or any privatization opportunity for water pollution control, collection, and treatment is the same group of decision makers discussed in Chapter 3 (see Exhibit 4-2 for a list of Central American water utilities or Exhibit 3-2 for a more detailed presentation of these water utilities). These entities range from national water utilities and municipalities to the environmental and public health ministries or departments.

Regulatory Environment

The regulatory environment currently does not provide sufficient incentives to control water pollution. Central American countries have only recently begun to focus on wastewater issues. Only Belize has enacted regulations covering wastewater discharges from industries. Costa Rica and Honduras are developing industrial discharge standards. Costa Rica has appointed a commission to coordinate the development of standards. The commission will base its recommendations on input given by AYA, the Ministry of Environment and Energy, the Ministry of Health, and the industrial sector. Standards are expected to be in place by the end of 1997, at which time industry will be required to comply. Honduras is drafting regulations under the auspices of a National Committee for Water Quality, which includes government agencies as well as the private sector.

Lack of sectoral reform is also inhibiting privatization opportunities. Honduran law makes no provisions for private sector participation in municipal wastewater treatment (e.g., BOTs). In fact, the



law under which SANAA is operating has not been updated since 1960. Costa Rican law allows private concessions to build infrastructure such as bridges and highways. However, this concession authority has not yet been extended explicitly to water pollution control.

Ability to Pay

As with water delivery, in spite of the region's significant need to expand collection systems and install treatment facilities for municipal wastewater, the reality is that the institutions responsible for the collection and treatment of wastewater have extremely limited resources because they charge inadequate fees for sanitation services. Customers are charged for water and wastewater services under the same bill, but there is typically no assignment of fees based on the actual volume of wastewater discharged. "Ability to pay" issues have historically been an even greater concern for water pollution than for water delivery, because national and local governments have historically placed a lower priority on providing such services. Water pollution control companies may therefore need guarantees from governments or international lending agencies to enforce payment for services.

Similarly, the primary impediment to privatization opportunities is the uncertainty regarding a privatized utility's ability to charge tariffs that will prove financially attractive for new private investments. In Belize, for example, current fees for water and sewerage disposal are just high enough to meet WASA's operating expenditures, but are not sufficient for expanding and upgrading the water and sewer system. Therefore, agencies such as WASA typically depend on government or external subsidies (e.g., donor funding) for new investments. Amendments to Belize's Water and Sewerage Act have, however, increased sewer fees for Belize City and Belmopan from 20% to 30% of the total tariff rate.

Private buyers of wastewater treatment systems face fewer "ability to pay" issues, because buyers are largely international companies with strong balance sheets and access to international capital markets and export revenues.

Suggested Strategies

With respect to decision makers and the regulatory environment, companies interested in water pollution control opportunities should consider strategies similar to the ones outlined in the water delivery section. For example, companies may require government guarantees for public sector projects that are not financed by multilateral development banks. Private sector water pollution control projects, however, cannot benefit from government guarantees. Thus, companies will need to evaluate the creditworthiness of private customers on a case-by-case basis.

There are several factors that might lead some companies to target industrial wastewater treatment opportunities rather than publicly-funded projects. First, industrial wastewater deals should be comparatively easy to replicate. As industrial market opportunities grow with the implementation of new regulations, companies may be able to use the experience they gain from one or a few private

projects to obtain more opportunities. In comparison, donor-funded projects are typically one-time deals. Second, many private customers are creditworthy. Public projects without donor funding may rely upon poor credit risks.

77

CHAPTER 5

WASTE MANAGEMENT

In many Central American countries, piles of garbage dot the countryside, which, in addition to being unsightly, pose an environmental hazard and major health risk to the communities living nearby. The region generates an estimated 17,600 metric tons of solid waste per day, a figure which is expected to almost double in the next two decades as the urban population continues to soar.¹ The amount of hazardous waste generated in the region is unknown. However, given the small industrial base, hazardous waste accounts for only a small fraction of the total volume of waste generated in Central America.

Only 50% of the solid waste generated in urban areas is collected by municipalities and other waste management service providers, and even less of this is disposed in designated landfills. Many of the existing landfills are nearing capacity, and few meet international sanitation standards. Population growth and urbanization are generating ever-higher volumes of waste, further straining an already insufficient infrastructure for waste collection and disposal. In rural areas most of the solid waste is incinerated in open fires or deposited in areas that have become *de facto* garbage dumps.

There is a clear need for waste management services and technology in the region. Short-term investments will likely be financed through donor programs. One area with promise in the near term is small-scale alternative management technologies such as recycling and composting. However, significant market opportunities are likely to emerge only in the medium term. As Central American countries develop national solid waste management plans, investments levels in this sector will increase, creating greater market opportunities.

5.1 MARKET NEEDS

Central American countries have generally underinvested in solid waste management. Previous neglect of this sector, combined with an increased recognition of the health and environmental impacts of improperly managed waste, has created the need for investment and improved management in three market segments:

- ▶ expanding waste collection systems
- ▶ upgrading existing landfills or building new ones

¹ This figure assumes that urban residents generate 0.75 kg per capita per day and that rural residents generate 0.35 kg per capita per day. Estimates of urban and rural populations are drawn from the World Resources Institute, *The Urban Environment 1996-1997*.

- ▶ creating source reduction and alternative waste management programs.

Expanding Waste Collection Systems

Currently, less than half of the approximately 17,600 metric tons of solid waste the region generates each day is adequately collected. Estimates of the percentages of waste collected in urban areas range from 50-80%, and the percentage in rural areas is much lower. One study estimated that in 1990 only 30% of all solid waste generated in Costa Rica was actually collected.² The biggest waste management problem is municipal waste (both residential and commercial) due to the sheer volume generated each day. Although the quantities of hazardous waste and hospital waste are small, improper collection and disposal also present an immediate environmental and health risk.

Municipal Solid Waste. The majority of domestic waste is generated in urban centers where higher population densities contribute to higher rates of waste generation; thus, the greatest need is to extend current collection systems to 100% of the urban populations. Estimates of the average per capita rate of solid waste generation in Central American cities ranges from 0.5 to 1.0 kilograms per person per day.³ For example, in Costa Rica, the San José metropolitan area produced 47% of the country's total solid wastes in 1995. Urban populations also tend to be more affluent; thus, they consume and discard more goods.⁴ Managua, for example, produces 61% of all garbage in Nicaragua. This is 7 times more than León, a city with about one-quarter the population of Managua. León accounts for 9% of Nicaragua's solid waste.

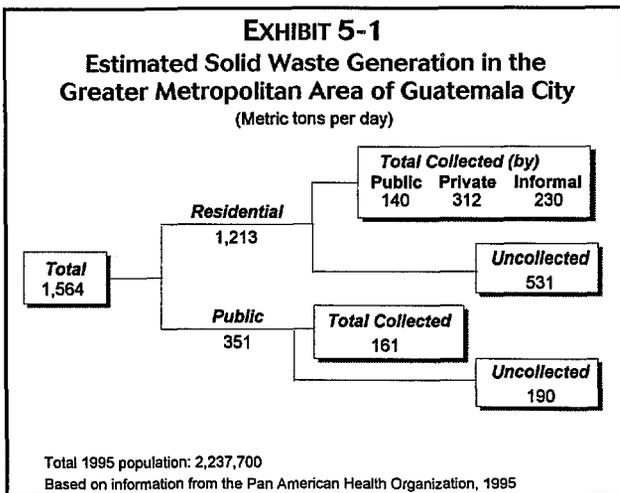
Urbanization and population growth have led to increases in the amount of solid waste generated in Central American cities, straining the existing waste collection systems. The volume of waste generated daily in Costa Rica's Central Valley (which includes the metropolitan area of San José) increased from 400 metric tons in 1978 to almost 1,000 metric tons in 1994, an annual growth rate of 5.9%.⁵ The metropolitan Guatemala City area currently produces approximately 1,500 tons/day, but only an estimated 54% of this waste is collected (see Exhibit 5-1). Efforts to expand services are also hampered by the population growth in peripheral areas where it is difficult to maneuver collection vehicles.

² Proyecto Estado de la Nación. 1995. *Estado de la Nación en Desarrollo Humano Sostenible*, p. 55.

³ USAID. 1996. *Informe sobre el Análisis Comparativo de Riesgos en Centroamérica: Volume I*. Washington, D.C., p. II-8.

⁴ Empirical studies have shown that levels of per capita waste are linked to standards of living. PAHO has estimated that in cities such as Mexico City, Río de Janeiro, and Buenos Aires, the average rate of solid waste generation is 0.8-0.9 kilograms per person per day.

⁵ CEGESTI. 1995. *Creation and Strengthening of a Local Capacity for Clean Technology in Costa Rica*. San José, Costa Rica. p. 29. These figures include estimates of domestic, industrial, construction, and hospital wastes.

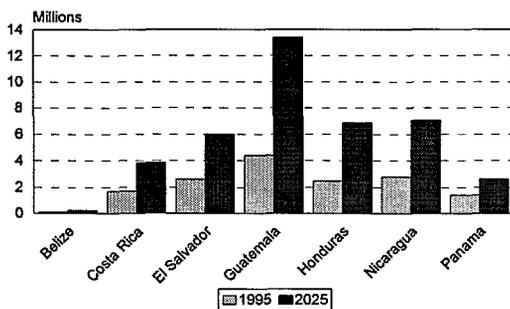


Outside of the major urban areas, many communities do not have garbage collection services. A study of 55 municipalities in El Salvador found that 60% do not have these services.⁶

As the urban population continues to grow, the volume of waste generated in the region is expected to almost double over the next 20 years, further straining waste collection and management services. As Exhibit 5-2 illustrates, the total urban population in Guatemala alone is expected to top 13 million by 2025 and the urban populations in Nicaragua, Honduras, and El Salvador are also expected to grow substantially over the next three decades. Assuming that waste generation levels remain constant, the amount of solid waste generated in Central America is projected to increase to more than 31,600 metric tons (see Exhibit 5-3). This increase can be attributed nearly entirely to population growth and larger urban populations resulting from migration.

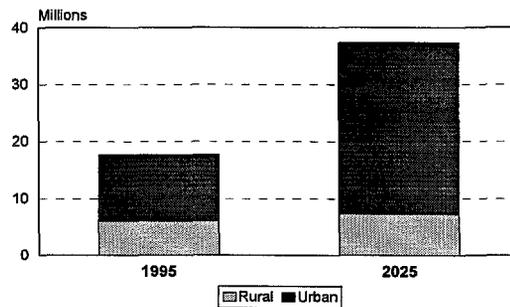
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EXHIBIT 5-2
Projected Growth in Urban Populations



Source: World Resources Institute, *The Urban Environment 1996-1997*

EXHIBIT 5-3
Projected Growth in Solid Waste Generation



Source: World Resources Institute and PRIDE

Industrial and Hazardous Waste. Nonagricultural industrial activity contributes a small amount of the total solid waste in the region. There are three principal categories of industrial waste: organic waste from the agro-industry; solid waste (both organic and inorganic) from the industrial sector as a whole; and hazardous waste. In Costa Rica, 86% of the total waste produced in the country stems from the agro-industrial sector; this type of waste includes the bagasse and filter mud press from sugar mills, citrus rinds from the citrus industry, and coffee husks. As most of the agro-industry is located in rural areas, much of this waste is burned or simply discarded. A small percentage may be used for other beneficial uses such as fertilizer or animal feed. When discarded improperly, agricultural wastes laden

⁶ ISDEM, personal communication.

with organic material can pose problems for ground and surface water resources. Another key waste problem from this sector is the use of plastics by large-scale plantations (see Exhibit 5-4).

EXHIBIT 5-4
PLASTIC WASTES IN THE AGRO-INDUSTRIAL SECTOR

A common problem in Central America is the disposal of plastic wastes from banana and melon plantations. In Costa Rica plastics used by agro-industries account for over 25% of total plastic wastes. If recycling were commercially viable, an estimated 80% of the plastic used by the agriculture industry could be recycled.

Banana Plantations

Banana plantations use blue low-density polyethylene bags, impregnated with an insecticide, to shield the bananas from ultraviolet radiation and insects. Although plantations increasingly recycle the blue bags, those bags that are not recycled typically end up in landfills or along river banks. The plantations also use polypropylene twines to support the banana trees. Much of the twine is left behind on the plantations, degrading the topsoil.

Melon Plantations

Melon plantations use polyethylene mulch film; most of this is improperly disposed at the plantations.

Source: CEGESTI. 1995. *Creation and Strengthening of a Local Capacity for Clean Technology in Costa Rica*. San José, Costa Rica

Industries are often located in urban areas; as a result, industrial solid waste is often part of the municipal waste stream. For example, one study estimated that of the 922 tons of solid waste generated daily in Managua, 210 tons are the result of industrial activity. For the most part, this waste is collected along with domestic wastes. In Honduras, some industries burn their wastes, while others transport their wastes directly to the municipal dump. In addition, there are no special requirements in the collection of hazardous waste; therefore, this waste is typically disposed of together with other wastes. Honduran industries produce an estimated 1,524 metric tons of hazardous wastes, none of which receives special treatment prior to disposal.

Hospital Waste. There are no special waste collection systems for infectious hospital waste in Central America, nor are there any regulations requiring special sorting and treatment of hospital wastes. While some hospitals do have on-site incineration facilities, for the most part, hospital waste is typically collected and disposed of with regular municipal wastes, creating the potential for human contact with pathogens and other infectious materials. In El Salvador, 7 state and 18 private hospitals generate 1.5 tons of waste each day, of which only one-third is incinerated. The remaining two-thirds is dumped — without sorting or treatment — in municipal dumps.⁷ Honduran hospitals do not have on-site incinerators.

⁷ USAID. 1996. *Informe sobre el Análisis Comparativo de Riesgos en Centroamérica: Volume I*. Washington, D.C., p. II-12.

Upgrading Existing Landfills or Building New Ones

Even if collected, wastes remain a problem because Central American countries generally lack sanitary landfills. Exhibit 5-5 lists the types of disposal sites and the amount of waste disposed at these sites for six Central American cities. In Honduras, only Tegucigalpa and San Pedro Sula have landfills.⁸ Other communities dispose of garbage in informal rubbish sites. Metropolitan Guatemala City, like the other major Central American cities, has hundreds of illegal dumps located around the city. As a result of the lack of properly sited and managed landfills, garbage that is not collected often ends up in lakes and rivers, contributing to water pollution and creating a health hazard for the communities that use the water source for drinking, fishing, and recreation.

EXHIBIT 5-5 VOLUME OF SOLID WASTE AND TYPES OF DISPOSAL SITES		
City	Volume (tons per day)	Type of Disposal Site ⁹
Guatemala	1,500	Open rubbish dump
Managua	600	Open rubbish dump
Panamá	930	Open rubbish dump
San José	1,000	Landfill / Open rubbish dump
San Salvador	990	Landfill / Open rubbish dump
Tegucigalpa	550	Open rubbish dump

Source: USAID. 1996. *Informe sobre el Análisis Comparativo de Riesgos en Centroamérica: Volume I*. Washington, D.C., p. II-11

Because there are few guidelines for waste management, solid wastes are typically dumped in landfills with little or no sorting. Solid waste landfills often handle both domestic and industrial wastes,

⁸ The American Society of Civil Engineers defines a sanitary landfill as “a method of disposing of refuse on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical areas, to reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day’s operation or at such more frequent intervals as may be necessary.” Operating requirements should include procedures related to excluding hazardous waste, daily cover, disease vector control, explosive gases, air criteria, access control, run-on and run-off control, surface water requirements, liquids management, and record keeping. USEPA. 1989. *Decision-Makers Guide To Solid Waste Management*. EPA/530-SW 89-072.

⁹ The term “open rubbish dump” refers to a solid waste disposal area that contains no environmental controls. “Landfill” refers to a disposal area that has some provisions for environmental controls.

including hazardous wastes.¹⁰ In El Salvador, for example, hospital, industrial, and domestic wastes are not separated before disposal in a landfill. The industrial and hospital wastes generated in Guatemala City are generally collected with the regular wastes and either brought to the landfill without any treatment or burned.

Many of Central America's existing landfills are reaching capacity, forcing municipal and federal governments to identify new sites for landfills. San José's landfill located at Río Azul, which covers 64 hectares and has a capacity of 10 million m³, is reaching capacity. The landfill for metropolitan Guatemala City is in a similarly poor state: "El Trébol," the city's one site for the final disposition of wastes, was established in 1961 and currently receives about 1,500 tons of waste per day. San Salvador's two landfills, Mariona and Sonsonate, are expected to reach capacity within the next five years.

Upgrading existing landfills to prevent contamination of ground and surface waters is also an urgent need. Many of the landfills are unsanitary, poorly managed, and prone to spontaneous combustion. San José's landfill, although it is described as a sanitary landfill, has no controls for leachate or methane gas.¹¹ Runoff from Managua's landfill is a major contributing factor to the severe pollution of Lake Managua.

Creating Source Reduction and Alternative Waste Management Programs

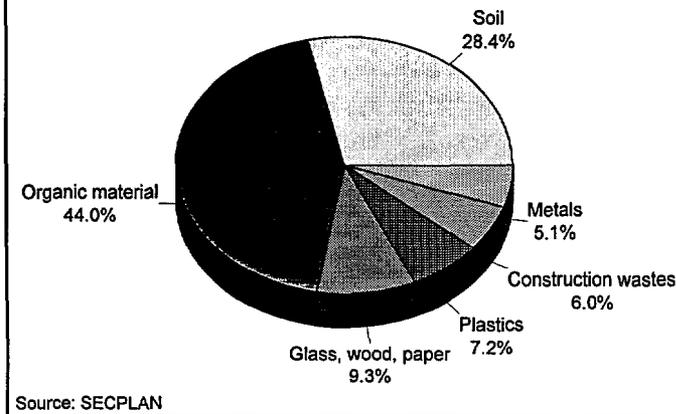
There is a need for alternative waste management programs such as recycling, composting, waste-to-energy facilities, and source reduction. Until now, these types of programs were relatively new concepts for most areas of Central America. Some pilot programs for recycling have been established by community or university groups concerned about the environment. For example, the National University of Costa Rica has implemented a recycling program in coordination with local manufacturers. Collection fees, however, are typically quite low, which can make these efforts unprofitable. Belize has undertaken several small initiatives to recycle certain wastes such as batteries, but these programs are generally not economically feasible on a national level. Belize has no manufacturing industries that will potentially buy recycled material. Therefore, all recycling has to be exported, adding to the cost and administration of a program.

Organic waste accounts for the greatest portion of waste in each of the Central American countries. Thus, composting is a potential strategy for waste reduction. Although the percentage of organic waste varies from area to area, it typically accounts for 50% or more of the total waste stream. In Managua organic waste accounts for 85% of all waste generated in the city, while in San Salvador organic material accounts for 70%, and in Tegucigalpa, 44%. Other types of waste include plastics, paper and

¹⁰ Any sorting that does go on is informal or done by scavengers. The scavengers sort the garbage in search of items that can be resold. The practice is now being discouraged to protect the health of the scavengers.

¹¹ USAID. 1996. *Perfiles Nacionales Relativos al Análisis Comparativo de Riesgo Para Centroamérica: Volume II*. Washington, D.C., p. I-16.

EXHIBIT 5-6
Composition of Solid Wastes
- Tegucigalpa -



carton, textiles, construction wastes, and glass. Exhibit 5-6 shows the composition of solid wastes for Tegucigalpa as a representative example of solid waste streams in the region. Initiatives to sort wastes at the source or after collection can facilitate composting.

Waste-to-energy plants are also currently being explored as a waste management option in several countries. These facilities have the additional benefit of producing much needed electricity to supplement power generation capacity. A Canadian firm is undertaking a feasibility study for a waste-to-energy facility in San Salvador.

5.2 MARKET OPPORTUNITIES

The market for waste management services will reach about \$100 million over the next five years. Market opportunities will appear as Central American countries develop master solid waste plans and develop the capacity of local governmental institutions to manage solid waste issues. In the near term the majority of investments will be donor driven. The trend toward privatization in the region may also create some opportunities; however, these are likely to be limited to local companies. Market opportunities fall into two categories:

- ▶ publicly-funded initiatives
- ▶ privatization in the municipal sector.

Publicly-Funded Initiatives

Waste management generally will remain the responsibility of local governments. Because the required levels of investment are high and generally beyond the financial capacity of Central American municipalities, donor assistance will be integral to the development of the solid waste market in Central America. However, current donor activity in the solid waste sector is only around \$80 million, significantly less than current funding for the water delivery and water pollution control sectors. The following donor-assisted projects are planned for the region:

- ▶ **Guatemala.** The IDB is planning to finance a large environmental program for metropolitan Guatemala City. A large component of the \$43.6 million project will modernize the solid waste collection services, including equipment improvements, and will address the final disposition of

wastes. Proposed equipment purchases include waste sorting units and collection vehicles. Emphasis will also be placed on creating mechanisms for private sector participation.

- ▶ **El Salvador.** An environmental program proposed by the IDB for El Salvador will provide \$33 million for the management of solid wastes in key areas of the country. Major investments will be made for new vehicles and equipment, transfer stations, the construction of recycling facilities and new sanitary landfills. The areas covered by the program include the municipalities of San Miguel (the third-largest city in the country with 183,000 residents), la Unión, and Santa Rosa de Lima and an area surrounding a water aquifer known as Opico-Quezaltepeque.
- ▶ **Nicaragua.** JICA, the Japanese foreign assistance agency, financed the preparation of a master plan for solid waste management in Managua. The study was finished in 1995 and recently the Japanese government indicated that they will finance the investments needed to implement the first stage of the plan. This will include the construction of a new sanitary landfill in Acahualinca.
- ▶ **Panama.** The IDB is planning to fund a large-scale sanitation and environmental protection program for Panama City. A small component of this project will focus on solid waste management.

In addition to these construction and equipment-related procurement projects, the IDB anticipates a \$10 million procurement for Honduras to provide consulting, management, and technical assistance to help modernize the water and sanitation sector and increase private participation in the solid waste sector.

Privatization

There are limited market opportunities for foreign firms to participate in the provision of waste management services. Although the municipalities typically have the authority to contract with private firms to provide collection and disposal services, local workers or unions resist private participation. In other cases, local private firms already supply this market segment. El Salvador, Costa Rica, and Guatemala are all pursuing or currently using private contractors to provide solid waste management services. The Japanese are assisting El Salvador with the formulation of a plan for solid waste management in urban areas. A key goal of the program, defined under the Master Plan for Technical Cooperation for Solid Wastes, is to allow private companies to enter the market for the collection and disposal of solid wastes. However, opportunities in this area will likely be limited for foreign firms.

Market Summary

The market potential for solid and hazardous waste management is an estimated \$21.5 million annually over the next five years. The siting and construction of landfills accounts for a large share of the market potential. However, due to the uncertainty surrounding the project timing of these types of projects, the market potential is difficult to assess. Projects such as the construction of landfills and

incineration facilities require long lead times and it is difficult to predict when these projects will be approved and funded, even when they are backed by donor funding. Exhibit 5-7 highlights the market size and potential in this sector for each country and indicates the best bets for each given likely investments in this sector. Some additional considerations are discussed below.

EXHIBIT 5-7 MARKET OUTLOOK FOR THE WASTE MANAGEMENT SECTOR				
Country	Market Potential (avg annual, US\$ millions)	Market Conditions		Best Bets
		Outlook	Rationale	
Belize	negligible	○	▶ no donor funding ▶ low fees and taxes	▶ none
Costa Rica	2.5	○	▶ strong need for new landfill ▶ recycling initiatives ▶ limited donor funding	▶ consulting ▶ siting and design ▶ recycling/composting equipment
El Salvador	8	◐	▶ donor funding ▶ extensive studies underway ▶ recycling initiatives	▶ consulting ▶ vehicles and equipment ▶ transfer station ▶ recycling equipment ▶ landfill siting and design
Guatemala	6	◐	▶ donor funding	▶ vehicles and equipment ▶ waste processing facilities
Honduras	negligible	○	▶ no donor funding ▶ not priority issue	▶ none
Nicaragua	3	◐	▶ donor funding to support first phase of Master Plan	▶ siting and design ▶ equipment
Panama	2	○	▶ no donor funding	▶ none
TOTAL	21.5	◐		
Strong opportunity (market size > \$25 million): ● Moderate opportunity (market size = \$3-25 million): ◐ Limited opportunity (market size < \$3 million): ○				

Source: Hagler Bailly, 1997

- ▶ **Sanitary landfills** that control odors and prevent the dispersion of hazardous waste into the ground or surrounding areas are clearly necessary. Given the lack of requirements for constructing sanitary landfills, however, new constructions will likely be unlined, natural renovations. While there may be opportunities for siting, design, and feasibility studies, local

firms will have the advantage in the construction phase. Local opposition to the construction of new facilities, particularly landfills, has also delayed some new investments.

- ▶ **Incinerators** are currently being studied in some cities as a waste management option. For example, the San Salvador municipal government is working with a Canadian firm to study the potential for constructing a waste-to-energy facility for the San Salvador metropolitan area. The capital costs for incineration are high (costs in the U.S. are on the order of \$80,000-90,000 per ton of installed capacity). The high percentage of organic material in the solid waste stream means incineration is less suitable in Central America than it is for typical waste streams in more developed countries.
- ▶ **Recycling** programs are likely to become more prevalent, although the scarcity of re-processing facilities will limit the potential in the near term. Any waste with resale value that is found in a disposal facility is quickly collected by informal "scavengers." As in many parts of Latin America, this informal "recycling" can be an obstacle to establishing formal, legitimate recycling programs.
- ▶ **Composting** is often an economically and environmentally favorable option. Due to the high organic composition of Central America's wastes, composting is a viable option.

5.3 STRATEGIC MARKET CONSIDERATIONS

Waste management companies need to consider the following factors that affect the viability of this market for foreign vendors and investors:

- ▶ Decision makers are primarily within municipal governments or other local authorities.
- ▶ Regulatory authority is largely unclear.
- ▶ Inadequate collection and disposal fees complicate payment for government- and privately-funded projects.

Decision Makers

Municipalities generally are responsible for providing waste management services. However, local governments do not have the financial or technical resources to provide an adequate level of service. In some cities, unions or collectives of individual vendors provide garbage collection services for the municipality.



Regulatory Environment

Aside from legislation that assigns responsibility for solid waste management to municipalities, Central American countries do not have specific legislation to regulate collection, storage, and disposal for solid waste. Belize is the exception. In 1991 Belize passed the Solid Waste Management Authority Act that established a quasi-governmental authority to provide collection and disposal in declared service areas. Belize has also established littering and pollution regulations; legislation on hazardous waste management is pending.

Charging and Collecting Fees

Many municipalities face the challenge of expanding or improving services while charging very low fees that do not cover the costs of services. Fee structures also do not reflect the differences in the quantities of solid waste generated by residential, commercial, or industrial customers. The municipalities are unable to raise fees since residential customers who are unwilling or unable to pay the higher fee can simply dump household wastes in illegal dump sites.

Suggested Strategies

Because decision makers are primarily within municipal governments, companies will need to evaluate individual municipalities for potential market opportunities. The size of the municipality and the status of a solid waste master plan are critical issues in selecting potential customers. Companies will also need to monitor and assess country and municipal waste management regulations as they evolve. In particular, companies will need to perform due diligence of potential liability issues that may arise from siting and constructing landfills.

The current low fees for waste collection and treatment that generally prevail throughout the region will mean that companies will likely need government or multilateral guarantees for government-funded projects. Private sector initiatives will need to establish means to enforce the payment of higher rates.

CHAPTER 6

AIR POLLUTION CONTROL

Despite poor air quality in cities such as San Salvador and Guatemala City that rivals that of Mexico City, air pollution is just beginning to emerge as an environmental and health concern in Central America. The results of a community-based environmental risk assessment process reveal that only in more affluent Costa Rica is air pollution ranked as a priority environmental problem.¹

The primary source of air pollution in the region is motor vehicle emissions. The second leading source of air pollution is the burning of fuelwood for cooking and heating. Although industrial processes and energy production (refining and power generation) contribute a smaller percentage of the overall air emissions, individual facilities can be important sources of localized air pollution problems.

Air pollution control opportunities will emerge over time. The best short-term opportunities will be for vehicle emissions testing (VET) and control equipment. There will also be opportunities for pollution controls on large, visible stationary sources, especially those owned by larger industrial and energy companies, multinational companies, and export-oriented companies. In the medium term, air regulations that are now being drafted should lead to opportunities for ambient air monitoring systems and fixed source air pollution control equipment.

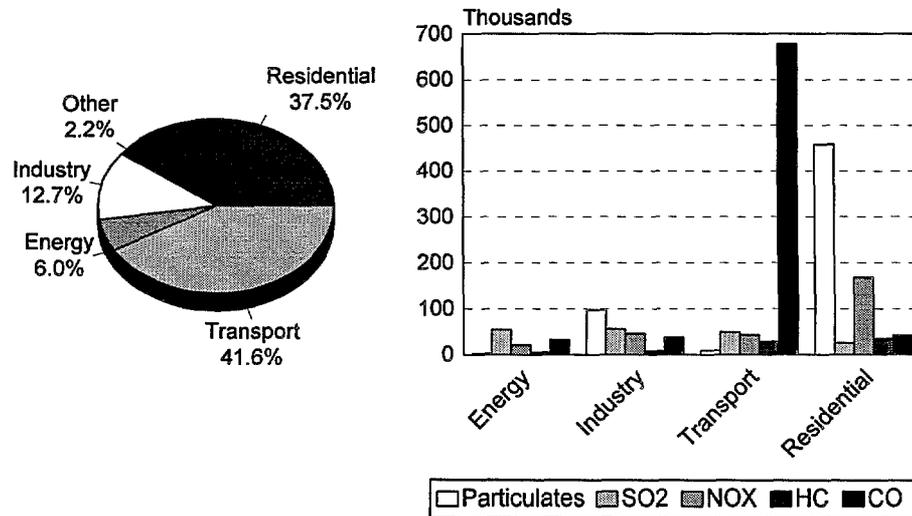
6.1 MARKET NEEDS

Poor air quality poses a hazard to human health and the environment in Central America. The problem is particularly serious in urban areas where there are large numbers of vehicles and industrial facilities. In the Honduran capital city of Tegucigalpa, for example, levels of total suspended particulates (TSP), carbon monoxide (CO), and lead consistently exceeded World Health Organization (WHO) standards during a 1995 study conducted by the national research laboratory. Similarly, data collected in San Salvador and Guatemala City revealed that the levels of CO and particulate matter exceeded both WHO and USEPA air quality standards.² Ozone levels were also exceeded in Guatemala City. The impacts on

¹ USAID. 1996. *Informe sobre el Análisis Comparativo de Riesgos en Centroamérica: Volume I*. Washington, D.C.

² A study done in El Salvador in 1995 observed the presence of carbon monoxide and total suspended particulates during the rainy season. In the samples for CO, 9 out of 10 exceeded the 8-hour standard established by the USEPA and the WHO, and 1 of 10 exceeded the USEPA's 1-hour standard (30 $\mu\text{g}/\text{m}^3$). The total suspended particulates were from 2 to 20 times higher than the standards established by the WHO. In Guatemala, a study done by ProEco established the concentration of suspended particulates, NO₂, ozone, and CO in six different stations in Guatemala City. In the case of suspended particulates, the permissible limit of 240 mg/m^3 was

EXHIBIT 6-1
Sources of Air Emissions



Source: Hagler Bailly, 1997, based on OLADE energy consumption data (1996) and WHO Rapid Assessment Guide emissions factors (1992)

human health are well established. In Honduras, studies have found that the incidence of respiratory infection is 14,410 per 100,000 habitants per year and causes 23% of the infant mortality in children under five years old.³

Emission estimates derived from fuel consumption data illustrate that the major sources of air pollution in Central America are the transportation and residential sectors, which contribute 42% and 38% of total air emissions respectively (see Exhibit 6-1). Carbon monoxide from incomplete fuel combustion in vehicles is the single largest source of air pollution; the transportation sector also produces significant SO₂ and NO_x. Residential sector air pollution is mostly due to the extensive use of fuelwood for cooking and heating, especially in rural areas.

While the large-scale burning of fuelwood has implications for global climate change, the more immediate problem is indoor air quality in rural areas.⁴ Stationary sources such as power plants,

exceeded in five of the six stations no less than 31 times between January and December 1995. The ozone concentration exceeded the limit of 150 mg/m³ 5 times in three of the stations and CO exceeded the limit of 9 ppm on 16 occasions. Source: USAID. 1996. *Perfiles Nacionales Relativos al Análisis Comparativo de Riesgo Para Centroamérica: Volume II*. Washington, D.C.

³ Ibid. p. IV-13.

⁴ The major consumers of fuelwood are homes, informal restaurants, and certain industries such as charcoal and brick making. Smoke from wood-burning stoves has been linked to respiratory illness due to the generation of particulate matter from the burning of wood. Women and children who spend long hours near the stove are particularly at risk for respiratory infection. Rural homes often have only one room with few windows for ventilation. The traditional stove is not vented to the outside, and in fact the soot from the cooking stove

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refineries, and industrial facilities — which often account for significant pollution in other countries — create less than 20% of total emissions in Central America. Nevertheless, these stationary sources are increasingly important sources of SO₂, particulates, and toxic air emissions.

Central American countries have three major market needs for air pollution prevention and control technology and services:

- ▶ improving vehicle emissions control
- ▶ expanding ambient air monitoring networks
- ▶ requiring fixed source emissions control.

Improving Vehicle Emissions Control

Vehicle emissions currently account for approximately 70% of air pollution in Costa Rica, El Salvador, and the metropolitan Guatemala City area (see Exhibit 6-2). The surge in the number of vehicles on the road during the past five years has significantly contributed to this problem. In El Salvador the number of cars more than doubled in a four-year period, from 150,000 in 1990 to more than 320,000 in 1994, leading to a 54% increase in gasoline consumption over the same period.

Due to the severe health hazards associated with high levels of lead concentration in the ambient air, the first priority in Central America has been to eliminate leaded gasoline.⁵ As lead has been phased out, Central American countries are beginning to target vehicle emissions.

Reduced Lead Emissions. Most Central American countries have either eliminated leaded gasoline or will do so in the near future. Guatemala had phased out leaded gasoline by 1993, Costa Rica in April 1996, El Salvador in June 1996, and Honduras in February 1996. Nicaragua introduced unleaded gasoline in August 1995 but has not established a legal agreement banning leaded gasoline. Panama still sells leaded gasoline but is studying the impacts of a total phaseout.

As a result of the introduction of unleaded gasoline, several countries have significantly reduced lead pollution. Honduras, for example, reduced lead concentration levels by more than 80%, falling from over 1.2 $\mu\text{g}/\text{m}^3$ in January 1996 to less than 0.2 $\mu\text{g}/\text{m}^3$ by May 1996, according to data from six monitoring stations in Tegucigalpa.⁶ The phaseout of lead is an important step in addressing air

creates a source of weather-proofing for thatched roofs. Thus, residents are resistant to the introduction of more modern ventilated stoves.

⁵ Leaded gasoline typically contains between 0.1 and 0.8 grams of lead per gallon of gasoline. Lead poses a serious health risk for humans and is linked to behavioral disorders, seizures, and mental and emotional retardation in children.

⁶ Centro de Estudios y Control de Contaminantes. 1996. *Boletín Informativo CESCO*. Tegucigalpa, Honduras.

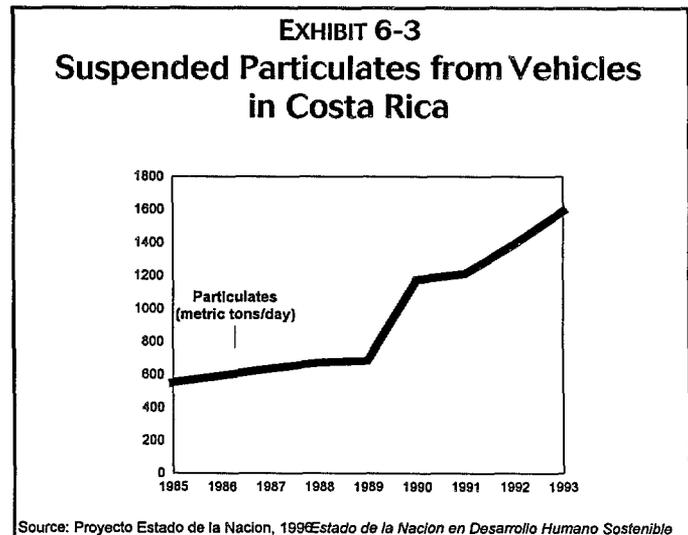
pollution in the region, and enables the introduction of pollution control equipment, such as catalytic converters, that do not function with leaded gasoline.

EXHIBIT 6-2 VEHICLE EMISSIONS AND CATALYTIC CONVERTER REQUIREMENTS			
Country	Number of Vehicles	% Emissions from Vehicles	Catalytic Converter Requirements
Costa Rica	450,000	70-75%	required on all cars newer than 1995
El Salvador	320,000 (1994)	65-70%	no known requirements
Guatemala (City)	> 450,000 (1996)	70%	required but not effectively enforced
Honduras	230,000 (1995)	50% of HC, 90% of CO, 40% of NO _x	under consideration
Panama	157,000 (1995)	99% of HC and 98% of CO	no known requirements

Sources: USAID. 1996. *Perfiles Nacionales Relativos al Análisis Comparativo de Riesgo para Centroamérica: Volume II*; MINAE; ProEco News, Year 3, No. 13, August 1996

Expanding Emissions Control and Testing Programs. As the number of vehicles on the road increases, air quality problems will continue to worsen. For example, the amount of suspended particulates from vehicles in Costa Rica has tripled since 1983 (see Exhibit 6-3). This escalation is due in part to the increase in diesel-powered trucks and buses on the road. Although diesel does not contain lead, it has a higher sulfur content and produces black smoke that contains particulate matter. Compounding the air emissions problem is the fact that many of the additional vehicles on the road are used imports that either lack or have been stripped of emissions control equipment. Panama, for example, imports about 25,000 vehicles each year, of which more than 10,000 are used. In 1994, Guatemala imported 45,000 vehicles, 79% of which were used vehicles.

To stem emissions from mobile sources, many Central American countries are beginning to phase in requirements for catalytic converters and monitoring and inspection programs to ensure that the vehicles on the road meet emissions standards. Currently, the vast majority of the estimated two million cars in Central America do not have catalytic converters. Costa Rica has adopted the most stringent



requirements and has put into place a program called *ECOMarchamo* to promote car tuneups and emissions testing as a means to reduce air pollution. As part of this program, Costa Rica has also set up a certification program for auto mechanics that enables their auto shops to be qualified as official Emissions Verification Centers. The number of trained mechanics with proper testing equipment is still limited; this number will likely grow as enforcement of emissions standards is strengthened. Other countries are likely to follow suit.

Expanding Ambient Air Monitoring Networks

To better understand the sources and levels of air pollution, the Central American countries will need to expand their limited existing ambient air quality monitoring network. The region's existing network has been established primarily through donor-supported programs such as ProEco. (Exhibit 6-4 describes ProEco's mission.) ProEco's programs, conducted in collaboration with national entities such as universities and research laboratories, currently help several Central American governments to monitor TSP, PM10, lead, CO, CO₂, ozone, and hydrocarbons. Using low-cost technology from the Technical University of Zurich, ProEco monitors air quality in the urban areas of Guatemala and three other countries:

- ▶ ***Costa Rica (1993)***. The monitoring network is operated by the University of Costa Rica and consists of two continuous monitoring stations and four collection stations in San José. Current plans are to expand this network to 10 continuous monitoring stations.
- ▶ ***Honduras (1995)***. There are no fixed monitoring stations, but during previous studies, 10 stations were set up at sites around Tegucigalpa.
- ▶ ***El Salvador (1996)***. A Swiss foundation has signed an agreement with the El Salvador Foundation for Economic and Social Development to provide its laboratory with equipment and to train personnel to monitor the outdoor air quality of San Salvador.

EXHIBIT 6-4 PROECO'S MISSION

The Clean Air Program established by ProEco in 1993 (and funded by the Swiss Foundation for Technical Cooperation) is a regional program to improve air quality in the urban centers in Central America. The goals of the program are:

- ▶ to decrease the level of atmospheric contaminants in the major cities of Central America by 30-40%
- ▶ to reduce the use of fuel by 5-10% and reduce CO₂ emissions from automobiles
- ▶ to create a higher level of awareness among the population about the problems of air pollution
- ▶ to foster the adoption of laws and regulations for vehicle emissions.

To achieve these goals, the program works at a macro level to promote changes in laws and policies, conducts training for mechanics, and works to promote public awareness.

Source: ProEco, 1996

Central American countries will need to substantially expand their monitoring systems to establish credible estimates of the levels of air pollution, develop country-specific emission standards, and determine compliance with WHO and individual country regulations. The size and scope of monitoring programs will vary by country. The region's short-term priorities will likely be to continue expanding monitoring networks in larger cities by adding more stations and to begin expanding the monitoring network to the region's other cities with populations over 100,000.

Installing Fixed Sources Emissions Control and Monitoring Equipment

Central America has a small industrial base and virtually no heavy industry. Air emissions from fixed sources, therefore, account for less than 20% of the total air emissions of the region. The primary sources of such emissions are power generation and various industrial sectors such as sugar refining, cement, chemical and plastics, and refining. Together, these sectors are the largest source of SO₂ emissions and the second largest source of particulates after the residential sector.

Although no Central American country currently has standards regulating air emissions, air pollution from fixed sources is a growing concern, especially in urban areas that lack zoning requirements. In many cases industrial and energy production facilities are located close to crowded residential areas. In Guatemala, for example, more than 70% of industry is located in densely populated residential and commercial areas. Other sources of air pollution in the region's urban areas include facilities that incinerate domestic solid waste, hospital waste, and toxic and nontoxic industrial waste.

6.2 MARKET OPPORTUNITIES

The absence of air pollution regulation means that the market for air pollution control technologies and services is still relatively small, approximately \$17.5 million per year over the next five years. Mobile source emissions monitoring and control equipment offer the best near-term opportunities, accounting for nearly three-quarters of the market. Donor-funded initiatives should also create some near-term opportunities for ambient air quality monitoring equipment. Short-term opportunities for stationary source pollution control will most likely be limited to multinational and/or larger companies. As air pollution standards come into effect, there may be increased opportunities related to petroleum refining, power generation, sugar processing and refining, and other industrial sectors.

Vehicle Pollution Control and Emission Monitoring Equipment

Efforts to address air pollution from vehicles in Central America are beginning to take hold. The country that is furthest along is Costa Rica. In 1995 Costa Rica passed a new Transportation Law requiring that all cars pass an emissions test and that all models newer than 1995 must have a catalytic converter. After Costa Rica, El Salvador is likely to be the next emerging market. While pollution levels from mobile sources in Guatemala area are also very high, the average age of vehicles and the cost of retrofitting makes it unlikely that the existing regulations will be strictly enforced.

94

- ▶ **Vehicle emission testing.** Increasing enforcement of vehicle emission standards will create opportunities for vehicle emissions testing equipment. Costa Rica, for example, is in the process of privatizing testing services and has also established a training program to enable traffic police to better enforce the emissions testing requirements. Currently, this market is being supplied through the ProEco program; as the demand for testing equipment increases, however, this market will likely be open to other suppliers.
- ▶ **Catalytic converters and other vehicle emission controls.** The market for emissions control equipment is emerging as regulations for catalytic converters come into effect and enforcement efforts are strengthened. Currently, only a small fraction of the approximately two million vehicles in Central America have catalytic converters. U.S. manufacturers should have an advantage in this market segment because many of the cars on the road in Central America are U.S. made.

Ambient Air Quality Monitoring

Central American countries have developed their existing monitoring networks largely through international donor funding. Some future donor initiatives should create short- to medium-term opportunities for U.S. companies to expand monitoring networks. The IDB's *Decontamination of Critical Areas Project* in El Salvador includes provisions for establishing air quality monitoring stations in as many as 13 urban areas. The ProEco program will also continue helping Central American countries to expand monitoring networks in major cities. This program, however, presents few near-term opportunities to U.S. companies because its funding is linked with the purchase of Swiss technology.

Fixed Source Pollution Control Equipment

As in virtually all other countries, the market for air pollution control technology for fixed sources is regulation-driven. Although certain provisions under the legal code — such as the Health Code or the Public Nuisance Code — exist that enable regulators to address air quality problems stemming from a given industrial facility, Central American countries generally lack air quality regulations and standards. In the near term there may be some opportunities in large, easy-to-target plants; in foreign-owned or foreign subsidiary plants where the parent company requires that certain standards be met; and in export-oriented companies that are pursuing ISO 14,000 certification or must meet client requirements for environmental management.

There will likely be short-term opportunities for SO₂, particulate, and NO_x control technologies and emissions monitoring equipment in petroleum refineries and power plants (see Exhibit 6-5). There should also be opportunities for afterburner and bag filter sales to sugar mills. As countries begin to promulgate and enforce air pollution control laws, there will also be medium- and long-term opportunities for the sale of emissions control and monitoring equipment to pulp and paper, cement,

chemicals, and plastics facilities. Cleaner production technologies that reduce air emissions will also be attractive options in most industrial sectors.

EXHIBIT 6-5 AIR POLLUTION TECHNOLOGY OPPORTUNITIES			
Sector	Focus	Major Emissions	Technologies
Petroleum Refining	All countries except Belize; esp. Panama	SO ₂ and other gas emissions	Scrubbers, low-NO _x burners, catalytic and thermal oxidation and monitoring equipment
Power Generation (oil and diesel plants)	Costa Rica El Salvador Panama Guatemala	SO ₂ , NO _x , and particulates	Electrostatic precipitators, baghouses, air quality monitoring equipment, flue gas desulfurization equipment
Sugar	All countries, esp. Guatemala	Particulates and SO ₂	Afterburners, bag filters
Pulp and Paper	Costa Rica El Salvador Guatemala Panama	VOCs, combustion emissions (SO ₂ , NO _x , CO ₂ , and particulates), chlorine. Emissions depend largely on type of fuel used.	Desulfurization scrubbers, electrostatic precipitators, fume analyzers and air quality monitoring devices
Cement	Panama Honduras	Suspended particulates, SO ₂ , and dust	Baghouses, scrubbers, flue gas desulfurization equipment, cyclones
Chemicals/Plastics	Costa Rica El Salvador Guatemala Honduras	Toxic gases	Emissions control and monitoring equipment

- ▶ **Petroleum refining.** Central American countries have an estimated refining capacity of 144.9 thousand barrels per day. In 1995, approximately 33 million barrels of crude oil were refined in the region, about one-half of the oil consumed in Central American countries that year. Each Central American country, with the exception of Belize, has one refinery (see Exhibit 6-6, which lists the size and characteristics of each refinery). The Refinería Panamá represents about 40% of the region's capacity. Five of these facilities also have catalytic reforming capacity, totaling about 14%, or 20.3 thousands barrels, of the total refining capacity. This latter type of refining produces more potentially hazardous metals material and may produce lethal hydrochloride emissions.

EXHIBIT 6-6 PETROLEUM REFINING CAPACITY IN CENTRAL AMERICA				
Country	Refinery - Location	Capacity (000 Bbl/calendar day)		
		Crude Capacity	Fluid Catalytic Cracking	Catalytic Reforming
Costa Rica	Refinadora Costarricense de Petróleo SA-Limón	15.0	---	1.2
El Salvador	Refinería Petrolera Acajutla SA-Acajutla	19.4	---	3.3
Guatemala	Basic Resources International-Petén	4.0	---	---
	Texas Petroleum Co.-Escuintla	16.0	---	3.0
Honduras	Refinería Texas de Honduras SA-Puerto Cortes	14.0	---	1.8
Nicaragua	Esso Standard Oil SA Ltd.-Managua	16.5	3.5	---
Panama	Refinería Panamá SA-Las Minas	60.0	---	11.0
Total Capacity		144.9	3.5	20.3

Source: Petroleum Encyclopedia, 1996

- ▶ **Power generation.** Central American countries depend upon fossil fuel for only about 20% of their electricity generation. For example, El Salvador produces about 60% of its electricity from hydropower. Similarly, the six thermal power plants in Costa Rica account for only 22% of the country's generation. Exhibit 6-7 lists the 20 oil-fired electric generating plants in Central America with generating capacities greater than 30 MW.

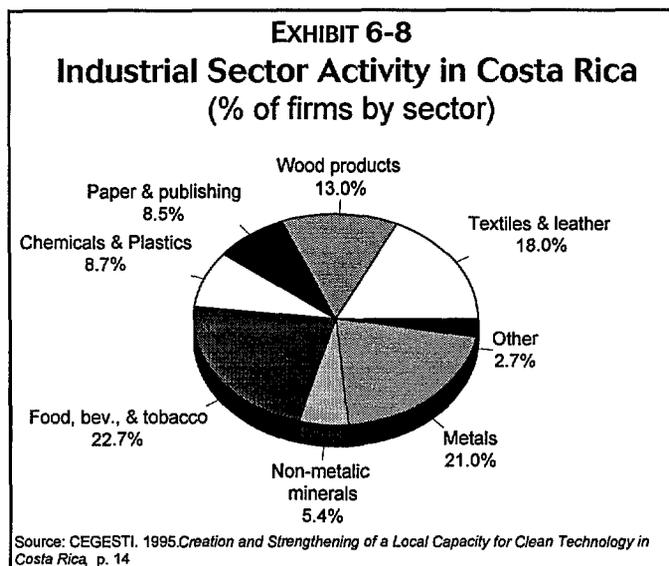
Much of this capacity was built by government utilities without the air pollution control equipment that is generally standard on U.S. power plants. The 40% of oil-fired generating capacity that is 20 years old or younger presents the best opportunities. Retrofits to older plants are less likely, given the other power sector investment priorities of most countries. The most important air pollution control equipment needs will be for particulate control equipment. There will also be medium- to long-term needs for air monitoring equipment.

EXHIBIT 6-7 UTILITY-OWNED OIL-FIRED GENERATING UNITS > 30 MW					
Country	Plant Name	Year	Type	Units	MW
Costa Rica	Moin	1973	Diesel	4	32
	San Antonio	1964	Combustion Turbine	4	48
	Barranca	1969	Combustion Turbine	2	42
El Salvador	Acajulta Thermal	1967	Steam	2	63
	Acajulta Turbine	1965, 1994	Combustion Turbine	3	157
	Soyopango	1972	Combustion Turbine	3	54
	San Miguel	1984-1992	Combustion Turbine	6	32
Guatemala	Escuintla Steam I & II		Steam	2	86
	Escuintla Steam III	1993	Steam	1	50
	Escuintla Turbine 1-5		Combustion Turbine	5	117
	Escuintla Turbine 6	1989	Combustion Turbine	1	33
	Laguna	1963	Thermal	2	75
Honduras	Puerto Cortes I & II	1980-1984	Diesel	8	60
Nicaragua	Managua		Diesel		75
	Nicaragua		Diesel		100
Panama	Las Minas	1964-1973	Thermal	4	144
	Las Minas	1988	Combustion Turbine	2	60
	Panama	1982	Thermal	2	40

Sources: Hagler Bailly, 1996; USAID/Regional Office for Central America and Panama, Central America and Panama Electric Power Sector Strategy Review, 1990

- ▶ **Sugar processing and refining.** There is sugar processing in every Central American country. The region's most important sugar processing plants are in Guatemala, where just six large plants have over 32.6 thousand tons per day of sugar processing capacity. The principal sources of air pollution are from boilers that produce steam for the milling and refining processes. Many of the mills use the "bagasse" (i.e., crushed cane stock that remains after the juice is extracted) as the primary fuel stock supplement to heavy oil. The primary pollutants vary depending on the fuel mix but usually include particulate, SO₂, and NO_x. The primary air pollution control equipment options will be for afterburners and bag filters.

- ▶ **Other industrial sectors.** The manufacturing base in Central America consists primarily of agro-industries, food processing, textile manufacturing, and metal working. There is also some growth in the assembly industry. Regulations are less likely to be developed and enforced in these industries in the short term. Some facilities will nonetheless come under pressure to control combustion emissions in the pulp and paper, chemical and plastics manufacturing, and cement industries. In Panama, for example, the growth in the cement industry has contributed to a recent increase in particulate emissions. Exhibit 6-8 provides a breakdown of the industrial activity in Costa Rica to illustrate the predominant industrial sectors in the region. The largest industrial sectors in Costa Rica include the general category of food, beverages, and tobacco; metal mechanics; and textiles and leather.



Market Summary

The market for air pollution control and prevention technologies is the smallest environmental market in Central America. Market potential is estimated at \$18 million per year over the next five years. Donor funding will finance investments in basic ambient air quality monitoring and will address air pollution from mobile sources. Additional public money is likely to be allocated to air quality monitoring programs. Market opportunities in the fixed sources market will emerge in the long term as air quality regulations are developed and enforced. Exhibit 6-9 identifies the market estimates for each country, the market outlook, and some best bets.

EXHIBIT 6-9 MARKET OUTLOOK FOR AIR POLLUTION CONTROL TECHNOLOGIES AND SERVICES				
Country	Market Potential (avg. annual, US\$ millions)	Market Conditions		Best Bets*
		Outlook	Rationale	
Belize	1.5	○	▶ no donor funding ▶ few vehicles	▶ monitoring equipment
Costa Rica	4.9	◐	▶ strong transportation law ▶ established monitoring program ▶ public pressure on polluting facilities	▶ vehicle emissions testing ▶ vehicle emissions control ▶ larger industrial facilities ▶ multinational companies
El Salvador	2.2	○	▶ donor funding for monitoring ▶ development of mobile sources program ▶ development of air regulations	▶ monitoring equipment ▶ industrial pollution control equipment
Guatemala	4.5	◐	▶ donor funding ▶ larger industrial sector	▶ vehicle emissions testing ▶ monitoring equipment ▶ industrial pollution control equipment
Honduras	1.4	○	▶ limited donor funding ▶ development of air regulations	▶ monitoring equipment ▶ larger industrial facilities
Nicaragua	1.5	○	▶ little emphasis on air problems ▶ limited donor funding	▶ monitoring ▶ limited industrial opportunities
Panama	1.5	○	▶ limited industrial sector ▶ some donor funding	▶ monitoring ▶ larger industrial facilities
TOTAL	17.5	◐		
<p>Strong opportunity (market size > \$25 million): ● Moderate opportunity (market size = \$3-25 million): ◐ Limited opportunity (market size < \$3 million): ○</p>				

Source: Hagler Bailly, 1997

* Specific sector and technology opportunities in the industrial sector are highlighted in Exhibit 6-6.

100

6.3 STRATEGIC MARKET CONSIDERATIONS

The most important strategic consideration affecting the emerging air pollution control market in Central American countries is discerning the timing at which opportunities for monitoring and vehicle and stationary source equipment will materialize. While the air market is small compared to other environmental markets, this market should mature as the environment continues to be a priority for Central American countries. Other important market considerations for producers of air pollution control equipment and services involve the decision makers for air pollution control and their ability to pay.

The following three factors will influence the development of this market:

- ▶ regulatory environment
- ▶ public pressure from Central American citizens
- ▶ internationalization, i.e., pressure on multinational companies from the international marketplace.

Regulatory Environment

To establish air pollution monitoring and control equipment opportunities on a wider scale, Central American countries will need to develop standards for both point source emissions and ambient air quality. The first priority throughout the region should be to continue addressing mobile source emission problems. Only a few countries have begun to draft regulations for ambient air quality and air emissions standards for fixed sources. For example, El Salvador is developing ambient air standards under the Air Contamination Control Program within the recently-reactivated Department of Environmental Sanitation. Honduras is also drafting air standards. In the interim, countries may use WHO ambient standards and USEPA emissions standards when taking an enforcement action.

Public Pressure

Public pressure is increasingly forcing companies to address air pollution problems. In Costa Rica, for example, air pollution problems accounted for nearly half of the 723 environmental complaints received by its ombudsman between May 1994 and April 1995. When a complaint is received, the Costa Rican ombudsman must inspect the source of the problem and work with the polluter to correct the problem. In the near term the best opportunities for public pressure-driven air pollution control and monitoring sales will be to such highly-visible sources as oil refineries and industrial facilities in densely populated urban areas.

Internationalization

International trade represents a growing influence on air pollution market opportunities. Multinational companies locating in the region may be subject to environmental policies established by their parent companies and will be required to install appropriate pollution control equipment. In addition, businesses that supply goods to international companies are increasingly meeting the stricter environmental requirements of their client companies. In the near term, international and export-oriented companies will represent the best opportunities.

Other Considerations: Decision Makers, Ability to Pay

Decision making for air pollution control equipment opportunities is largely centralized, with the exception of vehicle emissions control equipment opportunities, in which the decision makers are the individual vehicle owners. Opportunities for vehicle emissions control equipment will depend upon regulatory enforcement and access to distribution channels. The complexity of decision making in this area will likely hamper the exploitation of market opportunities.

“Ability to pay” is a less critical issue with regard to air pollution control opportunities than it is in other environmental markets because of the small size of these projects. Domestically-owned industries without access to export revenues will undoubtedly face financing problems.

EXHIBIT 6-10 DECISION MAKERS FOR AIR POLLUTION CONTROL OPPORTUNITIES		
Opportunity	Decision Maker	Funding Source
Ambient air monitoring network	Ministries of Health and Environment	Governments, multilateral development banks and NGOs (e.g., IDB, Pro-Eco)
Vehicle emissions control (e.g., catalytic converters)	Diffuse: individuals owners, government regulatory authorities, distribution agents	Private vehicle owners
Vehicle emissions monitoring equipment	Ministries of Transportation, private mechanic shops	Governments, multilateral development banks and NGOs (e.g., IDB, Pro-Eco)
Fixed source emissions control equipment	Private companies (e.g., refineries)	Private companies

Suggested Strategies

There are more potential market segments in the air pollution control market than in other environmental markets in Central America. Therefore, companies need to identify the correct decision makers and discern the ability to pay in the various market segments.

- ▶ Companies pursuing ambient air quality monitoring opportunities will need to monitor multinational development bank funding initiatives and address decision makers at the national government level.
- ▶ Companies selling vehicle emission control equipment should consider coordinating with a local partner to help implement a broad-based distribution and sales strategy.
- ▶ Companies selling vehicle emissions monitoring equipment will need to monitor large government and multilateral development projects, but may also need to develop relationships with small mechanic shops that may perform monitoring.
- ▶ Companies selling fixed source pollution control equipment need to identify large and highly visible pollution sources, especially those that may be the subject of local controversy, and target large, creditworthy international companies with access to foreign currency revenues.

CHAPTER 7

GREEN ENVIRONMENTAL MARKETS

Central America faces a number of “green” environmental problems, i.e., those resulting from unsustainable forestry and agricultural practices. Deforestation is perhaps the most serious of these problems, with wide-ranging implications for the environments and economies of Central American countries. Poor forest management is harming the region’s economic and environmental future by causing massive soil erosion, watershed degradation, and biodiversity loss. Poor agricultural practices are causing soil degradation, soil erosion, increased soil toxicity, and water contamination.

The most important near-term opportunities for private companies will result from donor and private foundation-supported initiatives to transfer knowledge and technologies to the region to improve the management of the agriculture and forestry sectors. Market-driven opportunities for sustainable farming and forestry are likely to emerge as Central American countries enact appropriate policies and regulations to support sustainable practices.

7.1 MARKET NEEDS

Central American countries have two major green environmental market needs: slowing the rate of deforestation and developing sustainable agricultural practices to control soil erosion, and reduce fertilizer and pesticide use.

Slowing the Rate of Deforestation

Central America urgently needs to promote sustainable forestry. The deforestation rate in Central America is about twice the global average for tropical forests. Moreover, while deforestation rates for tropical forests are declining or at least stabilizing in most other regions, deforestation is accelerating in nearly every Central American country. Exhibit 7-1 shows estimated deforestation rates for Central America.

EXHIBIT 7-1 DEFORESTATION IN CENTRAL AMERICA			
Country	Land Area ('000 ha)	Total Forested Area (%)	Annual Deforestation Rate (ha/yr)
Belize	2,280	88.0	N/A
Costa Rica	5,106	28.5	98,000
El Salvador	2,072	6.1	N/A
Guatemala	10,843	39.2	90,000
Honduras	11,189	41.2	90,000
Nicaragua	11,875	50.8	N/A
Panama	7,443	42.0	80,000

Source: For land area and forested area statistics: World Resources Institute, *The Urban Environment 1996-1997*. Deforestation rates: various sources. N/A: no estimate available

Forty years ago, more than 80% of Costa Rica was forested. By 1992, only 25% of the country was forested, with forest cover equaling about 1.6 million hectares. Guatemala currently loses 90,000 hectares per year of forests. The deforestation rate has increased from 60,000 hectares per year in 1980 to its current level. The deforestation of tropical forests accounts for about 77% of Guatemala's total deforestation.¹ In El Salvador, 98% of the original woodlands have been cut down or replaced.

Deforestation is a critical issue for Central American countries, not only because of the irreversible loss of flora and fauna, but also because of the economic consequences. Much of the land that is home to tropical forests is not suitable for farming. Thus, the productivity of land that has been deforested is very limited. In Honduras more than half of the cleared forests were not suitable for any other purpose than forestry. Because farmers and ranchers cleared lands unsuited to long-term agricultural production or cattle ranching, the land became unproductive within a few years, forcing farmers to move to new locations where they would typically clear new tracts of land.

Another important economic consequence of deforestation is the disruption of local watersheds and the water cycle. Deforestation is contributing to shortages of water for drinking, irrigation, and electricity generation by adversely changing local water cycles and helping to deplete groundwater resources. The need for water rationing in Panama, in effect since 1990, is partly attributed to reduced water flows resulting from deforestation. Less than one-third of Panama's forests remain and only 2,000 hectares of new trees are planted each year.

¹ Comisión Nacional del Medio Ambiente (CONAMA). 1995. *Plan de Acción Ambiental*, Guatemala.

Policy and Advisory Needs. To slow the rate of deforestation, the Central American governments must establish policies that promote more sustainable forestry by addressing the root causes of rapid deforestation. There are many causes of deforestation in Central America: advancing urban frontiers, conversion of forests into agricultural land, extensive livestock ranching, and the use of forests for logging and fuelwood extraction. Such forest exploitation occurs because of a lack of economic incentives to manage forest and land resources properly. Those who exploit forests usually do so at little or no economic cost.

Policies that address these problems include fair allocation methods and market-based fees for the use of forestry and land resources. To implement these initiatives, Central American countries will need improved conservation and planning tools (e.g., computer software to enable the collection and analysis of forestry statistics). Central American countries will also need to enact new legislation that strengthens the legal and institutional framework for land and forest management.

Sustainable Forestry Needs. The introduction of sustainable forestry practices could also help address these problems by re-establishing a balance between forest growth and forest use. Central America's forests have historically been exploited in both a nonproductive manner (e.g., slash and burn clearing for agricultural land) and to obtain low-value wood products, such as fuelwood. As Exhibit 7-2 illustrates, wood production for fuel and charcoal, two of the lowest value uses, is 13 times higher than the production of industrial roundwood, the next higher value wood product. Production for higher value uses such as sawn-wood and panels is even lower. Channeling wood production to higher value wood uses will help create better incentives to manage forestry resources sustainably.

EXHIBIT 7-2 CENTRAL AMERICAN WOOD PRODUCTION BY TYPE ('000 M ³)			
<u>Fuel and Charcoal</u>	<u>Industrial Roundwood</u>	<u>Saw-wood and Panels</u>	
30,469	2,398	1,401	
Low value	→		High value

Source: World Resources Institute, *The Urban Environment 1996-1997*

The private sector may be able to help the region address its sustainable forestry needs by managing natural resources for long-term development and to prevent further degradation. Specifically, there maybe the potential for private sector assistance to establish plantations on degraded lands and sustainably harvest forests products.

- ▶ **Forest plantations.** Plantations currently account for a very small portion of Central America's total forested area. The total land area dedicated to plantations in Central America is only

85,000 hectares, or less than 1% of total forested area.² While plantations are not equivalent to natural forests, they can help decrease the impact of deforestation, help meet the increasing demand for forest products and decrease the deforestation of first-growth forests. If proper environmental, policy, and economic incentives exist, the development of plantations can be economically viable. Developers can offer Central American countries investment capital for plantations and mills, expertise in marketing and distribution, and knowledge of sustainable forestry methods.

- ▶ **Reduced impact logging.** Selective logging practices minimize the damage to the surrounding forests by reducing damage from tractors and other machinery and by employing directional felling techniques.³ Selective, or reduced-impact, logging is made possible by computer simulation of forest plantations and by onboard computers that allow higher precision in cutting trees.

Developing Sustainable Agricultural Practices to Control Soil Erosion and Reduce Pesticide Use

Sustainable agricultural methods can address two principal problems caused by current farming practices: soil erosion and excessive pesticide and fertilizer use.

Soil Erosion. Soil erosion in Central America contributes to watershed degradation and sedimentation and siltation in rivers, lakes, and reservoirs. It can also result in flooding and landslides which damage roads, infrastructure, and buildings. The severity of soil erosion in Central America is difficult to calculate because of the lack of environmental monitoring programs. However, the Center for Studies and Social Action in Panama estimated that Panama, El Salvador, and Guatemala have the worst soil erosion in the world.⁴ Although this assertion could be debated, it is, nonetheless, indicative of Central America's problems. For example, Guatemala estimates that the country loses 65.5 million tons of topsoil annually. Nicaragua estimates that 53% of its land has moderate levels of soil erosion, 33.4% suffers moderate to severe soil erosion, and 14.9% suffers severe soil erosion.

² World Resources Institute. 1996. *The Urban Environment 1996-1997*. p. 218.

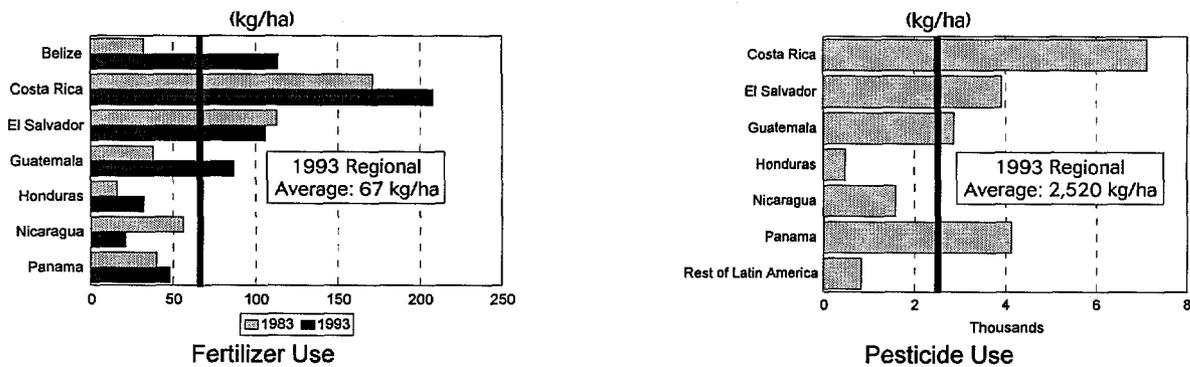
³ One mechanism to encourage sustainable logging is timber certification and labeling. A recent World Bank study estimated that 20% of the European tropical timber market and 10% of the United States market could ultimately be met by certified tropical timber. American imports of tropical logs and lumber in 1995 were valued at \$105.5 million. The United States obtains its supply of tropical woods from more than 50 countries, but the countries of Central and South American are the primary suppliers. Guatemalan exports of tropical wood totaled \$3.0 million, Nicaragua \$1.9 million, and Belize \$1.2 million. A number of forestry operations in Central America have qualified for certification through a program managed by the Rainforest Alliance.

⁴ Hernandez, Silvio. "Afro-Asian Trees to the Rescue in Central America." Inter Press Service. January 5, 1996. The research center is the Center of Studies and Social Action of Panama.

The agricultural practice of farming on steep slopes is one cause of soil erosion. In El Salvador, where soil erosion affects 75% of all land, local farmers grow annual cereal crops on small farms situated on steep slopes without adopting any preventive measures for soil erosion. Current cattle ranching practices are also a principal cause of soil erosion. Farmers have been responding to high demand for beef in the United States by deforesting land rather than making better use of existing grazing land. An estimated 30% of potentially cultivable land in Central America has been lost as a result of unsustainable agricultural practices. Many farmers compensate for this loss by increasing their fertilizer use.

Excessive Pesticide and Fertilizer Use. Five of the seven Central American countries increased their fertilizer use between 1983 and 1993. Costa Rica, which lost approximately 2.2 billion metric tons of topsoil due to erosion, is the largest consumer of fertilizers, as shown in Exhibit 7-3.⁵ Belize, El Salvador, and Guatemala are other large consumers.

EXHIBIT 7-3
Fertilizer and Pesticide Use in Central America
(1993)



Source: World Resources Institute, *The Urban Environment 1996-97*

Excessive fertilizer use contributes to serious water quality problems due to agricultural runoff. While the increasing use of pesticides has some short-term economic benefits in terms of boosting agricultural production, it has many negative long-term environmental impacts. Pesticides introduce toxins into the environment with the potential for long-term buildup, and pollute rivers, lakes, and groundwater resources. The aerial spraying of pesticides spreads the toxins to rural population centers, affecting the health of these communities. Pesticides can also contribute to increased rates of accidental injury and death of farm workers and their families. In addition, Central America's natural biological controls for crop pests are being poisoned while the pests themselves are becoming more poison resistant.

⁵ Proyecto Estado de la Nación. 1995. *Estado de la Nación en Desarrollo Humano Sostenible*, p. 46.

108

Central America's pesticide use of 2,520 kg per acre is about three times that of the rest of Latin America (see Exhibit 7-3). Costa Rica uses nearly 7,000 kg of pesticides per acre, nearly three times as much as the average in Central America and nearly nine times as much as other Latin American countries. In 1993 Costa Rica imported \$78 million in pesticides. Banana plantations account for approximately 57% of the country's pesticide consumption.

Sustainable agricultural practices that can help address these problems include technology/knowledge transfers in organic farming and integrated pest management (IPM) techniques. Both organic farming and IPM techniques can significantly reduce the use of pesticides.

- ▶ **Organic farming.** Although Central American farmers have begun to embrace organic farming — coffee farmers in Costa Rica and vegetable farmers in El Salvador have been cultivating organic products for international markets for several years — its use is still not widespread. Organic farming presents agricultural workers with several challenges that limit the widespread adoption of this method. First, organic farming requires intimate knowledge of agro-ecological conditions, including the crops' and pests' natural enemies, soil qualities, nutrient cycles, and ways to manage these factors. Second, the investment costs for organic crops are higher. For example, organically-grown coffee requires shade trees to be planted and other crops to be interspersed among the coffee plants. Third, organic farmers must be able to access the niche markets for organic produce in Europe and the United States, often a difficult task for small individual farmers.
- ▶ **Integrated pest management techniques.** IPM faces similar challenges because farmers must be taught a whole new approach to crop production. In one IPM effort with Guatemalan producers of snow peas, everyone from the farmers to the personnel in export companies received training and demonstrations on IPM to ensure the success of the new techniques.

7.2 MARKET OPPORTUNITIES

Although addressing green environmental problems is a growing necessity for Central American countries, market opportunities are likely to reach only \$39 million over the next five years. These opportunities fall into four categories:

- ▶ publicly-funded initiatives, which will be primarily supported by donor funding
- ▶ privately-supported projects
- ▶ market-driven opportunities
- ▶ other forest conservation opportunities.

109

Publicly-Funded Initiatives

A majority of the investments in environmental conservation and natural resource management will be financed by multilateral and bilateral donor institutions. Planned donor activities, described in Exhibit 7-4, will provide nearly \$125 million for Central American countries. Guatemala, El Salvador, and Panama are the primary recipients of multilateral donor funding in the region. These projects present consulting opportunities to develop natural resource management plans, to initiate land-use planning, or to provide technical assistance to national or community-based institutions in the agricultural and forestry sectors.

EXHIBIT 7-4 SELECTED DONOR-SUPPORTED NATURAL RESOURCE PROJECTS		
Donor	Country	Project Description
World Bank, IDA/GEF	Honduras	\$6 million environmental natural resource planning/development project for: <ul style="list-style-type: none"> ▶ natural resource planning to help transform current unsustainable production practices ▶ land use planning ▶ studies on incentives for environmental management, biodiversity conservation
IDB	Guatemala	\$19.8 million loan for sustainable development in Petén in northern Guatemala to support land use planning process and resource conservation. Includes: <ul style="list-style-type: none"> ▶ strengthening land use planning ▶ valuation and protection of natural and cultural resources ▶ natural resource management ▶ institutional strengthening
IDB	El Salvador	\$30 million loan to finance investments in the upper Lempa River basin to: <ul style="list-style-type: none"> ▶ focus on soil conservation and agroforestry ▶ work to halt land deterioration of 34,000 ha of crop land ▶ establish protected areas ▶ fund water resource monitoring
World Bank, IBRD	Panama	\$55 million natural resource loan to: <ul style="list-style-type: none"> ▶ reduce resource deterioration ▶ strengthen country's protected area system
World Bank, GEF	Costa Rica	\$7 million biodiversity loan to: <ul style="list-style-type: none"> ▶ support development of biodiversity inventory ▶ develop revenue-generating biodiversity activities
World Bank, GEF	Nicaragua	\$7 million biodiversity loan (preparation underway) for: <ul style="list-style-type: none"> ▶ biodiversity fund to finance projects in protected areas ▶ monitoring and evaluation system on biodiversity threats

Source: World Bank and Inter-American Development Bank

Privately-Supported Projects

There are some opportunities for companies to either finance or jointly develop private sector initiatives in the area of sustainable agriculture and forestry. For example, the Environmental Enterprises Assistance Fund (EEAF), a nonprofit venture capital fund, has successfully invested in several projects that support sustainable forestry. One investment allowed an eco-tourism lodge to purchase rainforest land; another investment supported a tree plantation that intends to develop sustainable harvesting techniques. EEAF's success demonstrates the viability of alternative approaches to logging and agricultural cultivation.

Market-Driven Opportunities

Demand from the U.S. and other western countries for eco-tourism, high-value wood products from sustainable plantations, and organic agricultural products are beginning to create green market opportunities in the forestry and agricultural sectors.

Forestry Protection and Eco-Tourism. Eco-tourism is a relatively new phenomenon in Central America, but one that has the potential to become an important catalyst for environmental initiatives within the region. Eco-tourism is a highly profitable business; worldwide annual revenues are estimated at \$10 billion. Within Central America, Costa Rica attracted 275,000 visitors to its national parks system in 1991. More than 10,000 foreign tourists visited Belize's national parks in the same years. Expenditures by tourists to Belize reached \$138 million in 1993. The economic benefits of tourism often justify governmental investment in protected areas and natural resource conservation.

Sustainable Wood Products. Environmentally-conscious consumers in the United States and Europe are increasingly seeking timber and other wood products harvested from sustainable plantations or forests. For example, a large U.S.-based clothing retailer recently refurbished some of its retail outlets with timber certified as grown in a sustainable manner. Despite some Central American efforts to implement sustainable forestry practices, demand for such products currently outstrips supply.

Demand for Organic Agricultural Products. Increased demand in the United States and Europe for organically-grown produce has already stimulated production of organic crops in Central America. The U.S. market for organic products grew 14% annually between 1988-1992. Organically-grown coffee, valued at over \$12.5 million worldwide, is also a promising market niche.⁶ Organic coffee can be sold at a 20% premium over nonorganic coffee. Costa Rica has so far been at the forefront of this effort, although several Central American countries have organic farming initiatives underway. Because organic farming requires very specialized knowledge — from crop cultivation to gaining access to market niches — the majority of market opportunities fall under technical or business consulting and/or training.

⁶Thrupp, Lori Ann, G. Bergeron, W. Waters. 1995. *Bittersweet Harvests for Global Supermarkets: Challenges in Latin America's Agricultural Export Boom*. pp. 123 and 126.

Other Forest Conservation Opportunities

Forest conservation opportunities have recently resulted from debt-for-nature swaps, often initiated by multilateral development banks. In the future, carbon sequestration projects should result from joint implementation projects.

Debt-for-Nature Swaps.⁷ Each of the Central American countries have outstanding foreign exchange debts with commercial banks, international financing organizations, and foreign governments. To relieve these sometimes overwhelming debt burdens, some Central American countries have opted to pay creditors in local currency for local investment instead of discounting their debt settlements in dollars. These arrangements have been termed “debt-for-nature swaps” because the local investments were sometimes channeled into environmental improvement programs. Costa Rica negotiated to have \$79.9 million of debt swapped for \$42.9 million in conservation programs. Guatemala swapped \$5.0 million in debt for \$2.0 million in conservation programs over a five-year period.

Joint Implementation. Central American countries have actively supported various efforts by private entities to implement forestry-related projects under the United States’ pilot Joint Implementation (JI) program.⁸ These projects, which typically involve the purchase of forested land and/or the reforestation of a tract of land to increase the levels of carbon sequestration in the country, include four forestry-sector projects in Costa Rica and another in Belize that are already under development as JI projects.

An ongoing project in Panama involves the reforestation of degraded pasture land in the Chiriqui Province in western Panama. The project will plant 500 hectares with teak with an estimated net sequestration of 58,000 metric tons of carbon over the 25-year lifetime of the project. The sustainably-managed teak plantation will yield a stream of high-quality hardwood for furniture production, providing a substitute for unsustainably harvested natural forest hardwoods. The plantation will also reduce soil erosion from grazing and cropping and increase wildlife habitat.

Market Summary

Although the green environmental markets are currently very small in most Central American countries, they are expected to increase and prove sustainable over the long term. The annual market for green environmental opportunities is \$39 million per year over the next five years. A significant share of the market will be supported through donor programs for natural resource management and sustainable agricultural development. A smaller share of the market opportunities will arise from

⁷ USAID and World Resources Institute. 1993. *Green Guidance for Latin American and the Caribbean*, p. 21

⁸ The concept of “joint implementation” describes various possible arrangements between entities in two or more countries which lead to the development and implementation of projects that reduce or sequester greenhouse gas emissions. Information for this section is drawn from the JI Online Internet site located at www.ji.org.

programs initiated by private foundations, environmentally-oriented venture capital funds, or other private sector efforts. Exhibit 7-5 presents the market outlook for this sector.

EXHIBIT 7-5 MARKET OUTLOOK FOR GREEN ENVIRONMENTAL MARKETS				
Country	Market Potential (avg. annual US\$ millions)	Market Conditions		Best Bets
		Outlook	Rationale	
Belize	2.0	○	▶ no donor funding ▶ relatively low deforestation	▶ eco-tourism related
Costa Rica	8.0	◐	▶ donor funding to support biodiversity ▶ organic farming already practiced	▶ eco-tourism related ▶ organic farming ▶ sustainable plantations ▶ selective logging tools ▶ Joint Implementation
El Salvador	8.0	◐	▶ donor funding for soil conservation and agroforestry ▶ organic farming already practiced ▶ limited forest cover	▶ organic farming ▶ technical assistance for resource conservation
Guatemala	6.0	◐	▶ donor funding for natural resource conservation ▶ organic farming / IPM already practiced	▶ organic farming ▶ eco-tourism in nature reserves ▶ Joint Implementation
Honduras	2.5	○	▶ donor funding for natural resource conservation ▶ established timber and sawmill industry	▶ technical assistance for resource conservation ▶ Joint Implementation
Nicaragua	2.5	○	▶ limited donor funding for biodiversity protection	▶ technical assistance for resource conservation
Panama	10.0	◐	▶ donor funding for natural resource conservation ▶ established timber production trade	▶ sustainable plantations ▶ Joint Implementation
TOTAL	39.0	◐		
Strong opportunity (market size > \$25 million): ● Moderate opportunity (market size = \$3-25 million): ◐ Limited opportunity (market size < \$3 million): ○				

Source: Hagler Bailly, 1997

7.3 STRATEGIC CONSIDERATIONS

The most important strategic consideration affecting green environmental market opportunities in Central America is the establishment of appropriate regulatory frameworks that will encourage sustainable forestry and agricultural methods or at least not provide unfair advantages for unsustainable practices. In addition, successful companies will need to take advantage of local community participation and develop relationships with appropriate government decision makers.

Regulatory Environment

In many Central American countries, current government policies exacerbate the negative environmental effects of agriculture and forestry activities. Forestry and agriculture legislation do not incorporate the concepts of sustainable yields, conservation, or environmental protection. As a result, landowners, logging companies, farmers, ranchers, and other groups do not have proper incentives to adopt sustainable forestry or agriculture techniques. In general, Central American governments will need to consider revising existing legislation to better address some of the following issues:

- ▶ national land zoning
- ▶ land tenure security that will promote long-term investment in the land
- ▶ user fees for natural resources and enforcement of their collection
- ▶ incentives and guarantees for long-term investments in sustainable resources.

Community Participation

Although some market opportunities will exist with large-scale wood and agriculture plantations, most opportunities will involve, at some level, the small local farmers, ranchers, and individual households. Thus, successfully exploiting these market opportunities will require community participation, particularly if a change in habits or culture is necessary. For example, efforts to introduce IPM to snow pea production in Guatemala were only partially successful. One problem was that approaches for technology transfer were top-down and not participatory. Thus, when the farmers were left to carry out IPM without the technicians, many practices were abandoned.⁹

Decision Makers

The decision makers influencing green market opportunities are the public sector agencies that regulate land use, resource planning, and agriculture. These include the ministries of natural resources, land use planning, agriculture, and agencies in charge of protected areas (see Exhibit 7-6).

EXHIBIT 7-6 DECISION MAKERS FOR GREEN ENVIRONMENTAL MARKET OPPORTUNITIES	
Country	Relevant Organizations
Belize	Forest Department
Costa Rica	MINAE
El Salvador	SEMA
Guatemala	CONAMA
Honduras	COHDEFOR (Honduran Forestry Development Corporation)
Nicaragua	MARENA, CONAFOR
Panama	INRENARE

⁹ Thrupp, Bergeron, and Waters. p. 117-188.

Suggested Strategies

The need for local partners will depend on the type of market opportunity. For example, JI projects may require the approval of a government agency, while other opportunities such as organic farming may require community participation. In addition, successful exploitation of green market opportunities will likely require a public relations strategy that targets niche markets in developed countries with a high environmental awareness.

CHAPTER 8 RENEWABLE ENERGY

Central America faces several considerable challenges in the provision of electricity to the region's population. Approximately one-half of Central Americans do not have access to electricity services. While power shortages are not as pervasive as in recent years, they continue to threaten economic development and growth in the region. To address these needs, Central American countries will need to add 2.6 GW of new generating plants over the next 10 years.

Renewable energy power plants will likely supply a considerable portion of Central America's future generating needs. The region has little fossil fuel reserves but considerable renewable energy resources, including 40 GW of potential hydroelectric power and nearly 4 GW of potential geothermal resources. Small-scale renewable energy plants can provide energy at economical levels without creating adverse air, water, land, or other environmental impacts.

Renewable energy opportunities for U.S. companies could total about \$310 million per year over the next five years. This market will not only include opportunities in design, equipment sales, and construction, but will also include opportunities for private companies to own and operate renewable energy power plants. Power sector regulatory reforms underway in most countries should further improve the investment climate for renewable energy plants and expand future opportunities. Multilateral development banks also are highly supportive of both public and private sector renewable energy initiatives.

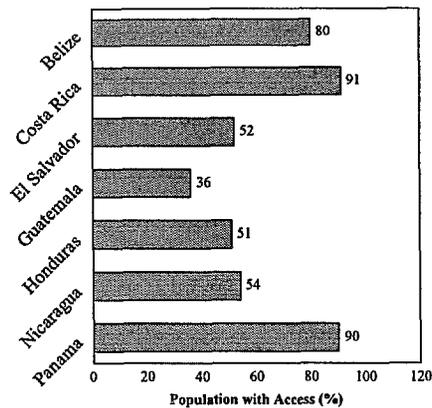
8.1 MARKET NEEDS

Renewable energy resources can fulfill two major needs of Central American countries: increasing generating capacity to meet current and future needs, and diversifying the generation mix.

Increasing Generating Capacity to Meet Current and Future Needs

Nearly one-half of Central America's population — approximately 15 million people — does not have access to electricity. In addition, demand for electricity has been increasing by over 6% per year, foreshadowing enormous needs for additional electricity sector infrastructure in the near future. In fact, Central American countries will need to develop about 2.6 GW of new electricity generating plants over the next 10 years, both to meet future anticipated demand and to extend coverage to the 15 million people in the region who are without access to electricity. About one-half of these people live in

EXHIBIT 8-1
Population with Access to Electricity



Guatemala where only 36% of the population has electricity access. There are also about 3 million people each in El Salvador and Honduras with no electricity supply (see Exhibit 8-1).

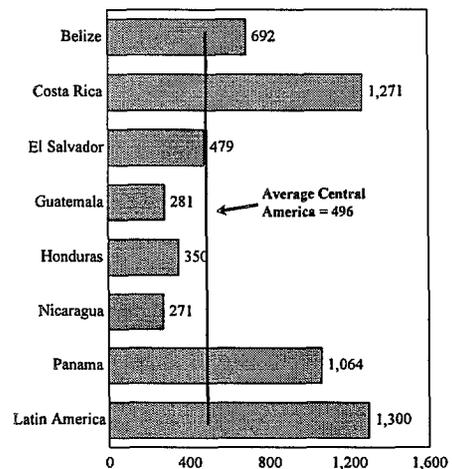
Per capita electricity use is low due partly to low levels of power sector coverage and partly to the low market penetration of electric technologies such as air conditioning. Per capita electricity use in Central America averages only 500 kWh (see Exhibit 8-2), a level that is only about 40% of the Latin American average. (This low level of per capita electricity use is the equivalent of the

annual continuous operation of a single 60 watt light bulb.) Annual per capita electricity consumption in Guatemala is only about 60% of the Central American average, or less than 300 kWh.

In addition to providing greater access to electricity services, Central American countries urgently need to increase their generation capacity to better serve current customers. Recent experiences with power shortages indicate that current capacity is insufficient. Demand for electricity is growing rapidly; thus, capacity needs will only increase in the future. Central America will need 2.6 GW of new capacity by 2005.

Power Shortages. Power shortages continue to be a concern in several Central American countries, particularly during years of low rainfall when hydroelectric facilities provide only limited power. Honduras has recently experienced serious energy shortages. Nicaragua and Panama face less significant power shortages that, nevertheless, can become serious during dry years when hydroelectric plants are unable to operate at high levels. As Exhibit 8-3 illustrates, the three countries currently have an estimated capacity shortage of about 200 MW.

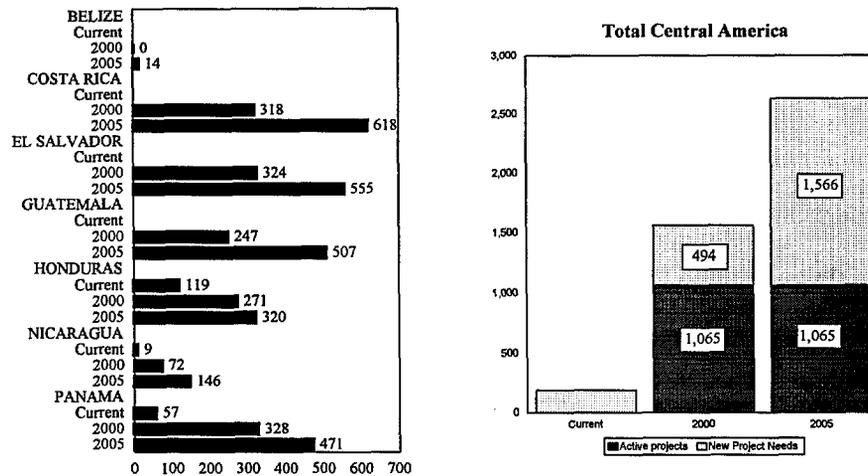
EXHIBIT 8-2
Per Capita Electricity Consumption
(kWh per person, 1995)



Source: OLADE, adjusted for estimated losses

Future Demand for Electricity Generating Capacity. The continuation of recent electricity demand trends should create more significant power needs in the very near future. Electricity demand in Central American countries has increased by an average rate of over 6% per year since 1990. Electricity demand in El Salvador and Panama has increased by 7.5% and 6.5% per year, respectively, since 1990. Projects that are currently being developed or constructed will be able to meet an estimated 1,065 MW of the projected future demand, as shown in Exhibit 8-3. Even if demand growth slows to 5% per year after 2000, Central America will need an additional 1,100 MW of new generating capacity by the year 2005.

EXHIBIT 8-3 Peak Generating Capacity Needs (MW)



Source: Hagler Bailly estimates based on McGraw-Hill International Power Quarterly data and Hagler Bailly database. Total of capacity currently under development/construction likely to be completed and new needs. Lower growth rates assumed in poorer countries.

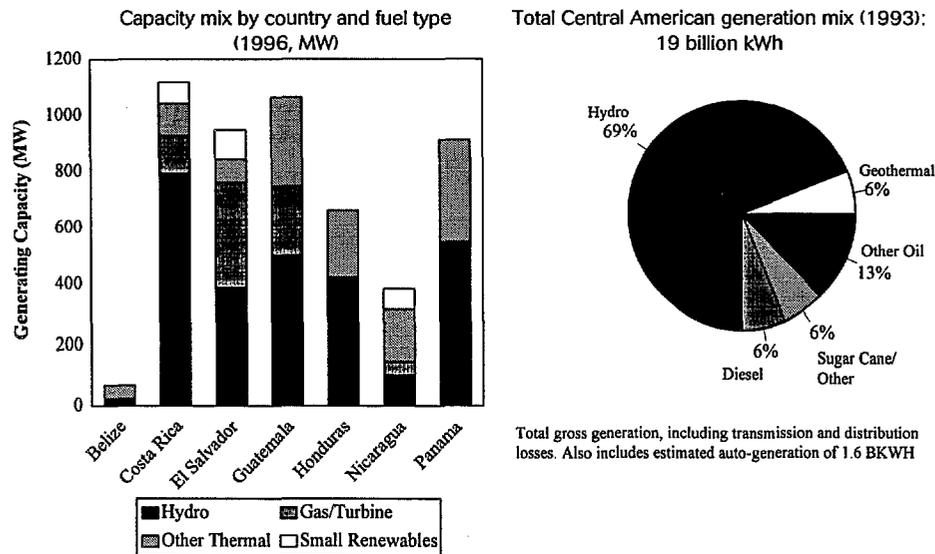
Diversifying the Generation Mix

Central American countries need to diversify their energy supplies to reduce current reliance on large hydroelectric plants and to replace expensive, unreliable oil-fired plants that require oil imports. Small renewable energy power plants can meet these needs.

Excessive Reliance Upon Large Hydroelectric Facilities. Central American countries rely on large hydroelectric facilities for nearly 55% of their generating capacity and over two-thirds of their electric generation, as shown in Exhibit 8-4. Three countries (Costa Rica, Honduras, and Panama) rely on hydroelectric resources for about two-thirds of their current generating capacity. In comparison, other renewable energy sources comprise only about 4% of generating capacity and about 6% of electricity generation.

EXHIBIT 8-4

Capacity and Generation Mix



Source: OLADE, 1996, and Hagler Bailly, 1997

Excessive reliance on large hydroelectric plants by many Central American countries has historically been a major contributor to energy shortages during the region's periods of low rainfall. In 1994 drought severely reduced hydroelectric plant output in Honduras, forcing the state-owned utility, Empresa Nacional de Energía Eléctrica (ENEE), to implement rolling 12-hour blackouts. Guatemala also was forced to implement severe electricity rationing during periods of low rainfall in 1991.

Small renewable power plants are much better suited to meet the needs of the small power systems in Central America than large hydroelectric plants because they allow systems to operate more reliably with a smaller reserve margin. Reliability concerns generally dictate that power systems maintain a "spinning reserve" (i.e., a readily available reserve of power) equal to the size of the largest unit in the system. In Guatemala, for example, this reserve requirement is usually equal to the size of the 300 MW Chixoy hydropower facility, which represents 30% of the country's generating capacity. In contrast, most power systems in the United States avoid reliance upon any one unit to meet more than 10% of electricity demand.

Expensive and Unreliable Fossil Fuel Plants. A majority of Central America's non-hydro generating capacity is composed of simple-cycle turbines, diesel engines, or other fossil fuel resources. As a result, operating costs are quite high, with baseload costs of \$100 per MWh.¹ High operating costs create excessive foreign currency demands because Central America lacks significant oil or gas resources and must import virtually all fuel.

¹ Based on a distillate oil price of \$7.00/MMBtu and a heat rate efficiency of 14,250 Btu/kWh.

In addition, fossil fuel plants have historically exhibited poor availability, because many plants are old and even new plants have been poorly maintained. The fact that many of these plants are only available around two-thirds of the time has been a major contributor to electricity shortages. In Honduras the 27 MW Ceiba plant and the 15 MW gas-fired La Puerta plant have not been operating; the 30 MW Termica Alstom and 30 MW Termica Sulzer plants are operating at only about 50% capacity.² New renewable energy plants would maintain a considerably higher rate of availability. For example, new wind technologies on good sites can generate power almost continuously. Geothermal projects can also produce power during nearly all hours of a year.

8.2 MARKET OPPORTUNITIES

Central American countries currently have a viable renewable energy market. There are currently more than 20 major, active renewable energy projects already under development through government- and donor-funded initiatives and privately-sponsored ventures. With these active projects and other new projects, Central America represents a \$1.5 billion renewable energy market over the next five years. The market has grown substantially since 1993 when a USAID-funded initiative for renewable energy and energy efficiency in Central America identified \$500 million in potential projects. In the future there should also be opportunities to own and operate renewable energy projects as governments privatize existing hydroelectric, geothermal, and other renewable energy resources.

Renewable energy projects fall into three categories:

- ▶ publicly-funded projects
- ▶ private sector projects
- ▶ privatization of existing renewable energy resources.

Publicly-Funded Projects

Central American electric utilities and donor agencies are currently developing 10 renewable energy projects with potential capacity of more than 600 MW (see Exhibit 8-5). These projects include large- and medium-sized hydroelectric stations, geothermal projects, and wind energy facilities. Over half of this recently-financed capacity is found in Costa Rica, where four publicly-funded projects totaling 349 MW of capacity are under development. These projects may represent opportunities for companies in the areas of design, engineering, procurement, and construction. In addition, IDB studies in Honduras and Panama may lead to new hydroelectric and geothermal opportunities in the near future.

² McGraw-Hill, *International Private Power Quarterly*, Third-Quarter 1996.

EXHIBIT 8-5 PUBLIC SECTOR RENEWABLE ENERGY PROJECTS			
Country/Project	Funding Source	Type	Size (MW)
Costa Rica: 349 MW			
Daniel Guterrez	ICE	Hydro	62
Toro I and II	ICE	Hydro	90
Angostura	IDB, ICE	Hydro	177
Tejona	IDB, ICE	Wind	20
El Salvador: 120 MW			
Salvador, Berlin	IDB, CEL	Geothermal	55
Ahucachapian Rehabilitation	IDB, CEL	Geothermal	65
Honduras: 144 MW			
Francisco Morazan	IDB	Hydro	N/A ³
El Cajon	ENEE	Hydro	144
Panama			
Panama	IDB	Geothermal	N/A ⁴

Sources: World Bank, Inter-American Development Bank, McGraw Hill's Independent Power Quarterly

Private Sector Projects

Private companies are currently developing, financing, and constructing 10 major renewable energy projects which could add up to 720 MW of generating capacity in four Central American countries. Exhibit 8-6 outlines the projects' names, sizes, developers, and power source. These projects represent opportunities for engineering, design, and equipment supply. Geothermal projects also offer opportunities for resource exploration and development. There are opportunities for equity acquisitions as projects progress because most of the projects are currently being developed by only one or two sponsors who may conceivably wish to sell some of their equity interests at some point in the future.

³ \$36.8 million loan for civil works to rehabilitate an existing hydroelectric facility and for other emergency energy investments, including advice on energy sector deregulation.

⁴ Donor funding of \$1.4 million has been allocated for the \$2.27 million assessment of the El Campo del Vallee de Anton generating facility.

121

EXHIBIT 8-6 ONGOING PRIVATE RENEWABLE ENERGY PROJECTS					
Sponsors	Project Description			Status	Est. Start Year
	Name	Type	Size (MW)		
Costa Rica: 108 MW					
Energia Global	Rio Volcan	Hydro	16	Construction	1997
Westinghouse	Donya Julia	Hydro	12	Preliminary	
Oxbow Power	Miravalles III	Geothermal	50	Open Bid	1999
Maria Julieta Choishul	La Paz	Hydro	15	Prelim. Development	
Electrica Platanar	Platanar	Hydro	15	Letter of Intent	
Guatemala: 259 MW					
Ormat/Orzunil	Zunil 1	Geothermal	24	Development	1997
Various Sugar Mills	Sugar Mills I	Biomass	150	Construction	1997
Various Sugar Mills	Sugar Mills II	Biomass	85	Preliminary	2000
Honduras: 100 MW					
Oxbow	Unnamed	Geothermal	100	Prelim. Development	
Nicaragua: 254 MW					
Intergeotherm/INE	Unnamed	Geothermal	120	Development	
Trans-Pacific	El Hoyo Monta Galan	Geothermal	50	Prelim. Development	1998
Energia Global	Unnamed	Biomass	56	Prelim. Development	
Energia Global	Unnamed	Geothermal	28	Prelim. Development	

Source: Hagler Bailly's Independent Power Database

In addition to the projects shown in Exhibit 8-6, there are at least three other types of private sector opportunities: (1) non-power renewable applications, (2) very small projects, and (3) newly-emerging opportunities. Exhibit 8-7 describes some of these opportunities in Costa Rica, which is currently one of the best markets for renewable energy in Central America.

EXHIBIT 8-7
NEW RENEWABLE ENERGY OPPORTUNITIES IN COSTA RICA

Costa Rica has become one of the most sought after renewable energy markets in Central America. In addition to the five ongoing private power renewable energy projects shown in Exhibit 8-9, private companies can pursue three other types of opportunities:

1. *Non-power renewable applications* such as solar water heating. For example, a local company in Costa Rica called Ecosol provides hot water heating systems that are suitable for homes and hotels. The equipment is imported but is exempt from import duties.
2. *Smaller renewable energy projects*. For example, the International Fund for Renewable Energy and Energy Efficiency recently considered pre-feasibility funding for seven different projects of less than 20 MW.
3. *Newly-emerging private power opportunities*. Additional private power opportunities should be emerging in Costa Rica. ICE is considering soliciting bids for 15 MW blocks of geothermal energy.

Source: IFREE, Ecosol, McGraw Hill's Independent Power Quarterly

Many similar opportunities exist in other Central American countries. For example, there are two small wind projects in the eastern part of Guatemala, both of which use U.S. technology. There are plans to build a third wind farm close to Guatemala City. In El Salvador, hotels have successfully installed photovoltaic collectors. In rural areas without electricity access, small photovoltaic (PV) projects may be an economically viable alternative to electricity transmission grid extension.

Privatization Opportunities

Privatization in the power sector could create opportunities to acquire and/or operate a portion of Central America's existing renewable energy capacity. All Central American countries are considering privatizing or corporatizing their state-owned utilities. El Salvador, Guatemala, and Panama have recently passed laws that would facilitate privatization of their utilities (see Exhibit 8-8). Nevertheless, there are no assurances that all or any portion of Central America's renewable energy assets will be privatized. Moreover, privatization of the assets may be difficult. Many of the renewable energy plants are hydroelectric facilities that provide social benefits other than power (e.g., irrigation, water management), possibly making private ownership a controversial issue.

125

EXHIBIT 8-8				
STATUS OF POWER SECTOR PRIVATIZATION IN CENTRAL AMERICA				
Country	Electric Utility		Current Status of Privatization	Ongoing Activity/Likely Future Developments
	Name(s)	Renew. Capacity (MW)		
Belize	Belize Electricity Ltd.	0	BEL 37.5% privately held; up to 49% can be private	No changes foreseen
Costa Rica	Instituto Costarricense de Electricidad	847	Corporatization proposed	Corporatization could be implemented; continued state role likely
El Salvador	Comisión Ejecutiva Hidroeléctrica del Lempa	493	Law unbundles power sector; still state held	Ongoing restructuring study will assess possible privatization
Guatemala	Instituto Nacional de Electrificación & EEGSA ⁵	502	Law unbundles power sector; still state-owned; EEGSA thermal units being privatized	Future actions not yet determined
Honduras	Empresa Nacional de Energía Eléctrica	424	Privatization plans developed in 1994; ENEE corporately unbundled	Future actions not yet determined
Nicaragua	Instituto Nicaragüense de Energía	173	Law under development would unbundle power sector	Future actions not yet determined
Panama	Instituto Nacional de Recursos Hidráulicos y Electrificación	551	Law would reorganize and partially privatize IRHE	Generation companies could eventually be privatized

Market Summary

The estimated annual market for renewable energy over the next five years is \$310 million, making it by far Central America's largest market for environmental goods and services. With the exceptions of Belize and Nicaragua, all of the countries have strong renewable energy potential, as shown in Exhibit 8-9. The Nicaraguan market could grow if the government pursues economic reforms and the economy grows. Costa Rica represents the strongest market because it has significant experience with both private and public renewable energy projects. El Salvador and Guatemala also represent excellent

⁵ Empresa de Energía de Guatemala S.A.

markets. These three countries together comprise nearly 80% of the total estimated market over the next five years. There are opportunities for small hydro project construction and rehabilitation, geothermal generation, and sugar mill cogeneration.

EXHIBIT 8-9 MARKET OUTLOOK FOR THE RENEWABLE ENERGY SECTOR				
Country	Market Potential (avg. annual US\$ millions)	Market Conditions		Best Bets
		Outlook	Rationale	
Belize	0.0	○	▶ Sufficient capacity to 2000	▶ Small rural PV
Costa Rica	103.9	●	▶ Active projects, mostly publicly funded ▶ New projects due to high growth/favorable policies ▶ Joint Implementation	▶ Small hydro ▶ Wind ▶ Geothermal
El Salvador	74.3	●	▶ Active private and publicly funded projects ▶ Improving regulatory climate	▶ Geothermal ▶ Wind
Guatemala	60.6	●	▶ Private projects, mostly active ▶ Improving regulatory climate	▶ Sugar mill cogen ▶ Small hydro ▶ Small rural PV
Honduras	26.2	●	▶ Large needs/current shortage ▶ Active hydro rehab. project ▶ Poor economy/growth potential	▶ Hydro rehabilitation ▶ Small hydro
Nicaragua	7.0	◐	▶ Large needs, but poor economy ▶ Possible new public projects	▶ Small projects, esp. geothermal
Panama	37.9	●	▶ Pending Esti hydro bid ▶ Large needs/likely growth ▶ Improving regulatory climate	▶ Small hydro ▶ Geothermal
TOTAL	309.9	●		
<p>Strong opportunity (market size > \$25 million): ● Moderate opportunity (market size = \$3-25 million): ◐ Limited opportunity (market size < \$3 million): ○</p>				

Source: Hagler Bailly, 1997

175

8.3 STRATEGIC MARKET CONSIDERATIONS

There are three strategic considerations that affect the market for renewable energy plants:

- ▶ Renewable energy projects face competition from other types of power generation (e.g., fossil fuel generation).
- ▶ Most countries have a limited ability to pay for new environmental energy projects.
- ▶ Regulatory frameworks are generally in a state of transition and do not explicitly favor clean energy projects.

Competing Sources of Power Generation

Unlike most other environmental markets, renewable energy projects face competition from other types of power generation. Despite this fact, renewable energy has some comparative advantages, including the abundant potential for renewable energy, the high prices of competing resources, and the small and underdeveloped electricity grids of Central American countries. There is also a large network of organizations and professionals in Central America that support the development of renewable energy.

Abundant Renewable Energy Potential. Renewable energy potential far exceeds the anticipated capacity need of 2.6 GW over the next 10 years. Thus, there are few, if any, technical limitations on renewable energy development for the foreseeable future. Moreover, efforts to use Central America's renewable energy resources have recently gained government support.

Central American countries possess 40 GW of potential hydroelectric power, 4 GW of potential geothermal resources, and favorable wind conditions in several countries, including Costa Rica and Nicaragua (see Exhibit 8-10). Costa Rica and Guatemala each have over 10 GW of renewable energy potential in hydroelectric and geothermal resources alone; Nicaragua and Panama each have over 7 GW of renewable energy potential. The potential for harnessing wind energy is being evaluated in most countries. In Costa Rica, researchers have determined that there is a potential for the production of 600 MW of wind-generated energy.

In addition, there is significant potential for sugar mill cogeneration in every Central American country, with the possible exception of Panama. Guatemala has 235 MW of sugar mill projects under construction or development. El Salvador currently has 10 sugar factories that could sell 55 MW of power to the national grid during the crushing season (December through March) and 75 MW during the rest of the year.⁶

⁶ Fundación Solar, 1996.

EXHIBIT 8-10 TECHNICAL POTENTIAL FOR RENEWABLE ENERGY (MW)				
Country	Hydro	Geothermal	Sugar Mill Cogen	Other Renewable Energy Currently Used
Belize	80	--	N/A ⁷	--
Costa Rica	9,155	900	5	Biomass
El Salvador	1,726	300	2	Thermal & PV Solar; 100 MW biomass
Guatemala	10,890	200	129	Biomass, PV
Honduras	3,600	--	7	Biomass, PV
Nicaragua	5,050	2,200	N/A	2.63 MW PV
Panama	6,645	360	N/A	--
Total	37,146	3,960	> 143	

Source: Fundación Solar and International Cane Energy Network, August 1995

High Cost of Fossil Fuel Resources. Renewable energy projects in Central America are likely to be economic due to the high cost of competing fossil fuel resources. Fossil fuel plants in Central American countries generate power at very high costs due to the lack of indigenous supplies of oil, gas, or coal. All Central American countries, including Guatemala, are net oil importers. No Central American country has oil or gas reserves except Guatemala, which only has reserves of 55 million barrels of oil and 20.6 billion cubic feet of natural gas. These reserves would provide natural gas and oil for only 20 MW and 270 MW, respectively, of generating capacity.

Exhibit 8-11 shows the marginal cost of fossil fuel units operated during all or most available hours, i.e., baseload units. The costs range from about \$0.052 per kWh for coal plants to over \$0.06 per kWh for oil-fired resources. In comparison, the Plantas Eolicas facility, a wind farm, has a lower baseload price of \$0.05 per kWh. Plantas Eolicas is also competitive when operated in "intermediate load," i.e., about half of available hours.

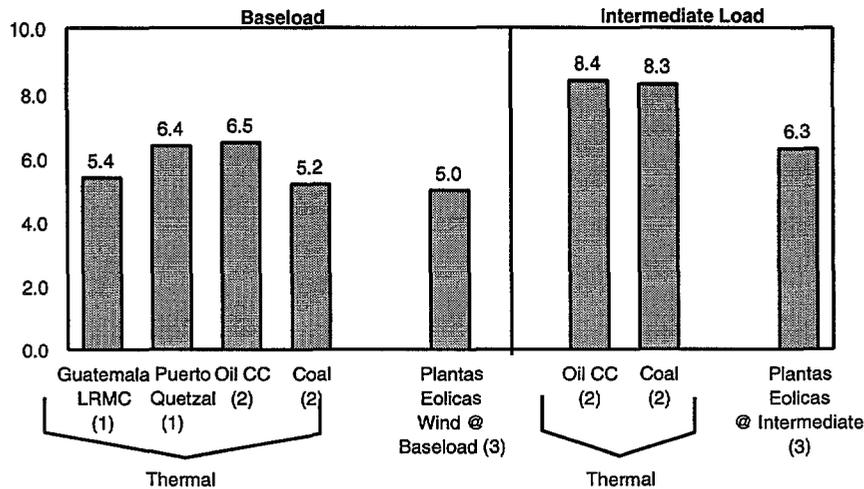
Small, Underdeveloped Electricity Grids. The small size and poor development of Central American electricity grids make them ideally suited to small renewable energy projects. The average system size is only about 700 MW. The largest electricity system, located in Costa Rica, is only slightly larger than 1,000 MW. In these systems reliability considerations dictate that generating resources should not exceed about 70 MW.⁸ Renewable energy projects can be developed economically at or below this level, whereas fossil fuel projects can be more cheaply developed at larger sizes.

⁷ Sugar mill cogeneration capacity figures are currently unavailable for Belize, Nicaragua, and Panama.

⁸ See page 8-4.

EXHIBIT 8-11

Electricity Generation Power Price Markers (Levelized 1996 cents/kWh)



(1) Source: USAID/World Bank, Mobilizing Private Capital for the Power Sector

(2) Source: Hagler Bailly estimate of 1996 levelized cent/kWh price

(3) Source: Hagler Bailly estimate based on project information reported in McGraw-Hill International Private Power Quarterly

The poor development of Central American grids similarly creates opportunities for small renewable energy projects, especially solar photovoltaic projects. Large portions of rural populations are not served by the grid, and grid extension to these rural areas is typically very expensive. In addition, most grids are not connected with each other. Small renewable energy projects can avoid transmission and distribution expenses because they usually can be located closer to the point of electricity use than large projects. For example, small photovoltaic projects can be built directly at the site of electricity use.

The economies of scale of Central American power systems that currently favor small renewable energy projects could be substantially altered with the implementation of the Central American Electrical Interconnection Project (SIEPAC). SIEPAC is intended to create a stronger transmission tie among the Central American countries and to gradually develop a competitive regional electric market. An integrated transmission system could reduce energy costs and raise reliability, quality, and continuity of service in the region. However, a larger transmission system would also negate some of the above-mentioned advantages of renewable energy projects. Policy makers in Central American countries have discussed for many years such an interconnected system. However, in the past the perceived benefits to an interconnected system seemed limited. In the context of increasingly liberalized power sectors, an interconnected system that provides access to a larger, regional market may be more viable.

Strong Support Network. A substantial network exists to support environmental energy sources. This network consists of development funds and nongovernmental organizations that provide equity and debt funds, feasibility study money, technical assistance, or other support for renewable energy and other environmental energy sources (see Exhibit 8-12).

One example of this available assistance is the Corporación Financiera Ambiental, S.A. (CFA), a venture capital fund based in San José, Costa Rica. Sponsored by the Environmental Enterprises Assistance Fund (EEAF) and its subsidiary, Empresas Ambientales de Centroamérica (EACA), CFA was established in 1996 through an agreement with the Multilateral Investment Fund. CFA invests in technically and financially feasible environmental energy projects. CFA makes investments of \$100,000 to \$750,000, offering grace periods of one year or more. Another source of equity and debt funds for environmental energy projects is E&Co's Latin American fund, which provides loans and, in some cases, grant money. E&Co also provides technical assistance.

EXHIBIT 8-12 TECHNICAL SUPPORT NETWORK FOR RENEWABLE ENERGY/ENERGY EFFICIENCY		
Organization	Description	Available Assistance
Corporación Financiera Ambiental	\$9.6 million fund managed by EEAF and EACA; 40% is available for technically and financially feasible renewable energy	Equity investments, loans with focus on small and medium-sized enterprises
E&Co Latin American Fund	\$7 million fund to finance and develop environmental energy in Latin America	Technical assistance, capital mobilization, and grant money
Fundación Solar	Central American REPSO to identify/support renewable energy investments	Partial funding of feasibility studies
Biomass Users Network	Fosters sustainable use of biomass and other natural resources by assisting private industry, rural cooperatives, communities, etc.	Facilitates information exchanges; performs studies
Wind Organizations	PLAN International, American Wind Energy Association (AWEA), National Rural Electricity Cooperative Association (NRECA)	Assistance for resource evaluation, project development; technical training

Another example of available assistance is Fundación Solar, a Renewable Energy Project Support Office (REPSO) funded by USAID and Winrock International. The Foundation shares costs for feasibility studies with private developers. In its initial solicitation, Fundación Solar identified 103 MW of potential projects and provided partial feasibility study funding for 33 MW of geothermal, wind, and solar projects, leading to the funding of seven projects, including 3 MW of geothermal capacity and 6 MW of hydropower projects. Fundación Solar also provides renewable energy resource assessments and helps to aggregate small renewable projects by identifying projects in proximate villages. Fundación Solar is also working to help establish an energy service company (ESCO) in the region.

In 1994 Fundación Solar and PLAN International began implementing wind projects with support from the American Wind Energy Association and the National Rural Electric Cooperative Association (NRECA). These organizations have supported resource evaluation, technical training, and project development initiatives.

129

Suggested Strategies

Renewable energy project developers can capture a large share of the region's future power needs by emphasizing the favorable economic and environmental aspects of renewable power plants. In most countries private grid-connected power projects will likely require government or multilateral bank guarantees.

Companies may find that initial market entry is facilitated by participating in one or more of the projects currently being developed. Alternatively, companies can take a long-term approach by identifying new project opportunities, potentially through contact with the existing renewable energy support network.

CHAPTER 9

ENERGY EFFICIENCY

Energy efficiency investments have received little attention in the marketplace, primarily due to the relatively low level of overall energy use in Central America. However, in recent years companies and government organizations have identified hundreds of millions of dollars in potential annual energy savings in existing and new facilities. Recent energy sector reforms have raised energy prices to levels that are more commensurate with electricity costs and therefore create fewer barriers to future energy efficiency investments.

9.1 MARKET NEEDS

Central American countries have three major energy efficiency needs: minimizing waste in energy consumption to maximize use of scarce energy supplies, reducing energy consumption in the industrial and commercial sectors, and reducing electricity transmission and distribution losses.

Minimizing Waste to Maximize Use of Scarce Energy Supplies

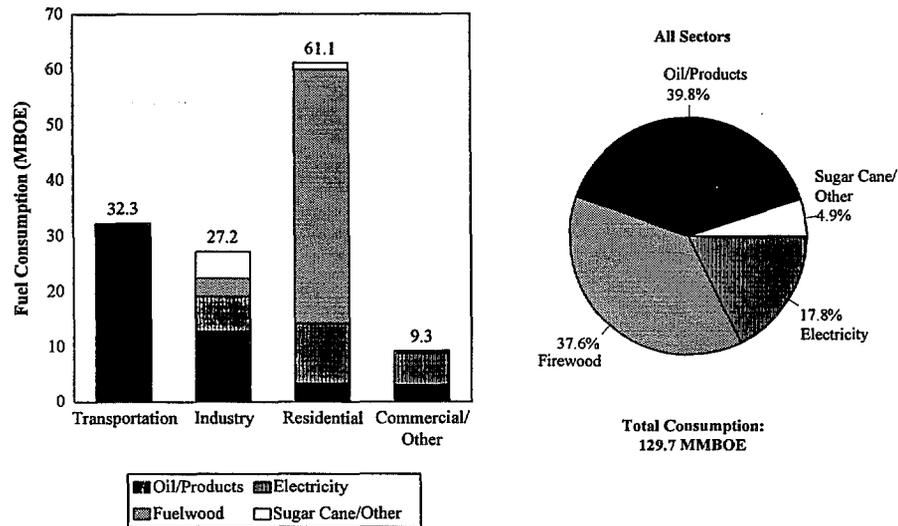
Central American countries have historically made energy efficiency a low priority because of their low level of primary energy consumption. In fact, this low level of energy use is precisely the reason Central American countries need to use the energy they have more efficiently.

Per capita energy use in Central America is very low. Central American countries use only about 260 kg oil equivalent (kgoe) per capita, which is only one-quarter of the per capita energy use of other Latin American countries. Costa Rica's per capita energy use of 438 kgoe per capita is more than twice as great as the average in Central America and 50% greater than that of the next largest per capita energy consumers, Panama and Nicaragua. However, even Costa Rica's energy use is only slightly more than half of the average per capita energy use in Latin America.

Energy efficiency has also been a low priority in the region because one of the largest energy sources in Central American countries is fuelwood, which is poorly suited for energy efficiency investments.¹ Fuelwood comprises nearly three-fourths of the region's residential energy consumption and nearly 40% of its total energy consumption (see Exhibit 9-1).

¹ The IDB, however, is funding a \$40,000 study in Honduras to study better management and efficient use of fuelwood.

EXHIBIT 9-1
Energy Consumption by Sector and Fuel Source
 (Millions of Barrels of Oil Equivalent, 1995)



Source: OLADE, Second Quarter, 1996, includes transportation and transformation losses

There are, however, opportunities for Central American countries to lessen their energy problems by using energy more effectively. In Nicaragua, for example, energy use is highly inefficient. Nicaragua's energy use of 0.81 kgoe per dollar of GDP is four times that of the rest of Central America and twice that of Latin American countries overall. Inefficient energy use is partly a long-term consequence of energy price subsidization that occurred during the Sandinista regime. However, Nicaragua's energy prices have since increased to levels comparable to other Central American countries.

Moreover, Central American countries need to use energy efficiently because of their lack of indigenous energy resources. With the exception of renewable energy resources described in Section 8.3, Central American countries have few domestic energy reserves. They import virtually all of their oil resources. Central America has historically been unable to use any natural gas.

Reducing Energy Consumption in the Industrial and Commercial Sectors

Industrial and commercial companies need to reduce energy expenditures to offset the effects of rising energy prices and to remain competitive in the international marketplace. Commercial and industrial customers in most Central American countries have witnessed energy price increases over the last several years. In some countries, such as Honduras, commercial and industrial customers have been subjected to rate increases in order to subsidize continuing low rates to residential customers.

132

Reducing Electricity Line Losses

Electricity line losses in Central America average over 19%. In comparison, developed countries typically experience line losses of only about 10%. The cost of these high losses exceeds \$130 million per year.² Three countries account for about 75% of this \$130 million inefficiency cost: Honduras, Nicaragua, and Panama. Electricity line losses in Honduras and Nicaragua are 28% and 34%, respectively. Line losses in Panama are about 23%. To some extent, these high losses reflect theft. However, capacitors and other transmission and distribution equipment could significantly reduce line losses in these countries.

9.2 MARKET OPPORTUNITIES

There are two major sources of electricity efficiency opportunities: economically-driven energy efficiency and regulation-mandated energy efficiency. Exhibit 9-2 outlines the types of energy efficiency opportunities that exist in Central America. The region should generate \$24.8 million per year in energy efficiency opportunities over the next five years.

EXHIBIT 9-2 ENERGY EFFICIENCY OPPORTUNITIES		
Country	Type of Opportunity	
	Identified Economic Opportunities	Regulation-Driven
Costa Rica	> \$40 million annual savings potential	Developing standards; utility program experience
El Salvador	> \$37 million annual savings potential	Little/no experience
Guatemala	Commercial/industrial savings of 10-50% identified at >90 firms indicates ~\$40 million annual savings in entire commercial/industrial sectors	Little/no experience
Honduras, Nicaragua Panama	Electricity line loss reductions	Little/no experience

Economically-Driven Energy Efficiency

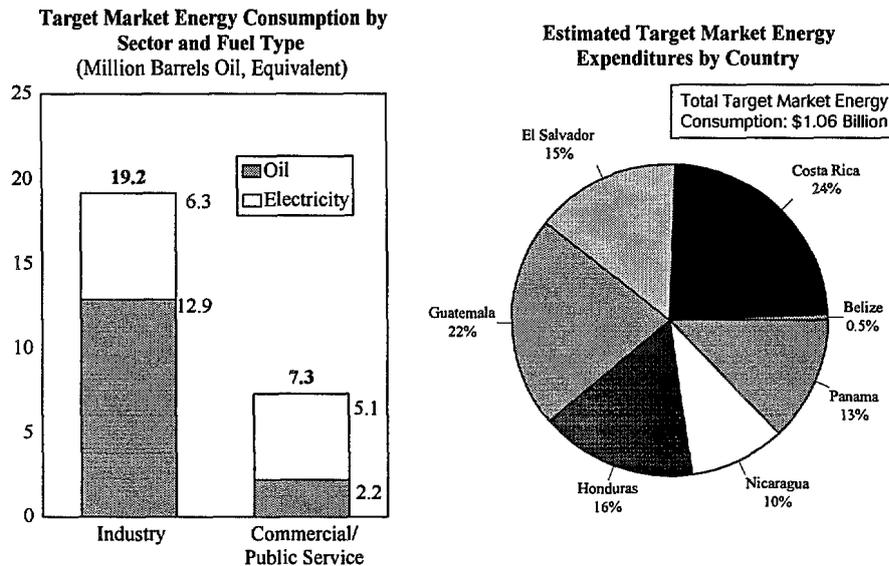
There is potential for Central American countries to reduce energy expenditures by several hundred million dollars, mostly in the commercial and residential sectors. The strongest market opportunities

² Calculated as the difference between 19% and 10% line losses times estimated electricity spending in Central America.

will be to help the industrial and commercial sectors in Costa Rica, Guatemala, and El Salvador. There are also opportunities for electricity line loss reductions, especially in Honduras, Nicaragua, and Panama.

The primary short-term energy efficiency market opportunity is in the reduction of oil and electricity consumption in the industrial and commercial sectors. As Exhibit 9-3 illustrates, these two sectors consume about 11.4 million barrels of oil equivalent (MBOE) of electricity (equivalent to about 7 billion kWh) and 15.1 MBOE of oil products. The industrial sector uses about three-quarters of this energy. Overall, the two sectors spend an estimated \$1.06 billion for the two fuels.³ Assuming a 30% technical savings potential⁴ in these sectors, this target market represents technical potential annual savings of about \$320 million.

EXHIBIT 9-3
Energy Efficiency Target Market
 (Oil & Electricity Consumption, Industrial and Commercial Sectors)



Source: OLADE, Second Quarter, 1996, and ENEL (Nicaragua) Compendio Estadístico 1990-1994, includes transformation and transportation losses

Three countries (Costa Rica, Guatemala, and El Salvador) consume over 60% of the region's energy in these target markets. They therefore offer particularly promising market potential (see Exhibit 9-3). International organizations and energy service companies have identified potential energy savings of more than \$100 million in the industrial and commercial sectors of these three countries. Most of these efficiency measures were economic even when electricity rates were one-half their current levels. Thus,

³ Estimated 1995 industrial and commercial oil expenditures are \$430 million. Estimated industrial and commercial electricity expenditures are \$630 million.

⁴ A USAID report, entitled *Exporting Energy Efficiency Products to Latin America* (1993), estimates potential energy savings of 10-50% for technologies such as high efficiency motors, energy efficient lighting, and refrigeration systems.

134

there are opportunities to implement energy efficiency measures that have favorable project economics. Measures with the most greatest energy savings potential include energy-efficient industrial motors, energy-efficient commercial lighting, and low- or no-cost maintenance and other measures.

Costa Rica. A 1991 study estimated that Costa Rica's industrial and commercial sectors could save 320 GWh and 140 GWh per year, respectively, by 2005.⁵ This level of savings would be equivalent to nearly \$40 million per year in electricity bill reductions. The industrial sector could achieve 320 GWh of annual savings with only a 10% reduction in energy consumption. Two-thirds of the reduced energy consumption would result from low- or no-cost measures such as O&M improvements, equipment repairs, insulation replacement, equipment lubrication, or compressed air pressure reductions. The installation of energy-efficient motors comprised another 20% of the industrial savings. Potential energy savings in the commercial sector could be achieved with energy-efficient lighting, including lamps, ballasts, and reflectors, as well as better overall energy management.

Recent studies performed by Costa Rica's MINAE and the Central American Institute for Research and Industrial Technology (ICAITI) found similar levels of savings potential. Audits conducted by MINAE of 19 Costa Rican enterprises found possible savings of 5-25% in electricity and oil use. An ICAITI survey of 51 firms noted a potential to save 13.5% in energy bills.

El Salvador. Servicios Técnicos de Ingeniera, SA de CV (SETSSA), an El Salvadoran energy service company, has identified energy savings of 13-49% for its client base of over 90 firms. According to SETSSA, industrial motors are the largest single potential source of energy savings in El Salvador, comprising 78% of industrial sector electricity consumption and 27% of total electricity consumption. Air conditioning and lighting account for about two-thirds of commercial electricity consumption. Steam traps and pipe insulation are other common areas for energy savings. Most energy efficiency projects have taken place in the commercial and industrial sectors; the typical capital investment made for energy efficiency in El Salvador is around \$25,000. El Salvador conducted a nationwide energy efficiency campaign in 1991 and 1992 that saved 18 GWh of energy, equivalent to about \$1.4 million.

Guatemala. A 1994 USAID study found that Guatemala could save 420 GWh by 2010 at economically feasible levels.⁶ Such savings are equivalent to nearly \$37 million at today's electricity rates. The industrial sector alone accounted for 198 GWh (i.e., nearly \$20 million) of potential savings. As in Costa Rica, low- or no-cost measures and the use of energy-efficient motors account for over 90% of potential savings. This study identified commercial sector savings of about 100 GWh (\$9.5 million) that could result largely through low- or no-cost measures and energy-efficient lighting.

Honduras, Nicaragua, and Panama. There should be near-term market for capacitors and other electricity line equipment to reduce electricity line losses in Honduras, Nicaragua, and Panama. Until recently, there has been few incentives for countries to invest in such equipment, because power

⁵ USAID. 1991. *Costa Rica: Power Sector Efficiency Assessment*. Washington, D.C.

⁶ USAID. 1994. *Guatemala: Power Sector Efficiency Assessment*. Washington, D.C.

systems have been dominated by state-owned utilities that had little regulatory oversight. Power sector liberalization should provide stronger incentives to invest in these areas in the future (See Section 8.3).

Regulation-Mandated Energy Efficiency

The implementation of regulatory practices to encourage energy efficiency similar to those implemented in the United States is still several years away. With the exception of Costa Rica, no Central American country has established standards for energy efficiency or implemented utility DSM programs. Exhibit 9-4 describes the experience in Costa Rica.

EXHIBIT 9-4 REGULATION-MANDATED ENERGY EFFICIENCY IN COSTA RICA

Costa Rica has taken the most significant steps to date of any Central American country to create a favorable regulatory environment for energy efficiency programs; the country has initiated a process to develop energy efficiency standards and implemented a utility demand-side management program.

Energy Efficiency Standards

Costa Rica has initiated a process that should lead to energy efficiency standards. A 1994 energy conservation law requires companies with annual electricity consumption of more than 13,600 kWh to present an energy conservation plan. This law will affect 1,000-1,500 food, cement, metals, ceramics, textiles, rubber, and other industries, of which about 60% are in the metropolitan San José area.

Under the 1994 law the Energy Ministry is currently reviewing international energy consumption policy to develop appropriate efficiency standards for Costa Rica based on the ratio of consumption over the value of production. The government will then identify companies whose rate of energy consumption exceeds these standards and therefore need to reduce energy use. Until standards are developed, the ministry is encouraging voluntary energy efficiency programs.

Utility DSM Programs

The Costa Rican utility, ICE, has initiated several DSM programs, including a 1989 pilot project that successfully reduced peak capacity by shifting the consumption of commercial and industrial customers, and a 1994 program that provided low-interest loans for energy efficiency. These programs have since expired.

ICE has several ongoing programs for energy efficiency, including a compact fluorescent lighting (CFL) program under which customers can pay for CFL lighting retrofits through their monthly electric bills. Under this program, consumers have so far purchased 375,000 CFLs.

ICE has also increased electricity rates to help make energy efficiency measures more attractive. It has raised overall electricity rates in the commercial and industrial sectors where measures are most likely to be implemented. ICE has also implemented an interruptible rate program for commercial and industrial consumers under which companies can receive lower rates in exchange for allowing ICE to interrupt power during peak demand periods.

Sources: IFREE, Biomass Users Network, World Energy Efficiency Association

Market Summary

The estimated short-term market for energy efficiency is \$24.8 million per year — a relatively small figure in comparison to the potential for \$320 million per year in energy savings. Costa Rica, El Salvador, and Guatemala comprise all but \$7 million of the market's short-term potential, as shown in Exhibit 9-5. Panama also has energy efficiency potential, due primarily to its overwhelming problem with line losses, and the ability of its large commercial sector to invest in energy efficiency. Line loss reduction opportunities also exist in Honduras and Nicaragua. The “best bets” for U.S. companies are in industrial motors, commercial lighting, and line loss reduction. In addition, energy service company (ESCO) opportunities in energy management are beginning to emerge in countries such as El Salvador.

EXHIBIT 9-5 MARKET OUTLOOK FOR ENERGY EFFICIENCY				
Country	Market Potential (avg. annual, US\$ million)	Market Conditions		Best Bets
		Outlook	Rationale	
Belize	0.0	○	▶ Market undefined	▶ N/A
Costa Rica	5.6	◐	▶ Defined economically-driven EE ▶ Regulation-mandated EE	▶ Energy-efficient motors ▶ Commercial lighting ▶ Demand-side mgmt.
El Salvador	5.2	◐	▶ Defined economically-driven EE	▶ Energy efficient motors ▶ Commercial lighting ▶ Air conditioning ▶ ESCO energy mgmt.
Guatemala	7.2	◐	▶ Defined economically-driven EE	▶ Energy management ▶ Commercial lighting ▶ Energy-efficient motors
Honduras	2.0	○	▶ Market currently undefined	▶ Line loss reduction
Nicaragua	2.0	○	▶ Market undefined ▶ Inefficient energy use	▶ Line loss reduction
Panama	2.8	○	▶ Market largely undefined ▶ Commercial sector, line-loss opportunities	▶ Commercial lighting ▶ Line loss reduction
TOTAL	24.8	◐		
Strong opportunity (market size > \$25 million): ● Moderate opportunity (market size = \$3-25 million): ◐ Limited opportunity (market size < \$3 million): ○				

Source: Hagler Bailly, 1997

The main market limitations are the likelihood that Central American countries will continue to give low priority to energy efficiency, the region's ability to implement many low- and no-cost measures without foreign assistance, and the lack of regulation-driven energy efficiency in most countries.

9.3 STRATEGIC MARKET CONSIDERATIONS

There are three major strategic considerations affecting the ability of U.S. companies to exploit energy efficiency opportunities in Central American countries:

- ▶ current energy prices
- ▶ regulatory framework
- ▶ energy efficiency infrastructure.

Energy Prices

Energy prices (for electricity and other forms of energy) have increased in recent years. At today's higher levels, the prices are comparable to those in other Latin American countries that have recently reformed their energy sectors and are generally considered to be unsubsidized. Average gasoline prices are within 6% of those in other Latin American countries (see Exhibit 9-6).

Electricity prices in Central America have increased by an average of 35% since 1993, and are higher than those in other Latin American countries, as shown in Exhibit 9-6. Cross-subsidies among customers, however, persist in the industrial and residential sectors in many countries. Honduras, for example, increased its industrial rates by 60% since 1993, but actually lowered rates to commercial and residential customers by 4% and 12% respectively. The increasing burden upon industrial customers will place greater pressures upon industries to implement energy efficiency measures.

Regulatory Framework for Energy Efficiency

Central American countries, with the exception of Costa Rica, have historically lacked the strong, independent regulatory authority to require electric utilities to implement energy efficiency as regulators have done in other countries, including the U.S. Laws recently passed in El Salvador, Guatemala, and Panama are now establishing regulatory authorities that may be in a position to implement energy efficiency incentives or requirements.

138

EXHIBIT 9-6 OIL AND ELECTRICITY PRICES							
Country	Oil Prices (U.S. \$/Gallon)				Electricity Prices (U.S. ¢/kWh)		
	Gasoline (Regular)	Diesel	Kerosene	Distillate	Indust.	Resident.	Commerc.
Costa Rica	1.16	0.96	0.99	0.95	8.6	6.62	10.57
El Salvador	1.53	0.86	0.92	0.97	10.05	8.91	10.28
Guatemala	1.40	1.12	1.01	1.01	9.54	7.05	8.07
Honduras	1.25	0.97	0.74	0.99	9.09	5.32	8.99
Nicaragua	--	--	--	--	10.32	10.97	13.06
Panama	1.45	1.03	1.00	0.80	9.87	12.02	11.84
9.87 Average Central America	1.36	0.99	0.93	0.94	9.46	8.28	10.33
Average Latin America	1.46	1.01	0.91	0.94	8.0	8.1	11.0

Source: OLADE, 1996

Energy Efficiency Infrastructure

With a few exceptions such as SETSSA in El Salvador, an ESCO industry has yet to emerge in Central America. A few multinationals including Philips Lighting have done the audits to precede lighting retrofits. Other companies such as Energía Global have investigated opportunities but have experienced difficulties realizing ESCO agreements. Performance contracting, under which ESCOs are paid based upon the delivery of promised energy savings, is still a new concept in Central America.

Suggested Strategies

Companies should focus primarily upon energy-efficient equipment and simple fee-for-service opportunities in the short term, given the region's relatively weak regulatory framework for energy efficiency and lack of experience with ESCO services. Success in these markets may lead to more sophisticated performance contracting opportunities in the long term.

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U.S. Department of Commerce

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140

II. Other U.S. Government Contacts (continued)

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Office of Environmental Technology Exports
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U.S. Department of Commerce Country Desk Officers
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Costa Rica, Nicaragua: (202) 482-0704
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U.S. Trade and Development Agency
1621 North Kent St.
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1100 New York Ave., N.W.
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Tel: 202-336-8453
Fax: 202-408-9859

Export-Import Bank
811 Vermont Ave., NW
Washington, D.C. 20571
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III. Other Organizations

Alliance to Save Energy
1200 18th Street, N.W., Suite 900
Washington, D.C. 20036
Tel: (202) 857-0666
Fax: (202) 331-9588

American Chambers of Commerce
Costa Rica: (506) 220-2200
El Salvador: (503) 23-3292
Guatemala: (502) 337-4489
Honduras: (504) 237-043
Nicaragua: (505) 267-3099
Panama: (507) 269-3881

III. Other Organizations (continued)

Environmental Enterprises Assistance Fund
1901 N. Moore St.
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Arlington, VA 22209
Tel: 703-522-5928
Fax: 703-522-6450

Environmental Export Council (EEC)
1835 K Street, N.W. Suite 805
Washington, D.C. 20006
Tel: (202) 466-6933
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International Fund for Renewable Energy and Energy Efficiency (IFREE)
727 15th Street, NW 11th Floor
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REPSO Office (Guatemala)
Fundación Solar
15 Avenida 18-78, Zona 13
Guatemala City, Guatemala
Tel/Fax: (502) 332-2548

193

ENVIRONMENTAL PROJECT PIPELINE FOR CENTRAL AMERICA				
Country	Project Name	Executing Agency	Donor Agency	Chapter Reference
Belize	Belize City Infrastructure Improvement	WASA	WB	4
Costa Rica	Sanitation & Drinking Water for Intermediate Size Cities	AYA Avenida Central, Calle 5 Apartado 5.120, 1000 San Jose Tel: 506-2-332-155 Fax: 506-2-222-259	IDB	3, 4
	Second Water Supply and Sewerage Project	AYA Avenida Central, Calle 5 Apartado 5.120, 1000 San Jose Tel: 506-2-332-155 Fax: 506-2-222-259	IDB	3, 4
	National Parks Protection and Management Program	MINAE Avenida 8 y 10, Calle 25, Apartado 10104 San Jose, Costa Rica Tel: 506-334-533 Fax: 506-257-0697	IDB	7
	Tárcoles River Watershed Management	MINAE Avenida 8 y 10, Calle 25, Apartado 10104 San Jose, Costa Rica Tel: 506-334-533 Fax: 506-257-0697	IDB	4

ENVIRONMENTAL PROJECT PIPELINE FOR CENTRAL AMERICA				
Country	Project Name	Executing Agency	Donor Agency	Chapter Reference
El Salvador	Critical Areas of Decontamination	ISDEM 49 Avenida Sur #725 San Salvador, El Salvador Tel: 503-230-920 Fax: 503-23-6787	IDB	4, 5
	Water & Sewer Program	ANDA Calle Ruben Dario No. 930 San Salvador, El Salvador Tel: 503-224-469	IDB	4
Guatemala	Environmental Management System, Guatemala Metropolitan Area	Municipalidad de Guatemala Plan de Desarrollo Metropolitano 21 Calle 6-77, Zona 7, 4° piso Ciudad de Guatemala, Guatemala Tel: 502-2-515-797 Fax: 502-2-531-711	IDB	4
	Sustainable Development of Péten	Secretaria General de Planificacion Economica, Region VIII, Flores, Péten Tel: 502-926-0196 Fax: 502-926-997	IDB	7
Honduras	Sanitation Sector Reform	SANAA Frente a El Obelisco, 1 Avendia, 13 Calle Comayaguela, Honduras Tel: 504-379-200 Fax: 504-375-975	IDB	3, 4

146

ENVIRONMENTAL PROJECT PIPELINE FOR CENTRAL AMERICA				
Country	Project Name	Executing Agency	Donor Agency	Chapter Reference
Honduras (cont.)	Land Administration and Natural Resource Management	Ministry of Natural Resources Boulevard Miraflores S/N Apartado Postal 309 Tegucigalpa, Honduras Tel: 504-2-619-3132 Fax: 504-32-78-48	WB	7
	Sewerage Project for Puerto Cortes	Municipalidad de Puerto Cortes Puerto Cortes, Honduras	IDB	4
Nicaragua	Rehabilitation of Electrical Distribution Systems	Empresa Nicaraguense de Electricidad Managua, Nicaragua Tel: 505-2-67-2461 Fax: 505-2-67-4258	IDB	8
	Water & Sanitation	INAA Km. 5 1/2 Carretera Sur, Contiguo al Hospital Psiquiatrico Managua, Nicaragua Tel: 505-2-66-7869 Fax: 505-2-66-7872	WB	3, 4
	Lake Managua Environmental Improvement Program	INAA Km. 5 1/2 Carretera Sur, Contiguo al Hospital Psiquiatrico Managua, Nicaragua Tel: 505-2-66-7869 Fax: 505-2-66-7872	IDB	4

ENVIRONMENTAL PROJECT PIPELINE FOR CENTRAL AMERICA				
Country	Project Name	Executing Agency	Donor Agency	Chapter Reference
Panama	Potable Water Supply Optimization	IDAAN Suministro y Optimizacion de Agua Potable Apartado 5234, Zona 5 Panama City, Panama Tel: 507-642-348 Fax: 507-640-034	IDB	3
	Sanitation & Environmental Protection of Panama City	IDAAN Apartado 5234, Zona 5 Panama City, Panama Tel: 507-237-519	IDB	4, 5

144

Another organization that provides technical assistance for renewable energy projects is the Biomass Users Network (BUN) which fosters the sustainable use of natural resource bases for productive uses, including electricity generation. While BUN primarily focuses upon biomass projects, it also provides technical assistance for other renewable energy sources.

Inability to Pay for Renewable Energy

Central American countries' ability to pay for renewable energy plants is constrained both by current low levels of economic development and by weak power sector financial conditions. For example, the Honduran utility, ENEE, has a debt burden of \$656 million, or \$1,000 per kW for an asset base that is largely depreciated. Central American utilities continue to have financial problems despite tariff increases of 35% over the last three years. Utilities' financial problems may become more serious in the future as a consequence of cross-subsidization of electricity rates in countries such as Honduras. Recent electricity price increases in Honduras disproportionately affected industrial customers; rates for residential and commercial customers have actually declined. As a result, many industrial customers in Honduras have decided to self-generate their electricity. As these high paying customers leave power systems, utilities lose their best and most profitable revenue sources.

Power Sector Regulatory Frameworks in Transition

Every Central American country has embarked upon at least partial reform of its power sector in the last three to five years. Reform is improving the investment environment for new private power projects and could lead to privatization of some of the region's substantial renewable energy asset base. The most recent and comprehensive reforms have taken place in El Salvador, Guatemala, and Panama (see Exhibit 8-13). In these three countries, major power sector reform legislation was passed that should lead to new regulations in one to two years.

Power sector reform is a positive development. All countries except Nicaragua have concluded contracts with privately-financed power projects. Among these contracts have been three renewable energy projects in Costa Rica. Several countries are introducing independent regulators to create more open regulatory environments. There are, moreover, many direct incentives for renewable energy projects. In Costa Rica, for example, private power projects have been reserved for renewable energy.

There are, however, two negative aspects of ongoing reform. First, the reform process introduces a degree of uncertainty. Countries will need to develop actual experience in implementing resolutions, resolving contract disputes, and setting power tariffs under the new regulatory framework before this uncertainty is eliminated. Second, several Central American countries are considering power sector

EXHIBIT 8-13 PRIVATE POWER SECTOR REGULATION IN CENTRAL AMERICA			
Country	Current Situation		Pending Activities
	Regulatory Authority	Private Participation	
Belize	Ministry of Energy & Communications	Experience with private power/open access allowed	Integrated transmission grid to be created
Costa Rica	Servicio Nacional de Electricidad	Private power experience; 35% IPP participation in power sector allocated; must be renewable; subject to competitive bidding	General Electricity Law would permit private participation in all power sector activities
El Salvador	Superintendencia de Electricidad y Telecomunicaciones ⁹	Private power experience; competitive framework to be established for generators	Regulations to be implemented by May 1997
Honduras	National Commission for the Supervision of Public Services	Private power bidding allowed under Emergency Energy Article 245; two recent private power closings	Ongoing IDB-sponsored evaluation of power sector deregulation will determine future market
Guatemala	Comisión de Energía Eléctrica	Private power supplies 1/3 of all generation; > 409 MW through 2012 to be IPPs; 1996 law establishes basis for competitive wholesale price negotiation	Future actions to be determined
Nicaragua	Office of Utility Regulation	Utility purchases from self-generators and IPPs allowed	Ongoing reform led by National Commission of Energy to privatize/unbundle sector
Panama	El Ente Regulador de los Servicios Públicos	Private sector participation allowed; 45% ceiling raised; recent private projects	IRHE could be partially privatized

unbundling and competitive market structures that could cause prices to fall (this happened in Argentina following unbundling of its power sector). Lower prices would negatively affect the returns on investment for new power projects (both renewable and nonrenewable). Renewable energy projects face particular problems because their initial costs are relatively high. The prospect of lower future prices creates uncertainties about the ability to recover future costs.

⁹ Salvadoran and Guatemalan regulatory commissions recently established by 1996 reform laws.

APPENDIX A

CENTRAL AMERICAN BUSINESS CONTACTS

I. American Embassies and USAID Missions

Belize

U.S. Embassy, Belize
Corner Gabourel Lane and Hutson St.
Belize City, Belize
Tel: 501-2-77161
Fax: 501-2-35321

USAID / Belize
P.O. Box 817
Gabourel Lane at Queen St.
Belize City, Belize
Tel: 501-2-31066
Fax: 501-2-30215

Costa Rica

U.S. Embassy
APO AA 34020
San Jose, Costa Rica
Tel: (506) 20-39-39
Fax: (506) 220-2305

El Salvador

U.S. Embassy, El Salvador
Final Blvd. Station Antiguo Cuscatlan
Unit 3116 APO AA 34023
San Salvador
Tel: (503) 78-4444
Fax: (503) 78-6011

El Salvador (cont.)

USAID / El Salvador
Urbanizacion y Boulevard Santa Elena
Antiguo Cuscatlan
La Libertad
San Salvador, El Salvador
Tel: (503) 2-98-1666
Fax: (503) 2-98-0885

Guatemala

U.S. Embassy, Guatemala
7-01 Avenida de la Reforma, Zone 10
Unit 3306, APO AA 34024
Guatemala City, Guatemala
Tel: (502) 331-15-41
Fax: (502) 331-73-73

USAID / Guatemala
1 Calle 7-66, Zone 9
Guatemala City, Guatemala
Tel: (502) 332-0202
Fax: (502) 331-1151

Honduras

Commercial Officer
U.S. Embassy
Avenida La Paz
Tegucigalpa, M.D.C.
Tel: (504) 36-9320
Fax: (504) 38-2888

USAID / Honduras
Avenida La Paz
Frente Embajada Americana
Tegucigalpa, Honduras
Tel: (504) 36-9320
Fax: (504) 36-7776

150

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154

United States Agency for International Development
Bureau for Global Programs, Field Support, and Research
Center for Environment
Office of Energy, Environment, and Technology

The Center for Environment of the Bureau for Global Programs, Field Support, and Research houses the environmental programs of the U.S. Agency for International Development (USAID). One of five *Centers of Excellence* within the Agency, the Center for Environment provides field support to U.S. bilateral assistance efforts, manages global environmental program activities, oversees USAID's environmental research efforts, and is USAID's principal liaison on technical environmental issues to the rest of the U.S. Government, non-governmental organizations and universities, and other bilateral and multilateral donors.

The Office of Energy, Environment, and Technology is a part of the Center for Environment and helps developing countries and emerging economies find market-oriented solutions to their energy and environment problems. The Office helps set the energy policy direction for the Agency and responds to the short-term needs of USAID's field offices in assisted countries.

A lack of energy is seriously curtailing economic growth in developing countries and countries in transition. Expansion of energy supplies imposes a huge financial burden while increasing environmental threats in these countries. In addition, many countries lack the institutional capability and appropriate technology to operate and manage energy systems efficiently. These factors contribute to the role energy development plays as a leading contributor to global climate change and regional and local environmental problems.

To address these problems, the Office of Energy, Environment, and Technology leverages the financial resources of multilateral development banks, such as The World Bank and the InterAmerican Development Bank, the private sector, and other bilateral donors to increase energy efficiency and expand energy supplies, enhance the role of private power, and implement novel approaches through research and adaptation. These approaches include improving power sector investment planning ("integrated resources planning") and encouraging the application of cleaner technologies that use both conventional fossil fuels and renewable energy sources. The Office's promotion of greater private sector participation in the power sector and a wide-ranging training program also help to build the institutional infrastructure necessary to sustain cost-effective growth.

Further information regarding Center for Environment and Office of Energy, Environment, and Technology activities can be requested by contacting the Office of Energy, Environment, and Technology at the following address:

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185