ESMAP

Energy Sector Management Assistance Programme

12160-GU

Guatemala

Issues and Options in the Energy Sector

Report No. 12160-GU

JOINT UNDP / WORLD BANK
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

PURPOSE

The Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) was launched in 1983 to complement the Energy Assessment Programme, established three years earlier. ESMAP's original purpose was to implement key recommendations of the Energy Assessment reports and ensure that proposed investments in the energy sector represented the most efficient use of scarce domestic and external resources. In 1990, an international Commission addressed ESMAP's role for the 1990s and, noting the vital role of adequate and affordable energy in economic growth, concluded that the Programme should intensify its efforts to assist developing countries to manage their energy sectors more effectively. The Commission also recommended that ESMAP concentrate on making long-term efforts in a smaller number of countries. The Commission's report was endorsed at ESMAP's November 1990 Annual Meeting and prompted an extensive reorganization and reorientation of the Programme. Today, ESMAP is conducting Energy Assessments, performing preinvestment and prefeasibility work, and providing institutional and policy advice in selected developing countries. Through these efforts, ESMAP aims to assist governments, donors, and potential investors in identifying, funding, and implementing economically and environmentally sound energy strategies.

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Preface

Messrs. Salvador Rivera and Hernán Campero discussed the main conclusions of this report with the Minister of Energy and Mines and other government authorities in Guatemala on September 1-4, 1993.

In agreement with the Assessment Report, the government is moving to define clearer environmental regulation and preparing a new promotion exploration campaign along the lines defined in this report. In addition, the government is taking steps to liberalize the downstream petroleum market.

In the power subsector, the government agreed with the need to separate the regulatory and commercial functions, and to ensure a strong institutional framework to carry out the reforms; it further determined that the restructuring process should be initiated as soon as possible.

To benefit from experiences in other countries, the government considers that it would require technical assistance to carry out some of the recommendations addressed in this report. Following the discussion of this report, the government has asked the World Bank to discuss a program to carry out the reforms in the energy sector.

Currency Equivalents

Currency unit = Quetzal(Q)
Exchange Rate: Q 5.06 = 1US$ (September 1992)

Weights and Measures

bd	barrels per day
Btu	British thermal unit
Boe	Barrel of oil equivalent
Kcal	Kilocalories
kW	Kilowatt
kWh	kilowatt hour
GW	Giga Watt
GWh	Giga watt hour
tpy	Tons per year
Toe*	Tons of oil equivalent

* 1 Toe = 7.21 Boe

Abbreviations

CO	carbon monoxide
CO2	carbon dioxide
CONAMA	National Environmental Commission
db	decibels
DIGEBOS	Directorate General of Forestry Services
EEGSA	Guatemala City Power Utility S.A.
EIA	Environmental Impact Analysis
GDP	Gross Domestic Product
HC	hydrocarbons
INDE	National Institute of Electrification
LPG	Liquified Petroleum Gas
LRMC	Long Run Marginal Cost
m3	cubic meter
MEM	Ministry of Energy and Mines
mg	microgram
MW	megawatt
MWh	megawatt hour
NGO	Non Governmental Organization
NOx	nitrogen oxide
PAH	polycyclic aromatic hydrocarbons
Pb	lead
PCB	polychlorinated biphenyl
ppm	parts per million
SNI	National Interconnected System
SOx	sulfur oxide
SRMC	Short Run Marginal Cost

Acronyms

ASIES	Asociacion de Investigacion Estudios Sociales (Association for Social Research and Studies)
BID	International Development Bank (IDB)
CATIE	Centro Agronomico de Investigacion y Ensenanza (Agronomical Center for Investigation an d Education)
CECON	Centro de Estudios Conservationistas (Center for Conservation Studies)
CONAMA	Comision Nacional del Medio Ambiente (National Commission for the Environment)
CONAMCUEN	Comision Nacional para el Manejo de Cuencas (National Commission for Watershed Management)
CONAP	Consejo Nacional de Areas Protegidas (National Council for Protected Areas)
DIGEBOS	Direccion General de Bosques y Vida Silvestre (General Directorate for Forestry and Wildlife)
EEGSA	Empresa Eléctrica de Guatemala, Sociedad Anonima
EIA	Environmental Impact Assessment
ESMAP	Energy Sector Management Assistance Program
FAO	Food and Agriculture Organization
ICAITI	Instituto Centro Americano de Investigación y Tecnologia (Central American Institute for Investigation and Industrial Technology)
IDAEH	Instituto de Antropologia y Historia (Institute for Anthropology and History)
INAFOR	Instituto Nacional Forestal (National Forestry Institute)
INDE	Instituto Nacional de Electrificación (National Institute for Electrification)
INTA	Instituto Nacional de Transformacion Agraria (National Institute for Agarian Transformation)
MAGA	Ministerio de Agricultura, Ganaderia y Alimentación (Ministry of Agriculture, Livestock and Alimentation)
MEM	Ministerio de Energia y Minas (Ministry of Energy and Mines)
OEA	Organization of American States (OAS)
OECD	Organization for Economic Cooperation and Development
RE	Renewable energy
ROCAP	Regional Office for Central America and Panama
SIGAP	Sistema Guatemalteco de Areas Protegidas (Guatemalan System of Protected Areas)
TFAP	Tropical Forest Action Plan
URL	Universidad Rafael Landivar
USAC	Universidad de San Carlos de Guatemala
USAID	United States Agency for International Development

This report is based on the findings of an energy assessment mission which visited Guatemala in February 1992. The mission comprised S. Rivera (mission leader), F.H. Campero (Sr. Energy Planner), A. Meyer (Energy Economist), A. Roa (Power Engineer), C. Trujillo (Financial Economist), H. Bhat, and G. Zappala (Upstream Petroleum Consultants).

Executive Summary

1. The objectives of this report are twofold: first, to review developments in energy policy in Guatemala during the 1980s and early 1990s; and, second, to propose elements for consideration by the government in developing and implementing its energy strategy for the remainder of the decade.

A Sector in Transition

2. The period under review has two distinct phases. During the 1980s, the state played a dominant role both in regulating the energy sector and in operating sectoral enterprises. In the power sector, operational difficulties and high indebtedness became acute, especially in the case of INDE, one of the two national utilities. INDE was not even able to cover its debt service (and, at times, its fuel costs) out of its operating income because of the erosion of tariffs, which in 1991 were less than half of their 1980 level in real terms. Those indirect subsidies, as well as direct subsidies for residential electricity consumption and for some household fuels, were politically motivated to benefit the poorest segments of society. But the evidence shows that the bulk of subsidies reached less than 5 percent of energy consumers, that is, the households that use modern fuels. The majority of consumers, especially those in the lowest income levels, use fuelwood almost exclusively. Hence, they did not benefit from the subsidy policies.

3. Overall during the 1980s, the energy sector was a drain on the economy. Capital spending in the power sector and its financing with foreign and domestic loans contributed to the very large public sector deficits in the early 1980s and the high debt service payments in the late 1980s. The subsidization of the exchange rate for debt service payments of the power sector and fuel imports was another source of loss for the public sector.

4. Since 1991, however, the government has taken steps to moderate the state's role in providing public services, including energy services, and to open the sector to private participation. The government's attempts to restructure have been perhaps most radical in the heavily indebted power subsector, where a private generator has signed a 15-year power purchase agreement (PPA) with EEGSA, the second national utility, which is mainly responsible for distribution, on a 110 MW power plant; other, similar, contracts are under consideration. In the petroleum subsector, efforts are under way to attract further exploration in the Rubelsanto and frontier areas, and a draft law to liberalize the entire downstream chain, including imports, refining, distribution, transportation, and retail prices is under review.

5. To the government's credit, it has embarked on the reforms relatively quickly and in some respects dynamically. At the same time, however, the reform has lacked well-defined objectives and has not been accompanied by the creation of effective regulations and regulatory institutions that would ensure the transparency of rules for the sector, prevent interference by the government in the sector's day-to-day operations, and increase confidence for private participation. A key example of the incomplete status of the reform is that the government has yet to promulgate general regulations for electricity tariffs and to disentangle the regulatory and operational functions of INDE. Thus, the government still has to define the role of the state in

the sector and establish a process to decentralize, corporatize, or privatize current state-owned assets.

6. The lack of clear goals and rules for the restructuring process may hinder the government's efforts to attract private participation. Whereas the government has sought to encourage private investment in both power generation and petroleum operations, the draft law to liberalize the downstream petroleum market limits private foreign investment in distribution of petroleum products. Moreover, policies in the petroleum sector have yet to resolve contradictions between efforts to promote greater exploration and limits on activity mandated by current environmental laws and regulations. Clearly a key element of the restructuring strategy must be strengthening the institutional capacity so that Guatemala can implement the anticipated reforms consistently.

Need for Institutional and Pricing Reforms

7. The manifold contradictions still evident in the energy sector indicate the continuing need to coordinate strategy at the macroeconomic and sectorwide levels. They also indicate the importance of creating regulations and institutions appropriate to the sector that will ensure the solidity of structural changes already initiated.

8. The absence of an adequate independent regulatory capacity in the sector could lead to a recurrence of past experiences. In the 1980s, lumpy and high-risk projects ultimately led to negative macroeconomic effects in the presence of weak institutional and regulatory capacity at the sectoral level. This was further exacerbated by the politization of the tariff-setting process. In the past, the Ministry of Energy and Mines (MEM) lacked the mandate, capacity, or structure to perform the regulatory role. Future restructuring will need to be based on strengthening MEM, transferring to it sectoral planning and coordination functions, and creating an independent agency in charge of regulatory activities.

9. In the second half of the 1980s, the petroleum and power subsectors shared a common denominator: the excessive politization of their respective pricing policies. These policies had effects on utility revenues and hence on government transfers; consumers' choice of fuel uses; investment decisions, or lack of them, by petroleum suppliers; and revenues of the central government. For example, in the power subsector, retail tariffs started to fall below their long-run marginal cost levels after 1984, resulting in a cumulative subsidy of consumers of almost US$300 million by 1991. Further, bulk tariff subsidies, embodied in INDE's sales to EEGSA (the power distribution company), amounted to about US$350 million in the 1985-91 period. In total, this is more than five times INDE's debt arrears of US$114 million.

10. Even though electricity rates were increased in 1991 by about 47 percent, and, starting in January 1993, tariffs have been adjusted automatically in response to fuel cost variations, tariffs are on average still 20 percent below their long-run marginal cost levels. As of July 1993, an interministerial group has been analyzing a new adjustment mechanism to align tariffs with marginal and financial costs and avoid their inflationary erosion. Still, the recurrent issue is the lack of pricing principles embodied in an electricity law and supervised by an independent regulatory body. As long as this issue is not addressed, power purchase agreements formulated at the subsector level will not be part of a more coherent and sustainable strategy for the sector.

11. As a matter of general principle, electricity tariffs should be set so that the average tariff provides sufficient revenue to (a) cover operating costs (fuel, purchased power, staff, operations and maintenance), (b) repay capital costs (depreciation and a reasonable rate of return both based on revalued assets plus increases in working capital as required), (c) service debt (interest plus amortization) and (d) finance a portion of the construction program.

12. In the case of Guatemala, however, this principle cannot yet be applied as the power sector needs to be restructured as part of the measures needed to restore the power sector to a healthy condition and attract private sector participation. It is therefore proposed, first, to reduce INDE's investment program by inviting private sector financing in all new generation plants and, second, to restructure INDE's debt by transferring a portion to the government along with associated fixed assets in order to create a new generation company, which later could be privatized. Under these circumstances, aligning electricity rates with marginal cost for bulk and retail sales and establishing an automatic mechanism to prevent tariff levels from being eroded by inflation might be enough to cover financial requirements.

13. Financial requirements to be reflected in the tariff will also depend in part on the extent of private participation in the ownership and operation of the power sector. Indicative financial projections (Annex 8) have been made according to alternative scenarios; however, further analysis based on firmer indications of the interest of the private sector are needed before definitive projections and tariff recommendations can be made.

14. In the petroleum sector, product pricing in the past encompassed a mixture of taxes and subsidies, which led to retail prices that bore no relation to the economic costs of products. Whereas under the government pricing system the prices of commercial fuels declined in real terms, the prices of fuelwood increased in real terms during the past decade, making fuelwood the most expensive fuel for cooking purposes. Fuelwood prices, in contrast to fuel and electricity prices, are determined by market forces and are hence subject to local variations in supply and cost conditions.

Issues in the Energy Subsectors

Power

15. **Nature of the Problems.** In the absence of clear objectives and the institutional capacity to ensure an economic and reliable energy supply, the power sector lacks the minimal level of accountability to shareholders that would exist under a business operation bearing commercial risks, whether private or state owned. This situation has occurred because the sector was structured to rely on government contributions as the donor of last resort. Consequently, starting in 1988, the sector became unable to even cover interest payments on its debt service, leading to government transfers of about US$240 million in the 1988-93 period, on top of about US$593 million in contributions to investment between 1980 and 1984. The financial situation of the consolidated power sector is dominated by INDE; EEGSA has been able to finance its investment program (distribution only) with internal funds. In the vacuum created by the lack of a clear mandate and structure, the state's regulatory and corporate functions in the sector became mixed.

16. Despite recent efforts to encourage private producers, INDE remains both a provider of power and the main regulator of the sector, leaving the door open for a recurrence of past problems. The new 1992 law to regulate INDE's activities, which amends the original law creating INDE, has not corrected this situation.

17. **Electricity Law a Precondition to Restructuring.** Remedying the problems in the power subsector will require a more specific definition of the structure of the entity or entities to be responsible for generation, transmission, and distribution. This would be embodied in a formal electricity law that does not yet exist. The definition of a set of consistent principles for an electricity law should be based on an analysis of the financial, operational, and administrative implications of alternative structural options. The law should provide for (a) creation of an interministerial unit in charge of defining energy policy and provide indicative sectoral planning; (b) creation of an independent regulatory body responsible for pricing, concessioning, and other regulatory issues; (c) a specific program to decentralize and corporatize INDE; and (d) a specific program to float EEGSA's shares to the private sector.

18. In addition, reform should include a strategy for implementation of a nonpolitical electricity price setting procedure and for the development of a transparent and well-organized program to encourage private participation.

19. **Investment and Financing Requirements.** Future additions in generating plant, regardless of the source of financing, will be based on a mix of conventional thermal, geothermal, and hydro plant to meet load growth and replace worn out equipment. In addition to the requirements for generation must be added the cost of investments in transmission and distribution. The government will need to consider the implications of future investment needs on the structure of the sector and the manner in which it can be financed.

Hydrocarbons

20. **Needed Reforms.** The weaknesses of this subsector are predominantly institutional and regulatory. The first priority is to organize the MEM so that it can effectively monitor the activities of the oil companies currently operating in the country and attract others. Second, a new law has to be enacted for downstream activities to liberalize the market and prevent monopolistic structures.

21. **Upstream Priorities.** Only some minor changes are required, since basically the existing law is attractive for private foreign oil companies. Principal activities should comprise (a) preparing and implementing effective and unambiguous environmental regulations for petroleum exploration and production; (b) modifying the current fiscal regime by setting a flat royalty (rather than the current sliding-scale system) and allocating a percentage of production as profit oil from the beginning of production; (c) preparing and implementing regulation to use the Basic-owned pipeline on a common-carrier basis; and (d) strengthening MEM so that it can launch and carry through new promotion campaigns aimed at increasing private investment in secondary recovery and exploration.

22. **Downstream Priorities.** Deregulation of the downstream sector should be accompanied by strengthening the capacity of MEM to monitor the resulting more open market. In addition to clarifying the terms under which foreign capital may participate, key activities

should focus on (a) opening the import market for crude as well as products to competition; (b) removing entry barriers for investment in storage, transport, and distribution; (c) permitting companies to be active in all subsectoral activities (i.e., importation, supply, distribution); (d) liberalizing the pricing regime by eliminating all price controls (Decree 31-79) and abolishing the cost-plus system for the refinery, allowing it to operate as a free-market enterprise, as well as the guaranteed margins for the oil companies in the supply and distribution chain; (e) designing a system of petroleum product taxes and import duties (with equal rates for crude and petroleum products) to generate revenue for the government in a less distortive way than the previously used compensation funds; and (f) shifting the functions at the MEM from price fixing and quota allocations to controlling quality and supervising the companies to ensure that they behave competitively.

23. The main report details the process and steps required at a minimum to liberalize the market and gives some insights into the experiences of other countries in similar situations. Overall, the lessons learned in other countries indicate the need to prepare a minimal set of conditions to open the petroleum markets, both during the transition phase as well as during the fine tuning required for full implementation. Overall, it requires a strong government entity to ensure that the market operates within established standards of safety, product quality, and the environment and that those departing from the agreed conditions will be penalized.

24. The behavior of petroleum product prices in a liberalized system cannot be predicted with certainty. Experience in other countries shows, however, that after an initial hike, the average fuel price level does not experience a permanent increase. It depends on the new tax rates, the former level of distortions, and the competitive parameters chosen by the suppliers. With the tax rates proposed in this report (and assuming that supplies will be procured at lower average prices than under the old structure), prices for all products except LPG should not experience a permanent increase in real terms over the present level, which is in line with fuel price levels in most other Latin American countries.

Fuelwood

25. **Supply-Side Issues.** Even though about 60 percent of Guatemala's total energy consumption comes from fuelwood, this does not represent the main cause of deforestation. Rather, agricultural expansion is the main culprit. Although in general the fuelwood supply is not yet a major problem, shortages do occur locally around the main demand centers. Measures to mitigate the problem include, as a first step, completion of a forest inventory. In order to increase supplies small decentralized mixed-use tree plantations should be established, preferably with close involvement of individual communities.

26. **Demand-Side Issues.** Government strategies to reduce fuelwood consumption consisted of the promotion of improved woodstoves and of modern fuels, especially through the subsidization of LPG and electricity. Neither policy was successful. The key problem of the woodstove programs was apparently in their dissemination. However, further analysis is needed to assess the causes of failure. The experiences of countries with successful programs such as Mali, Rwanda, and China, should be helpful in designing new woodstove as well as kerosene stove programs, in which the government should seek to play a more significant and targeted role.

27. Energy price subsidies have benefited only a very small part of the population because the bulk of households consume fuelwood at market prices. Low commercial fuel prices are usually not enough to make households switch away from fuelwood. Related capital goods such as stoves are often unaffordable for poor households.

28. **Institutions**. Problems of fuelwood supply are part of a broader institutional quandary in which lack of trained human resources in the forestry sector is a key. Hence, to effect the required changes on the supply side (i.e., streamlining of entry controls, extraction of rents, and abolition of current land-clearing incentives), the government needs to define clearer objectives for the forestry sector, provide the personnel and financial resources to implement those objectives, and structure the sector accordingly. These goals obviously extend beyond the energy sector and the effects of fuelwood consumption and will require attention at the macroeconomic level.

Environment

29. Guatemala's energy-related atmospheric emissions do not pose a serious threat to the environment, either at the national or regional level. The most serious risks are (a) deforestation, at least partly caused by fuelwood consumption; (b) pollution caused by petroleum exploration (test drilling); (c) risks of spills from maritime transport of crude oil; and (d) environmental problems associated with operations at the Laguna power plant and future hydropower projects. The lack of definition in the current legal and institutional setup does represent a key obstacle to the formulation and implementation of an environmentally sound energy policy for the future. The restructuring must proceed within sound and clear environmental rules, monitored by an effective institution adequately empowered to enforce clear and consistent regulations.

Structure of this Report

30. The report consists of five chapters. Chapter 1 shows the interrelationships between energy policies and the economy as a whole. Chapter 2 presents the main issues in the power subsector. Chapter 3 deals with the upstream and downstream aspects of the petroleum subsector. Chapter 4 focuses on fuelwood supply and household energy demand and links the recurrence of local fuelwood shortages to the effects of the relative energy prices that households face. Chapter 5 assesses the environmental impact of energy-related operations.

Guatemala: Energy Sector Issues and Options

Summary Matrix: Policy Recommendations

SECTOR	POLICY ISSUE	STRATEGY RECOMMENDATION	STATUS/ COMMENTS
POWER SECTOR	RESTRUCTURING	Restructuring of INDE; divestiture of EEGSA	
		Open generation to competition; Increase private sector investment in generation, minimize investment by INDE	First PPA has been signed between EEGSA and private generator
		Prioritize transmission plans and reevaluate distribution plans	
		Improve demand forecasting	
	TARIFF POLICY	Revise tariff structure to reflect long-run marginal cost; establish automatic adjustment mechanism	
		Replace cost-plus pricing between IPPs and INDE to provide performance incentives	
		Remove subsidy element from bulk tariffs for INDE sales to EEGSA	
	OPERATIONS	Reduce losses in transmission and distribution	USAID assistance
	REGULATION	Prepare Electricity Law	Regulatory framework is being developed under consulting services financed by USAID
		Set up independent regulatory agency	
PETROLEUM			
- UPSTREAM	Provide incentives for more exploration and production	- prepare reservoir study and enhanced recovery study - prepare improved promotion package for exploration - Modify fiscal aspects of PSCs	
	Regulations	- Give Basic pipeline common carrier status - Harmonize environmental objectives and petroleum exploration and production	
- DOWNSTREAM	Liberalization	liberalize importation of crude and products, refining, distribution and product retail prices on a competitive basis	Draft law under review
		Establish standards regarding quality of products, safety and environmental requirements	
	Refining	Abolish cost-plus arrangement	
	Pricing and taxation of petroleum products	Remove government determination of retail prices	

SECTOR	POLICY ISSUE	STRATEGY RECOMMENDATION	STATUS/ COMMENTS
		Replace compensation funds by specific taxes on petroleum products	"Fondo compensatorio" was replaced by taxes
	Regulation	Prepare legislation to allow free entry to and exit from the industry, especially for construction of bulk storage terminals and gas stations	
		Set up independent agency to enforce competition	
FUELWOOD	Improve supply conditions	- prepare forest inventory - provide more finances and personnel to forestry sector	
		restructure stumpage fees to capture rent and provide incentives for more sustainable logging	
	Household fuel demand	Analyze failure of improved stove programs and design and implement new programs	
		Provide incentives to switch from fuelwood to kerosene (see fuel pricing)	
ENVIRONMENT		prepare safety standards for oil transport	
	Incompatibility of environmental objectives and energy issues	redefine responsibilities of MEM and CONAMA in order to remove incompatibilities	
INSTITUTIONS		Strengthen MEM to help perform their new role in structural planning, coordination and supervisory functions	

1

Energy and the Economy

A. Recent Economic Developments

1.1 This section surveys the economy and energy sector in Guatemala, links between economic performance and energy policy decisions, and lessons from the past.

1.2 During the 1980s, the energy sector, on balance, was a drain on the economy; the public sector deficit and government transfers to the power utility (INDE) were directly correlated. Avoiding a recurrence of this situation will require changes in the structure of energy policy in Guatemala, with the government taking on a specific and subsidiary role. Hence, the government will need to focus on establishing regulation to encourage competition in areas where is economically sound, particularly in downstream petroleum operations; on strengthening or restructuring government institutions to ensure a sustainable reform; and on promoting greater mobilization of resources from the private sector.

1.3 With 9.2 million inhabitants, Guatemala is the most populous of the five Central American countries. The GNP per capita, US$980 (1992), is distributed very unevenly. Agriculture employs more than half the population, but, like income, land ownership is distributed very unevenly. A majority of the population, most of them Indians in rural areas, lives in extreme poverty and lack access to basic services.

1.4 In the 1960s and 1970s, the economy recorded steady growth, averaging about 6 percent per year. During the 1980-85 period, deteriorating external economic conditions and inappropriate domestic macroeconomic policies led to unsustainable fiscal and current account deficits, and GDP declined on average by about 1.4 percent per year.

1.5 In 1986, after 30 years of military rule, a democratically elected government came to power and initiated a stabilization program to reduce the fiscal deficit and inflation. The government also embarked on a program of trade liberalization. Although these programs met with some initial success, the public sector deficit continued to soar, mainly because of a failure of the tax reform program in 1987. Deficit financing by the Central Bank and sharp devaluation of the exchange rate fueled inflation, especially in 1990. This, in turn, contributed to negative

real interest rates, pressure on the exchange rate, and capital flight, compounded by erratic exchange rate management. The lack of fiscal revenue and foreign exchange led to a rapid accumulation of external arrears in 1990, including to the World Bank, IDB, and IMF.

1.6 In January 1991, the new government initiated a new stabilization program. As a result of tight monetary and credit policy, inflation decreased from more than 60 percent between January and December 1990 to 9.5 percent in the same period of 1991. The exchange rate stabilized at around Q 5 per U.S. dollar, and foreign exchange reserves increased. The nonfinancial public sector deficit was reduced from 3.2 percent in 1989 to 0.9 percent in 1991. A broad-based structural adjustment program now is aimed at (a) comprehensive fiscal reform; (b) improved public sector performance through restructuring public sector enterprises, privatizing them, or both; (c) reform of import tariffs and elimination of nontariff barriers; (d) financial sector reform; and (e) alleviation of poverty.

1.7 The major proposed reforms affecting the energy sector are elimination of virtually all exemptions of the value-added tax (VAT); reform of import tariffs; modifications in the taxation of petroleum products; reduction of subsidies and fiscal transfers to, and restructuring of, the national electricity company, INDE.

1.8 The proposed economic and institutional reforms are expected to stabilize inflation, the public sector deficit, and the current account deficit (about US$250 million) and to contribute to increased investment, savings, and economic growth (expected to be between 3 and 5 percent in 1992-2000). The risks involved stem from the opposition of interest groups negatively affected by the adjustment program, the administration's and public sector's poor record with respect to tax collection and institutional capacity.

1.9 The proposed macroeconomic policies are critical for a positive reordering of the energy sector. In particular, fiscal discipline and the setting of conditions to further develop the financial markets is a necessary condition to allow the state to withdraw from activities that are capital intensive and could be developed by a more competitive private sector. The sections below give an overview of the energy sector, its impact on macroeconomic performance, and lessons learned from past energy policies.

B. Overview of the Energy Sector

1.10 Energy demand per capita of 3.3 barrels of oil equivalent (boe) is still relatively low in Guatemala (compared with about 4.4 boe in Costa Rica and 7.6 boe in Mexico). This low demand is caused by three factors: only about 40 percent of the population has access to electricity; automobile transportation is on a low level; and the relatively small industrial sector is not energy intensive and does not contribute much to energy demand. Noncommercial energy, mostly fuelwood, still plays a major role in Guatemala, with a share of about 60 percent of total energy supply. Table 1.1 summarizes the structure of primary energy production.

1.11 Guatemala imports most of its crude and petroleum products. Total primary energy requirements amount to about 34.2 million boe; of this, local production—mainly wood—accounts for 91 percent.

Table 1.1 Guatemala: Primary Energy Production, 1990
('000 boe)

Measure	*Hydro*	*Domestic crude*	*Imported crude*	*Fuel-wood*	*Bagasse*	*Residues*	*TOTAL*
Production	1,322	1,420	0	19,583	8,850	18	31,203
Imports	0	0	3,892	0	0	0	3,892
Exports	0	1,085	0	0	0	0	1,085
Inventory change	0	21	0	0	0	0	243
TOTAL	**1,332**	**356**	**4,113**	**19,583**	**8,850**	**18**	**34,253**

Source: MME, 1990 statistics.

Present Energy Demand

1.12 Final energy consumption of 31.65 million boe is concentrated heavily in the household sector, with 65 percent. Transportation and industry followed with 18 and 11 percent, respectively. Because of concentration of energy demand in the household sector, which uses energy mainly for cooking, fuelwood is the main fuel, with 60 percent of total consumption. Among the commercial fuels, petroleum products make up 28 percent, followed by electricity, with 5 percent (see Table 1.2)

Table 1.2 Guatemala: Energy Consumption, 1980-1990
('000 boe)

Year	*Elec.*	*LPG*	*Kerosene turbo*	*Gasoline regular*	*Gasoline super*	*Diesel*	*Fuel-oil*	*Fuelwood*	*Bagasse*	*Charcoal*	*TOTAL*
1980	1016	357	695	1106	853	3609	3543	17690	688	116	29676
1982	808	401	671	855	812	3003	1942	18708	852	121	28178
1984	838	517	673	1092	716	3004	1788	19795	736	126	29290
1986	928	667	549	1124	610	2773	962	17994	773	136	26519
1988	1077	767	520	1319	804	3523	1194	19058	807	141	9214
1990	1429	827	517	2365*		3865	1361	19281	1858	146	31649

*Includes both regular and super.
Source: MEM.

1.13 Table 1.3 provides growth rates for some important energy and nonenergy variables. Population outgrew real GDP by far in the 1980s, resulting in a decrease in GDP per capita. Also, total energy consumption showed a modest increase. A decrease in the demand for petroleum products was more than offset by a strong growth of electricity demand, made possible by a doubling of installed capacity. The massive capital outlays for the rapid expansion in the power sector probably came at the expense of other investment. On the other hand, further expansion of installed capacity in the power sector is to be expected, given that the annual consumption of electricity per capita in Guatemala is only half of the average consumption in developing countries of 500 kWh.

Table 1.3 Guatemala: Annual Average Growth Rates of Selected Variables, 1980-90
(percentages)

		Energy demand			
Population	*GDP, real*	*Total*	*Fuels*	*Electricity*	*Electricity (installed capacity)*
2.6	0.8	0.4	-4.3	3.1	6.9

Source: World Bank calculations based on data from INDE, MEM, and World Bank.

Future Energy Demand

1.14 Expected energy demand was projected based on intensity values obtained from a small survey of 20 sectors in the economy conducted for this report and a macroeconomic model used by the Ministry of Energy and Mines (MEM). The underlying assumptions of the forecast were as follows (results are shown in Table 1.4):

a. That economic growth will average 3 percent per year.

b. That industries with the highest energy intensities (sugar, paper, chemicals, refining, minerals, cement, electricity, and transportation) will become less energy-intense because of pricing policies and structural changes.

c. That some of the less energy-intensive sectors (agriculture, other industries, and commerce) will increase their consumption.

d. That the remaining sectors will maintain the same energy intensity as calculated in the input/output table, derived from energy consumption patterns based on the 1985 energy demand survey.

Table 1.4 Guatemala: Energy Demand Forecast, 1995 and 2000
('000 toe)

Source	*Agriculture*	*Industry*	*Commerce*	*Services*	*Households*	*TOTAL*
			1995			
Electricity	1.5	33.4	43.8	11.5	138.5	228.7
Diesel/gasoline	37.1	69.5	803.9	54.4	134.3	1099.2
Other fuels	0.4	211.7	311.7	1.5	54.9	580.2
Biomass	0.3	335.7	0.0	0.0	3099.7	3435.8
TOTAL	39.3	650.3	1159.4	67.4	3427.4	5343.9
			2000			
Electricity	1.9	36.7	51.2	13.7	207.2	310.6
Diesel/gasoline	44.2	76.4	783.4	64.3	150.2	1118.6
Other fuels	0.5	225.8	308.3	1.8	61.3	597.6
Biomass	0.4	349.7	0.0	0.0	3550.2	3900.4
TOTAL	47.0	688.6	1142.9	79.8	3968.9	5927.0

Source: Mission estimates.

Energy Policy and Regulation

1.15 In the past, the government lacked an explicit set of sectoral policies and objectives and an institutional structure to support those objectives. It appears as though past energy actions have been made either by default because of prevailing macroeconomic policies or short-term political realities or by reaction to a crisis.

1.16 **Institutional Framework.** Currently, Guatemala's energy sector is administered by the Ministry of Energy and Mines (MEM), which is in charge of formulating energy policy, promoting development of domestic energy resources, and regulating and coordinating the sector's activities. The MEM has five major directorates: the Mining Directorate; the Fossil Fuels Directorate; the Nuclear Energy Directorate; the New and Renewable Sources Directorate; and the Technical Services Directorate. Energy policy and planning activities are assigned to the Energy Planning Department, which is part of the New and Renewable Sources Directorate.

1.17 Policymaking for the electric power sector is shared between MEM, which has no specific division in charge of the electricity subsector, and the public utility, INDE. Responsibility for expansion, new construction, and tariffs lies primarily with INDE. Administrative and basic operational responsibility for the electric power subsector are assigned to the Instituto Nacional de Electrificación (INDE) and the Empresa Eléctrica de Guatemala S.A.

(EEGSA). INDE was created in 1959 as a state-owned institution in charge of promoting and developing electrification nationwide and responsible for power generation and transmission as well as supply of bulk electricity and retail distribution in most of the country. EEGSA, which is primarily involved in distribution . .he Guatemala City area, was originally privately owned; the government purchased 92 percent of its shares in 1973 and transferred them to INDE in 1983.

1.18 Despite their apparently close association, INDE and EEGSA function as separate units and rarely share strategies or even information. In addition, the MEM has lost some of its well-trained staff because of low salaries. Consequently, the institutional structure lacks the characteristics required to define a long-term energy policy and its implementation in a rapidly changing macroeconomic environment. This is evident by the absence of the MEM in the design of the restructuring of the power subsector or in leading the restructuring of downstream petroleum operations. In both cases, INDE and the Ministry of Finance have been the driving forces.

1.19 **Regulatory Framework.** At the subsectoral level, INDE plays the role of regulator and enterprise. In the absence of an electricity law, INDE's laws do not require any specific tariff regulation such as rate of return or marginal cost pricing. Overall, electricity tariffs are under the control of INDE's board of directors, which in turn operates under the orders of the executive power.

1.20 Whereas Guatemala's electricity subsector is dominated by government-owned companies, the petroleum sector is largely privatized. Within that context, however, importation of both crude and products as well as the market for products are heavily regulated. The only refinery is operated on a cost-plus basis. Its operating costs are well above international cost levels, but sales of its products are guaranteed through the pricing system. The government sets the retail prices, which overall are above international market prices. The difference is captured by the government as revenue, although, what once was a source of revenue, the compensation fund, has become in 1993 a pricing subsidy channel. Only in the fuelwood subsector does a free market prevail.

1.21 The MEM is also in charge of supervising and managing all aspects of upstream petroleum operations in Guatemala. The National Petroleum Commission, which is chaired by the Minister of Energy and Mines and representatives from the ministries of Defense, Finance, and Economy, the Attorney General, and the Central Bank, acts as an advisory body for the MEM. At the technical level, the General Directorate of Hydrocarbons within the MEM monitors compliance with laws, regulations, and contractual stipulations relative to petroleum operations.

C. The Energy Sector and the Economy

1.22 The energy sector and the economy interact in many areas: public finance, investment, the price level, the balance of payments, and foreign and domestic debt. In Guatemala, as in many developing countries, the energy sector has a particularly strong influence

on macroeconomic performance; public utilities play an important role, and the energy sector is heavily regulated.

1.23 Many of the country's macroeconomic problems were compounded by the Chixoy hydroelectric power project. Chixoy was planned to provide additional hydro generating capacity of 300 MW by 1982, reducing thermal generation and the country's dependence on imported fuel, and increasing total installed capacity by about two-thirds. Production actually began only in late 1985 because of construction and commissioning delays, which also led to cost overruns of 123 percent (from US$414 million to US$924 million). The total cost of the project thus reached 10 percent of the 1984 GDP (Q 9,970 million). The project was financed by loans from the World Bank (US$116 million), IDB (US$175 million), other external sources (US$123 million), and local sources (US$510 million). Most of the additional financing requirements were met by government contributions. As a consequence, government and INDE participation in the financing of the project increased from a forecasted level of 32 percent to 55 percent. The initial benefits of the project were lower than expected because of lower sales growth, reduced fuel savings stemming from lower-than-expected international oil prices, and the cost overrun.

1.24 Before Chixoy, the government built the 90 MW Aguacapa hydropower project, commissioned in October 1981. The project experienced delays and an 83 percent cost overrun, apparently caused by construction problems and inadequate preparation.

1.25 Between 1978 and 1982, cost overruns of investment projects, adverse market developments (i.e., less-than-expected sales growth because of reduced economic activity) and high fuel costs led the power sector to require additional funding. Government contributions supplied most of the funding; the rest came from additional borrowing. Between 1983 and 1987, the performance of the sector improved slightly, with a slow recovery in sales growth and reduced fuel costs. In 1988, however, the recovery stalled, as the unification of the exchange rate almost doubled the debt service burden in local currency. Some of these developments are shown in Table 1.5, which provides highlights of the results of the consolidated operations of the power sector between 1978 and 1991.

Table 1.5 Guatemala: Summary of Consolidated Financial Operations in the Power Sector, 1978-1991
(Million Quetzales)

Item	*1978-82*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*
Fuel expenses	362	45	57	59	3	21	25	20	39	190
Debt service	86	35	35	33	64	86	153	167	161	294
Balance to finance	888	193	55	89	70	19	99	NA	NA	NA
Government contrib.	513	131	40	17	28	5	70	96	29	255

Source: World Bank, *Project Completion Report, Chixoy, 1978-88* (1991), chapter 2.

1.26 The financing problem, especially of INDE, was exacerbated by the fact that although average electricity tariffs increased 140 percent between 1980 and 1991, in real terms they decreased 110 percent (see Table 1.8)

1.27 **Public Finances**. The energy sector is both a source of fiscal revenues, which originate principally from the oil subsector, and a destination of resources, either in the form of subsidies to energy imports of oil products or in the form of investments in energy enterprises, principally in the power subsector. The share of revenue from the energy sector reached more than 16 percent in 1991, up from only 4 percent in 1990.

1.28 Although a detailed breakdown of revenue according to source is not available for every year, the most important components of the central government's revenue from the energy sector are royalties paid by oil companies, sales taxes on petroleum products, and the compensation fund, which was created as a buffer to absorb the effects of price fluctuations in the international petroleum market and has, in practice, been used as a revenue collection mechanism. During the first semester of 1993, however, it became a subsidy vehicle. Income taxes paid by companies in the petroleum subsector are of only minor importance. For example, in 1990 the four companies active in downstream operations paid Q 11.5 million, less than 0.5 percent of total direct taxes. Table 1.6 shows that royalty revenue has declined with declining crude production and prices since 1984. Revenues from the compensation fund have been very volatile, high in years of low international oil prices and low in years of high prices. In 1991 it went up from a low of Q 10.8 million in 1990 to a high of almost 500 million. This was due mainly to the average 180 percent increase in retail prices between November 1989 and December 1990.

1.29 The main recipient of central government funds in the energy sector has been the power subsector, especially INDE. Government contributions as well as loans helped finance INDE's investment programs. In the early 1980s, during the completion of Chixoy, the central government contributed as much as 8 to 15 percent of its overall expenditures to INDE. This contribution peaked at Q 212 million in 1981. In the last few years, the government has again added considerable sums, this time to help INDE finance its debt service. Between 1980 and 1991, total government contributions to INDE reached Q 1 billion. Other public sector expenditures, which were recorded as losses of the Central Bank, were used to subsidize INDE's debt service (between 1984 and 1988) and petroleum imports (between 1984 and mid-1991) by giving these companies access to a more favorable exchange rate. In the case of petroleum imports, losses were particularly heavy, Q 133 million, in 1990, when the exchange rate lost 40 percent of its value and international oil prices increased in the wake of the Middle East crisis.

Table 1.6 Central Government Revenue from and Expenditures on the Energy Sector, 1980-1991
(Million Quetzales)

Category	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*
Total revenue	748	742.4	731	704	690	866.6	1466.8	1857.8	2299	2433.7	2795.8	4310.2
Total energy revenue	27.1	53.2	65.9	94.2	58.1	83.7	144.3	74.7	90.8	94.2	131.3	694.5
Income taxes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.5	NA
Sales tax	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	99.8	194
Royalties	13.6	26.6	30.7	40.7	26.6	12.7	4.8	6.6	5.8	7.6	9.2	9
Compensation fund	13.5	26.6	35.2	53.5	31.5	71	139.5	68.1	85	86.6	10.8	491.5*
% of total revenue	3.62	7.17	9.02	13.38	8.42	9.66	9.84	4.02	3.95	3.87	4.70	16.11
Total expenditure	1116	1380	1141.5	1034	1041.7	1068.3	1704.8	2093.6	2669.9	3130.6	3503	4380
Contribution to INDE	119.6	212.96	92.82	119.19	51.58	16.92	28.056	4.6	40.72	96.1	29.5	255.1
% of total	10.72	15.43	8.13	11.53	4.95	1.58	1.65	0.22	1.53	3.07	0.84	5.82
Overall deficit	-368.9	-638.6	-411	-331.2	-351.6	-202.6	-298.1	-433.8	-587.8	-891.8	-983	NA
GDP	7878.6	8607.6	8716.6	9050	9470.3	11180	15838.1	17711.1	20545.1	23625.6	34036.8	NA
Deficit in % of GDP	4.68	7.42	4.72	3.66	3.71	1.81	1.88	2.45	2.86	3.77	2.89	NA

Sources: Ministry of Finance; Mission estimates.
* Q475.7 million 1992 and zero revenues in the first semester of 1993.

1.30 The size of deficits of the public sector and the amount of capital spending in the energy sector were directly correlated. In the early 1980s, the central government contributed large amounts to investment in projects of public enterprises, especially INDE. Indeed, the transfers to INDE, as a percentage of transfers to public enterprises, reached 96 percent in 1983 before decreasing to 8.6 percent in 1990. This was one of the reasons for the very large public sector deficits in the early 1980s. Deficits peaked in 1981, at 7.4 percent of GDP, coinciding with the peak in transfers from the central government to INDE.

1.31 **Investment.** In Guatemala, total investment (in real terms) increased at an average rate of 7.6 percent annually to reach a 15.7 percent share of GDP in the early 1980s. The main contributor was public investment, with average annual growth rates of 13.8 percent in the 1970s and 11 percent 1980-82. In the latter period it seems to have crowded out private investment, which decreased on average 15.2 percent annually. Investment in the power sector, mainly Chixoy, accounted for almost half of public investment between 1980 and 1985. The growth in public investment was reversed starting 1983-85, when the government drastically cut investment 28 percent annually to reduce the fiscal deficit. Although public investment again

picked up in the late 1980s, the power sector played a much reduced role, with a share of only about 20 percent of public investment.

1.32 Whereas investment in the power sector is all public, investment in the hydrocarbon sector is overwhelmingly private. Companies spent Q 250 million for exploration and development in the upstream subsector between 1980 and 1984 and Q 370 million between 1985 and 1991. This compares with investment of about Q 770 million in the power sector over the latter period. Investment in the downstream petroleum sector has been minimal, although the companies are planning upgrades to their facilities as well as expansion once the market is liberalized.

Table 1.7 Guatemala: Investment, 1980-1991
(Million Quetzales)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total investment	1251	1466	1233	1003	1096	1286	1637	2464	2815	3192	4158	5963
Public	468	675	536	356	278	239	303	472	590	727	892	1455
Private	827	768	773	595	634	986	1290	1716	2157	2497	3217	4508
% of GDP	15.88	17.03	14.15	11.08	11.57	11.50	10.34	13.91	13.70	13.51	12.22	17.01
Power subsector	206	261	247	172	134	114	108	67	112	131	243	594
INDE	178	64	217	91	94	61	-3	8	62	33.9	34.4	195
Hydrocarbons	NA	NA	NA	NA	NA	19.07	86.33	92.61	52.52	70.24	48.74	86.92
Upstream	NA	NA	NA	NA	NA	19.07	86.33	92.61	52.52	70.24	48.74	86.92
Downstream	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Energy Invest.	206	261	247	172	134	133.07	194.33	159.61	164.52	201.24	291.74	680.92
% of Total I	16.47	17.80	20.03	17.15	12.23	10.35	11.87	6.48	5.84	6.30	7.02	11.42

Sources: Ministry of Finance; Mission estimates.

1.33 **Inflation.** Because prices of energy products are regulated in Guatemala, they generally do not move in tandem with costs or increase with inflation. Instead, price increases are mandated when politically opportune or inevitable. Between 1980 and 1991, the general price level increased 411 percent (average of 14.6 percent annually). Over the same period, average tariffs for final consumers increased 142 percent (7.7 percent annually), so that 1991 tariffs are less than half their 1980 level in real terms. The erosion in tariffs was particularly severe after 1984. Even with the 1990 and 1991 rate increases, tariffs did not keep pace with inflation.

1.34 Between 1980 and 1991, international oil prices declined more than 50 percent in U.S. dollars. But devaluations of the exchange rate led to oil-price increases of 165 percent in current Quetzales, and decreases of 48 percent in real terms. Over the same period, total consumption of petroleum products declined 9 percent. Total expenditures increased 450 percent in current Quetzales and increased 8 percent in real terms. The government decreed particularly large price increases in January 1986, November 1989, and September and December 1990. This seems to have had some effect on the consumer price level. In 1989/90, fuel prices increased

between 100 and 200 percent, leading to a rise in fuel expenditures of 41 percent in 1990 and 110 percent in 1991. Inflation reached record levels of 39 percent in 1990 and 35 percent in 1991. Thus, energy price increases appear to have affected the domestic price level.

1.35 **Balance of Payments**. The following factors originating in the energy sector affect the performance of the balance of payments: fuel imports; debt service payments and profit remittances (for outflows) and equity and debt capital (for inflows). The components of imported capital goods for energy sector projects cannot be quantified, but clearly the Chixoy project contributed to the high share of capital goods in total merchandise imports of about 23 percent in the early 1980s. In the mid-1980s, their share dropped to about 15 percent. Expenditures for crude oil and petroleum product imports have changed over the last decade with international oil prices as well as with the change in the input structure of electricity generation. Thus, imports of fuels fell from 10.8 million bbl in 1980 to a low of 7.4 million bbl in 1986 and then increased again to 10 million bbl in 1991.

1.36 The same developments can be observed in monetary terms (CIF values): Fuel imports came down from a record US$376 million (1981) to US$94 million (1986), following the decline in international oil prices. Exchange rate devaluations since then, along with the 1990 rise in international oil prices, increased the fuel import bill again to US$304 million in 1991. As a percentage of total merchandise imports (CIF), fuels have not reached their share of about 22 percent again, as they did in the first half of the 1980s. In the second half of the decade the share of fuels declined to 7 percent and only with the increase in oil prices and imports of products did it increase again to 17 percent in 1990. The export of crude oil is of minor importance. At its peak in 1983, it contributed about 6 percent (US$62 million) to total export revenues. Since then, its share has decreased to 2 percent.

Table 1.8 Guatemala: Balance of Payments
(Million US$)

Item	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*
Exports, goods (FOB)	1520	1291	1170	1092	1132	1060	1044	978	1073	1126	1212	1254
Imports, goods (FOB)	1472	1540	1284	1056	1182	1077	876	1333	1413	1484	1428	1602
Imports, goods (CIF)	1598	1674	1388	1135	1279	1175	959	1447	1557	1601	1649	NA
Fuels (CIF)	340	376	301	255	300	262	94	105	111	119	277	304
% of imports	21.3	22.5	21.7	22.5	23.5	22.3	9.8	7.3	7.1	7.4	16.8	NA
Interest payments	60	63	77	89	95	116	154	179	122	103	142	138
Current account	-176	-573	-399	-224	-378	-276	-42	-564	-523	-479	-342	-255

Sources: Ministry of Finance; Mission estimates.

1.37 The external debt service payments of the energy sector became a burden for the economy in the second half of the 1980s, when INDE's debt service payments increased. In the early 1980s, the power sector's share in total external debt service increased to 20 percent, then decreased to around 12 percent, and increased again to 21 percent in 1989. With the exception of the beginning of the decade, INDE is responsible for more than 90 percent of the power sector debt service. The impact of INDE's indebtedness becomes even more obvious in its rising share in total interest payments (i.e., on external *and* domestic debt), which increased from only 3 percent in 1980 to 22 percent in 1989 (in terms of Quetzales). Moreover, because about 90 percent of INDE's total debt is with foreign creditors (compared with 60 to 70 percent of the public sector debt), INDE's share in interest payments is even higher.

1.38 The unsustainability of debt service payments is shown clearly by the increasing share of external debt service payments in total exports of goods and nonfactor services from 6 percent in 1980 to 28 percent in 1987-88. This, and a growing trade deficit, led to an increasing deficit in the current account of more than 6 percent of GDP during 1987-89. Because sufficient external funds could not be mobilized, foreign reserves were depleted, and Guatemala incurred debt service arrears, which reached more than US$600 million by the end of 1990. INDE's debts accounted for about 10 percent (US$55 million) of these arrears.

1.39 **Foreign Debt.** Guatemala's external debt began to increase in the late 1970s and early 1980s, when the government pursued overly expansionary fiscal policies, which it supported largely with external credits. Between 1978 and 1985, the debt stock tripled to US$2.6 billion, reaching more than 30 percent of GDP. Since then it has remained relatively constant. The share of public debt increased from about 60 percent in 1980 to 80 percent of total foreign debt currently. Several large infrastructure projects were part of the problem. By the end of 1991, INDE accounted for 98 percent of the energy sector foreign debt and for 24 percent of the total foreign public debt.

Table 1.9 Guatemala: External Debt and Debt Service, 1980-1991
(US$ millions)

Item	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total external debt	932	1264	1537	1796	2340	2614	2753	2813	2577	2648	NA	NA
INDE in %	20.06	17.88	18.02	16.48	11.50	11.94	6.66	4.81	11.39	9.40	NA	NA
M+LT public debt	548	806	1144	1383	1945	2133	2258	2313	2081	2089	2164	2277
Total debt service	101	121	141	171	220	282	305	313	348	273	350	NA
INDE in %	8.91	10.74	15.60	18.71	12.73	10.28	10.32	10.35	16.23	20.68	9.74	NA

Sources: Central Bank, Mission estimates.

D. Lessons of the Past

1.40 The energy sector in Guatemala has been characterized by full ownership and control of public utilities and stiff regulation in the hydrocarbon sector. The results have not been satisfactory. The system has resulted in an electric power service that is both inefficient and a burden to public finances, in an upstream petroleum sector that attracts little investment, and in an overly expensive procurement process for petroleum products. At the same time, the majority of Guatemalan energy consumers still rely on fuelwood, which is expensive and subject to dwindling supply. The deficiencies of the sector are not caused by government involvement alone, but the government's poor administration of the sector has certainly exacerbated the problem.

1.41 In the power sector, problems originated with an investment project that was too complex for the institutional capacity of the public utility. The failure to raise tariffs to cover the utility's financial costs deprived the utility of sufficient funds for debt service payments and for future investment.

1.42 The government's practices of covering INDE's debt service and financing new investments cannot continue, in view of the government's difficulties in balancing public accounts. The private sector must continue to be involved, especially in providing new generation. This requires new policies and regulations for the power sector, as well as an adequate institutional structure. Again, coordination with macroeconomic policy is vital. In countries such as Guatemala, where financial markets and savings are limited, state participation—indirect or direct—may be needed in investments pertinent to the sector.

1.43 In many countries, the private sector is driven away from petroleum exploration and development by excessive government participation in the revenues from oil production. This is hardly the case in Guatemala, however; rather, the problems are that an ever-changing set of rules and regulations and administrative gridlock frustrate potential investors. As elaborated in chapter 5, this is particularly apparent in the environmental regulations for upstream operations, where clear regulations and definition and coordination of functions among the different government entities are lacking.

1.44 Companies active in the downstream petroleum sector and some consumer groups have long benefited from the disarray of the subsector. The government guarantees the operator of the only refinery the sale of all its products and a fixed profit regardless of performance. Concomitantly, the distribution companies are assured a safe margin via cost-plus regulation. The pricing system raises prices of imported products to the level of domestically produced fuels and provides subsidies for some products at the expense of others. As a result, the prices of fuels do not reflect their economic costs, leading to uneconomic uses. Perhaps not surprisingly, at a time of economic trouble, 1989-90, the government revised the pricing system to provide urgently needed revenue, abolishing all subsidies and raising all prices. However, price manipulation by the government has caused the compensation fund to shift from a revenue instrument, yielding Q 475 million in 1992, to a subsidy tool by the beginning of 1993.

1.45 Even where the government is interfering only minimally, as in the fuelwood sector, it is doing so inadequately. In order to reduce consumption of fuelwood, the government provided incentives to use more efficient woodstoves or switch to other fuels. But, in Guatemala, contrary to the experience of other countries, the program did not work (see chapter 4).

1.46 The general pattern is that the public sector has taken on too many tasks and has been unprepared to perform them well. Liberalization of markets, decentralization, and partial privatization should achieve better results in many areas by distributing the tasks of the sector's administration and development more widely. This does not mean that government has no role. On the contrary, markets work well only when complemented by sound rules, regulations, and institutions to enforce them. The government thus has an urgent role to play in establishing supervisory or regulatory agencies in the power and petroleum subsectors.

1.47 As for the future, the energy sector could become a contributor to economic growth, in contrast to its past drain on the economy. For such a reversal to occur, certain developments, though perhaps not sufficient, are necessary: (a) a more efficient mobilization of resources, both from the supply (investment) and demand (price/tariff) side, and greater private sector participation in investments; (b) a regulatory framework comprising laws and subsidiary legislation that clearly define adequate and economically sound pricing mechanisms, lift barriers to entry and exit, and establish predicable judiciary avenues to solve disputes; (c) a clear definition of environmental regulation and institutional responsibilities; and (d) an explicit and efficient taxation system that, in the medium term, ensures a certain level of revenue neutrality.

1.48 As an indication of the impact that some of these structural adjustments could have, the Table 1.11 shows the effects on government revenues that could result from greater private sector participation in future investment in the power subsector, successful development of the XAN petroleum field in the Petén region, and clearer definition of environmental regulations. The taxation reform for petroleum products, treated in more detail in chapter 3, is assumed to be revenue-neutral for the government.

Table 1.11 Guatemala: Projected Government Revenue Impact of Structural Adjustments in Two Energy Subsectors, 1994-2000
(US$ million)

Subsector	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
Hydrocarbons, upstream							
Base case	29.6	31.3	30.3	29.06	27.38	27.5	26.1
Oil price 25% up	44.9	46.8	44.9	42.7	39.9	39.7	37.5
Oil price 25% down	24.65	25.8	25.0	23.8	22.4	22.5	21.3
Power							
Financial projections with:							
- INDE in charge of expansion plan	-45	-790	-179	-426	-600	-626	-828
- Private sector in charge of expansion plan	36	129	141	198	199	217	267

Sources: INDE; Mission estimates. Annexes 8 and 11 were used as basis for simulation.

2

The Power Sector

The 1980s and Prospects for the Future

2.1 In the 1980s, four factors shaped the Guatemalan power sector: (a) installed capacity, and associated investment, in the interconnected system rose from about 300 MW to 800 MW, an increase of 166 percent; (b) GDP declined on average by about 1.4 percent per year during the first half of the 1980s, and electricity demand declined correspondingly; (c) devaluation of the Quetzal in 1985 without corresponding tariff adjustments led to tariff levels in 1989 equivalent to 60 percent of those in 1980; and (d) consequently, to close the financial gap, government transfers to the sector were increased to about US$852 million to cover investment in 1980-84, and corresponding debt service in 1988-92.

2.2 The unsustainable situation described above, and the 1991 power shortages, forced the government to reassess the role of the state in the power sector and to envisage a greater role for private generation. One of the government-owned companies, EEGSA, signed a 15-year contract with a private investor for a 110 MW thermal plant. In addition, negotiations are under way for additional 50 MW in Pto. Barrios and an additional 100 MW steam-oil fired plant, as well as cogeneration in sugar cane plants. Still, the state has a role to play in improving transmission and distribution facilities, in the regional interconnection, and in establishing the regulatory framework to ensure a sustainable reform.

2.3 In hindsight, the problems of the power sector were more than merely a failure to adjust tariffs or to contain large cost overruns. The present analysis points out that these problems were derived more fundamentally from structural problems, including the lack of government policies and objectives to ensure an economic and reliable energy supply, as well as the institutional structure to carry them out; the policy vacuum, which led to the practice of mixing the state's regulatory and operational functions in the power sector; and, under those conditions, the lack of accountability by INDE to its shareholders, in contrast to what would exist under a business operation bearing commercial risks. At present, despite recent efforts to open bidding for new generation to the private sector through Independent Power Producers (IPP), the old policies are still being pursued, leaving the door open to recurrences of past errors. Hence, the fundamental problem of lack of efficiency in the sector has not yet been tackled.

2.4 After providing some background on the organization of the sector, this chapter focuses on four areas: institutional and regulatory issues; how the sector's structure affected the operation of the power system; tariff policies; and the financial performance of the sector.

Organization of the Sector

2.5 Instituto Nacional de Electrificación (INDE) and Empresa Eléctrica de Guatemala (EEGSA) are the main institutions of the Guatemalan power sector. INDE accounts for about 95 percent of generation; EEGSA functions as a distribution company serving the Guatemala City area and its surroundings. The distribution market in Guatemala is heavily concentrated in Guatemala City and its surroundings, accounting for about 75 percent of retail sales.

2.6 INDE was established in 1959 as a state-owned enterprise responsible for the supply of electricity throughout Guatemala, except for the Central Zone. EEGSA was originally formed by private investors before INDE came into being. Although EEGSA operates as an investor-owned utility under the commercial code, INDE actually owns about 92 percent of EEGSA's outstanding stock. Hence, in practice, the government's responsibility as shareholder has not been clearly distinguished from its other duties and functions, such as regulation. Overall data on generation and sales by both entities are shown in Table 2.1.

Table 2.1 Generation and Sales of Electricity, Guatemala, 1989-93

Measure	*1989*	*1990*	*1991[a]*	*1992[b]*	*1993[b]*
Gross generation (GWh)	2196.10	2336.01	2463.33	2705.00	3048.44
Total sales (GWh)	1860.25	1969.37	2106.02	2365.44	2666.66
INDE retail sales	439.50	476.39	507.56	645.00	713.60
EEGSA retail sales	1420.76	1510.98	1598.44	1720.44	1953.06
Losses (GWh)	335.85	366.64	357.31	339.56	381.78
Losses (%)	15.37	16.50	14.51	12.55	12.52

[a]Preliminary figures.
[b]Estimates at 31/12/91 in 1993 include 40 MW of private generation.

2.7 Administratively, INDE reports to a board of directors and the MEM. In practice, and particularly for major policy decisions, INDE is instructed by the president of the Republic. Investment plans and budget execution are coordinated with the Planning and Finance Ministries.

2.8 Regarding market size, which is important in terms of economies of scale and restructuring options, the system has about 600,000 customers. EEGSA serves about 60 percent of these, accounting for nearly 75 percent of retail sales. Levels of average consumption per

customer of the two utilities are highly uneven; in the residential sector, for example, average consumption in the EEGSA system is 1,590 kWh/year, whereas for INDE's clients it is only 450 kWh/year (see Annex 1).

A. Structure of Mixed Regulatory and Operational Functions

Regulatory Framework

2.9 No specific electricity law governs the power sector, but the law creating INDE is, in effect, the main legal tool of regulation in the sector. Article 56A of INDE's law specifies that INDE, as the regulatory body of the power sector, will be in charge of developing all aspects related to tariff formulation and supervision of its application. This legislation does not specify any particular principle for setting tariffs (e.g., rate of return, marginal cost).

2.10 Despite the virtual legal monopoly that INDE has to regulate and operate the sector, the new administration in INDE has voiced a desire to allow a more competitive public/private sector market to emerge. Although INDE is solely responsible for the supply of electricity throughout Guatemala, its management is steadily relinquishing that responsibility by carefully exploiting loopholes in the existing laws. A recent example of this move away from past practices is the power purchase agreement signed last year between EEGSA and a foreign independent power producer to supply it with 100 MW of thermal power generation. Cogeneration contracts signed earlier with sugar mills and other industrial power producers led the way to this dramatic break with the past.

2.11 What INDE's administration has achieved, without changing existing legislation, is essentially to relieve INDE of the responsibility to provide electric power generation throughout the country on an exclusive basis (EEGSA's ad hoc purchase power agreements are private sector transactions outside the restrictive public sector procurement procedures).

2.12 Within the overall legal system, the constitution of the Republic (articles 129 and 130) establishes the conditions for a decentralized power sector with the participation of the state and municipal governments to formulate plans, as well as private sector participation. The constitution also formalizes and the state's role as a defender of a market economy, prohibiting monopolies.

Institutional and Regulatory Issues

2.13 The main institutional and regulatory issues in Guatemala's power sector are, first, the lack of a regulatory framework separating regulatory and public service utility functions, and second, the lack of a regulatory institution with responsibility for developing and coordinating regulation, policies, and norms. The entry of private power generators has alleviated the short-term investment requirements, but it has not addressed the fundamental operational, financial, and economic efficiency issues (described in more detail later in the chapter). For example, maintenance practices have been poor, financial transfers from the central government to the

sector were the norm rather than the exception during the last decade, and tariff levels and structure have reflected neither their economic cost of supply nor their financial cost.

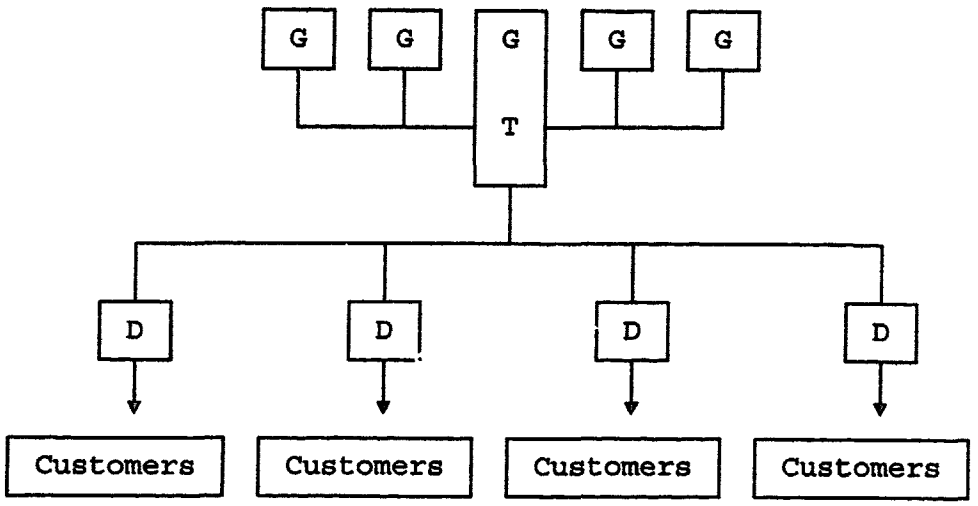
Strategy for Reform

2.14 Although it is desirable to separate quickly the regulatory and entrepreneurial roles the government plays, one also must recognize the potential political pitfalls of attempting to amend the existing INDE legal framework in the current, opposition-dominated national assembly; premature action could reverse the few gains INDE has achieved. Nonetheless, the government has embarked on a process for reform and should continue it by clearly elaborating the reform's objectives, strategy for implementation, and required institutional/regulatory framework. Objectives should be defined at both the "macro" and subsectoral levels.

2.15 **Macro-level Objectives.** Power sector policies should be coordinated with macroeconomic priorities, given that efficient resource allocation in the wider economy depends on achieving efficient and secure supplies of energy and that a reduction in the government's public sector deficit can be facilitated by reforming the established culture of government transfers to the power sector. Moreover, the strategy should encompass the sector as a whole, so that it includes efficient pricing on both energy production and use. Finally, the policies must be developed within the context of the constitutional mandate to avoid unnecessary monopolies and increase private sector participation.

2.16 **Subsectoral Objectives.** Policies for the power subsector should establish clear efficiency and quality objectives, such as providing minimum-cost service, subject to reliability constraints. This may mean that the regulatory body will need to provide planning functions that are more indicative than it has done previously. In addition, regulatory objectives must be clearly enunciated, such as the conditions under which the public and private generators will participate in the sector; the rules by which the transmission system may be shared by various generators; and the conditions for concession of distribution systems to municipalities or the private sector. For the government to develop clear subsectoral objectives, it will not only have to separate its regulatory and policy roles from its operational functions but will also have to establish basic principles for pricing, scope of regulation, quality of service, and environmental protection.

2.17 Strategies to establish an organizational and regulatory structure to tackle the above objectives can be developed in several ways. It appears, from the actions it has taken so far, that the government has decided to develop the institutional structure shown in Figure 2.1.



G = Generation companies or independent power producers.
GT = Generation and transmission company (possibly a trimmed-down INDE).
D = Distribution company.

Figure 2.1 Intended Structure of Guatemalan Power Sector

2.18 If adequately followed by required legislation and institutional reform, this structure would have three main characteristics compatible with the above-mentioned objectives. It would allow for a decentralization of INDE that may lead INDE toward becoming only a transmission company; for participation of the private sector in generation and some movement toward a more competitive market, with open access to transmission; and, in particular, for a system of invoices among generating companies according to their economic cost of supply and financial costs, thus enabling a hard budget discipline.

2.19 As the new institutional structure unfolds, the government will have to be aware that a number of its operating practices will change, depending on the extent of competition. These include the number and type of generating and distributing enterprises; regulatory arrangements; merit order dispatch arrangements; and rules for access to transmission facilities, ownership, and financial arrangements. For example, as power stations become more aware of the real costs of generation, they may be less willing to submit to central outage or merit order dispatch planning without adequate commercial incentives or a proper regulatory structure; power exchanges with neighboring countries are likely to change, as well. Still, the new institutional structure must accommodate these changes and continue to deliver least cost dispatch while maintaining security of supply.

2.20 **Scope for Competition.** Arguments could be made for introducing, up front, more competition in generation (after all, generation accounts for around 70 percent of total cost)

and a separation of transmission and distribution. Although these are legitimate issues to be taken into account in the drafting of the electricity law and subsidiary laws, there is no evidence that conditions exist for a genuinely competitive system in generation; on the contrary, in a small system such as Guatemala's, the atomization of new generation may lead to losses of significant economies of scale in generation and transmission.[1] To achieve economic efficiency objectives, the power plants must be of sufficient size to capture economies of scale and be financially viable without state intervention.

2.21 As a transition step, and because the bulk of total cost savings are in generation, competition between generating enterprises should be permitted to arise through bidding to provide additional or replacement generating capacity whenever this is required (kW or kWh), as now being practiced by INDE.

2.22 Another way to induce competition in generation is through a power pool supplied by different generators (practiced, e.g. in Chile and U.K.). However, the small size of Guatemala's system may preclude the achievement of one of the conditions for competition—the presence of many firms with none dominant. The introduction of supply competition, under which suppliers (generating and distributing companies) compete to sell the electricity to final consumers, requires an extremely complex legal and regulatory framework and sophisticated metering system.

2.23 Overall, given the small size of Guatemala's power market, competition in generation should continue on the basis of open and transparent tendering of bulk power. To hedge against the risk of having the prospective generator fail to meet its contractual obligations, the purchase agreements should include a provision for temporary imports by the contractor, if required, from the regional interconnected system. In any case, given the evidence of the last decade, future construction of generation by INDE should be minimized, and the relation with EEGSA should be established on a commercial basis. Further, because EEGSA already operates under the commercial code, its shares could be floated to the private sector.

2.24 **Creating an Enabling Environment for Restructuring.** To ensure coordination in the system and avoid conflict of interests, the reforms should aim first at separating, at least in accounting terms, the transmission and generation operations in INDE. In a more general sense, the government should be attuned to the three minimal measures necessary for carrying out an effective restructuring process. The first is introducing discipline through competition, performance contracts, and/or hard budget practices. Such activities are within the domain of the energy sector. The second is lifting the barriers to mobilization of resources (labor and capital). Third would be increasing the pool of resources—particularly managerial, institutional, information flow, and financial. The last two of these measures are integral parts of the structural adjustment of the economy.

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1. However, existing generation capacity should be transformed gradually into commercial companies operating under the commercial code.

2.25 **Areas of Regulation.** Overall, four main areas of regulation will require an independent and autonomous regulatory body: (a) environmental regulation; (b) economic regulation; (c) technical regulation; and (d) customer-service-related regulation. Environmental regulation should be done jointly with the National Environmental Commission (CONAMA). It should address several issues, including requirements for environmental impact assessments of proposed projects; monitoring of plans and programs; formulation of standards and codes; issuing of licenses to discharge effluents; and definition of emission standards.

2.26 Economic regulation deals with definition of tariff-setting mechanism and profits in those segments under rate of return regulation. Technical regulation includes standards on quality of supply, operational standards, and procedures for merit order dispatch. Finally, to encourage the growth of a more demand- and service-oriented industry, customer-service regulation should introduce rules for handling customers' complaints.

Lessons of the Past

2.27 The weak institutional performance of INDE and the inadequate regulation, management, and organization of the sector have been recurrent issues in Guatemala's power sector since the mid-1970s. Essential components of a stronger institutional structure in the power sector are clarification of the relationship between the operational and regulatory functions in the sector; establishment of an effective legal-regulatory framework; and creation of a regulatory organization with adequate staffing and powers. Although the government appears to have committed itself to the first component—separation of regulation and operation—it has yet to elaborate an explicit strategy for implementing the latter two. Indeed, the fact that INDE itself has been the driving force behind current changes has effectively perpetuated the mixing of regulatory and operational roles. Hence, the potential for repeating past mistakes appears to remain significant.

2.28 In this context, specific steps should include the preparation of an electricity law as a vehicle to separate regulation and operation, basic principles for electricity pricing throughout the chain, access to transmission, operation of the system, and jurisdiction for disputes. Finally, a program should be initiated to float EEGSA's shares to the private sector.

B. System Operations

2.29 This section looks at several aspects of the operation of the system, including generation/transmission and maintenance practices and electricity demand (for more comprehensive data on Guatemala's power sector, see Annex 2).

Generation and Transmission

2.30 **Infrastructure.** In Guatemala—as in the rest of Latin America in the late 1970s and early 1980s—hydroelectric power plants came first in the least-cost expansion plans, influenced by assumptions on high oil prices and high electricity demand growth rates. In addition, difficult geological characteristics have been a leitmotif in the construction of Guatemala's hydro plants.

2.31 Two main hydropower plants formed the backbone for generation expansion during the early 1980s: the 100 MW Aguacapa hydropower plant (1981) and the 250 MW Chixoy hydropower project (1985). In the Aguacapa plant, after 11 months of operation, the power house was flooded. A recent PCR and project performance audit report prepared by OED concludes that after an overrun of 83 percent with respect to appraisal estimates, the project suffered from inadequate preparation and defective designs.

2.32 The Chixoy project was also affected by construction problems, caused in part by insufficient geological analysis during the feasibility study phase. The severity of these omissions was confirmed by a major failure in the tunnel just three months into operations. Conditions are still not stable, and risk of future collapses is high. These difficulties, together with probable underestimates at the appraisal stage, led to large cost overruns (final cost was almost US$1 billion).

2.33 **Maintenance Practices.** INDE's maintenance practices are deficient. Budgetary constraints, restrictive procurement practices, and inadequate training and supervision of maintenance personnel cause unsatisfactory preventive and programmed maintenance. Timely procurement of spare parts is particularly difficult under the overly restrictive public sector procurement practices that INDE must follow as a state-owned enterprise. Similarly, governmental directives on personnel policies prevent INDE from establishing adequate career development programs for maintenance personnel. Requests for specialized technical assistance have been postponed repeatedly, presumably for lack of funds.

2.34 As a result of these procurement problems and other difficulties, INDE's preventive maintenance on thermal power plants was greatly neglected. INDE therefore relied heavily on hydro generation, but when the 1991 drought struck, INDE's thermal plants were ill-prepared to make up the shortfall in generating capacity. A crash maintenance program is being carried out with the support of several international financing institutions, mostly under bilateral aid arrangements. USAID, for example, is providing technical assistance to help INDE identify all opportunities to improve the efficiency of existing thermal and hydro power stations.

2.35 At EEGSA, well-defined maintenance procedures and practices introduced by the original owners are still being followed. EEGSA is ruled by the Commercial Code, and consequently it is more efficient than INDE in procuring spare parts and maintenance materials and equipment. For the same reason, EEGSA has attracted and retained good maintenance personnel through adequate compensation and promotion policies.

2.36 **Condition of Existing Power System.** Emergency measures were adopted to alleviate the shortage. By June 1992 almost all thermal plants had been repaired, increasing the capacity by about 88 MW (60 MW INDE and 28 MW EEGSA). A new 50 MW gas turbine (STIG) was commissioned in 1992, and a 110 MW firm energy supply contract was signed between EEGSA and an independent power producer. A drainage gallery is being built in the Chixoy plant to reduce the external water pressure around the tunnel and to decrease the risk that the tunnel will collapse when it is emptied for maintenance work.

Transmission and Distribution

2.37 EEGSA's sales in 1990 were 1,510,980 MWh. Total net generation and purchase power were 1,732,165 MWh. Total transmission and distribution and unaccounted for losses were 221,185 MWh, or 12.8 percent. EEGSA is aware that this loss figure is too high for a distribution company (it should be no more than 6 percent), and the company is making efforts to reduce losses through improvements in transmission and distribution networks and elimination of theft.

2.38 INDE's losses are worse than EEGSA's. In 1990, INDE's transmission and distribution and unaccounted losses were about 16.5 percent. USAID is assisting INDE in identifying opportunities to improve transmission and distribution networks, to be implemented with further USAID assistance.

Perspectives for the Future

2.39 Overall, capacity/power requirements to year 2003 are 614 MW, with an associated investment of about US$1 billion in generation alone. This is beyond the financial and institutional capacity of the sector. The future expansion of the power system in Guatemala will be influenced by internal and external factors. With regard to the former, new generation is being sought out by EEGSA with private producers.

2.40 **Regional Interconnection.** The main external factor to affect future generation will be the extent of interconnection with all five Central American countries and Panama. In the short term, energy exchanges within the region are marginal. At present, an interconnection at 230 kV links Guatemala and El Salvador; another 230 kV line links Honduras, Nicaragua, Costa Rica, and Panama. Some additional 150 km of 230 kV transmission will complete the regional interconnected system from Guatemala to Panama, a first step toward establishing a formal Central American power pool that will exploit possible economic interchanges, share reserves, and develop low-cost power supply based on large generation projects aimed at a regional electricity market.

2.41 **System Improvements.** The current institutional and regulatory structure is not adequate to permit major expansion investments or to maintain the system adequately. This justifies a more decentralized system with greater private sector participation. Under that

assumption, INDE's generation expansion plan includes the participation of the private sector and only minor public financing in generation before the year 2000. INDE's efforts would be addressed at improving the precarious condition of the transmission and distribution systems, an area that at this stage of reform is less attractive to private sector.

2.42 **Demand Assumptions and Projected Responses.** Annual electricity demand has increased 6.6 percent in the last years (1989-91), and INDE expects this tendency to continue in the next years. As the economy in Guatemala is improving, this assumption is acceptable for use in planning the expansion of generating capacity. Annex 3 presents more detailed characteristics of future thermal and hydro power plants as well as energy balances.

2.43 INDE is using consultant services to prepare the engineering studies of candidate projects and to assist its own planning staff in the preparation of an "indicative least cost expansion plan for generation" (ILCEPG). Because the World Bank mission concluded that INDE's proposed expansion plan did not provide a reliable supply of energy in dry periods or during forced outages, the plan was complemented by incorporating 100 MW steam power plants by 1997 and 1998. The adjusted expansion plan is shown in Table 2.2.

2.44 The energy balance for the 1993-96 period shows that the system reserve is small and that any demand increase over the forecasted demand could jeopardize the system energy supply. This situation should be carefully examined by INDE in the next years. In addition, monthly detailed output of simulated load dispatching (shown in Annex 3) was used to calculate the short-term marginal cost of the system.

Table 2.2 Adjusted Expansion Requirements for the Guatemalan Power System, 1995-2003

Year	*Commissioning*	*To be Retired*
1995	Zunil I (Geothermal-15 MW)	
1996	Vapor III (Steam-100MW)	Esquintla Gas 1 & 2 Laguna Vapor 1 & 2 Laguna Gas 1 Diesel San Felipe Diesel Puerto Barrios
1997	Río Bobos (Hydro) Vapor IV (Steam-100 MW)	
1998	Santa María II (Hydro-68 MW)	Santa María I Esquintla Gas 3 & 4 Laguna Vapor 3 & 4 Laguna Gas 2 & 3
1999	El Palmar (Hydro-55 MW)	
2000	Geotérmica II (Geothermal 55 MW)	
2001	Serchil (Hydro-80 MW)	Esquintla Gas 5
2002	Vapor VI (Steam-100 MW)	Esquintla Vapor I
2003	Vapor VII (Steam-100 MW)	

Source: Mission estimates.

Note: Annex 4 provides energy balances and more detailed information on generation and transmission requirements.

Transmission and Distribution Expansion

2.45 **Transmission.** Annex 4 gives a detailed review of transmission projects. The existing 230 kV and 138 kV transmission system has the following purposes:

a. Interconnecting the Chixoy hydropower plant with the load center in Guatemala
b. Interconnecting other load centers toward the west (Mazatenango, Quetzaltenango)
c. Interconnecting smaller loads toward the eastern (Atlantic) seaboard.

2.46 INDE has prepared transmission plans for the 1992-2000 period, estimated at US$142 million (1991 U.S. dollars), within the framework of the National Electrification Plan:

a. The central-west 230 kV interconnection, broken down into three stages of development
b. The interconnection of the Atlantic and Petén areas via two projects
c. New substations and reinforcements to existing ones
d. Transmission lines connecting new plants to the main high-voltage network.

2.47 Of these projects, the small Atlantic market, with 7,500 customers and sales of 14 GWh in 1991, does not justify extending the network with a 165 km line of 230 kV. The line leading into the Petén is justified only for promoting the region's development. Studies carried out to recommend transmission expansions are outdated, and INDE's financial difficulties suggest that the review of priorities in the described transmission projects must be performed.

2.48 **Distribution.** Total investments in distribution planned by INDE for the 1992-2000 period amount to US$63 million (US$7 million per year). In the same period EEGSA has planned an investment of about US$120 million (US$13 million per year). INDE estimates that electricity service reaches some 2.8 million people; adding those covered by the municipal distributors brings national coverage to about 40 percent. In the last National Plan of Electrification (1988), INDE had an ambitious development plan to reach 275,000 new users by the year 2000, mostly in rural areas. Because INDE's financial constraints have shown that these targets are unrealistic, the economic effectiveness of the required investments and the need for improving planning methods should be examined.

Electricity Demand

2.49 **Background.** In Guatemala, as in many Latin American countries, the 1970s saw growth, whereas the 1980s were characterized by recession. Correspondingly, sales of electricity grew from 1971 to 1979 on an average 10 percent annually, and they decreased from 1979 to 1984. Only in 1985 did electricity sales reach the 1979 level. Since then, growth has resumed, averaging 9.3 percent annually in the 1985-91 period. Demand is expected to increase by an average of 6.7 percent in 1992-2000 period (see Figure 2.2).

2.50 **Demand Structure.** In the 1980s, because of the economic depression, the share of industrial electricity consumption declined, and residential participation increased. The 1980 market structure of the interconnected system accounted for sectoral sales of 25 percent in the residential subsector, 42 percent in industry, 19 percent for commercial users, and about 14 percent for government and other users. In 1990 residential, industrial, commercial, and government and other consumers accounted for 30 percent, 34 percent, 22 percent, and 14 percent, respectively (see Figure 2.3).

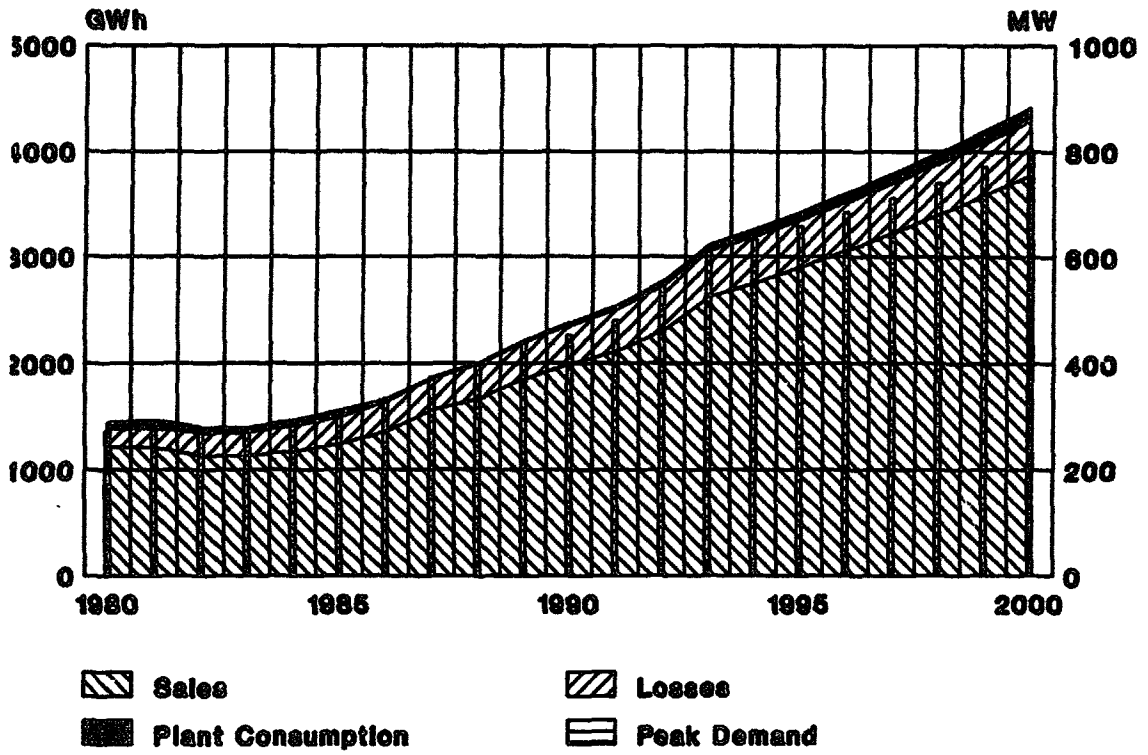

Figure 2.2 Guatemala: Electricity Demand, 1980-2000

2.51 Geographical sales show a dramatic imbalance: sales of EEGSA to final consumers, concentrated mainly in Guatemala City, account for about 1,600 GWh in 1991 (76 percent of the total end-consumers demand) against 510 GWh for the rest of the country. This geographical asymmetry reflects Guatemala's duality: an advanced, modern, and urban sector as counterposed to a traditional and comparatively isolated rural sector.

2.52 Geographical differences are remarkable when residential-specific consumption is analyzed. In 1990, EEGSA had roughly 280,000 residential consumers with an annual consumption of 1,687 kWh per customer, whereas INDE had 259,000 consumers with an annual consumption of just 505 kWh per customer. INDE's statistical data show that recently the utility has been reaching ever more marginal consumers with lower unit consumption.

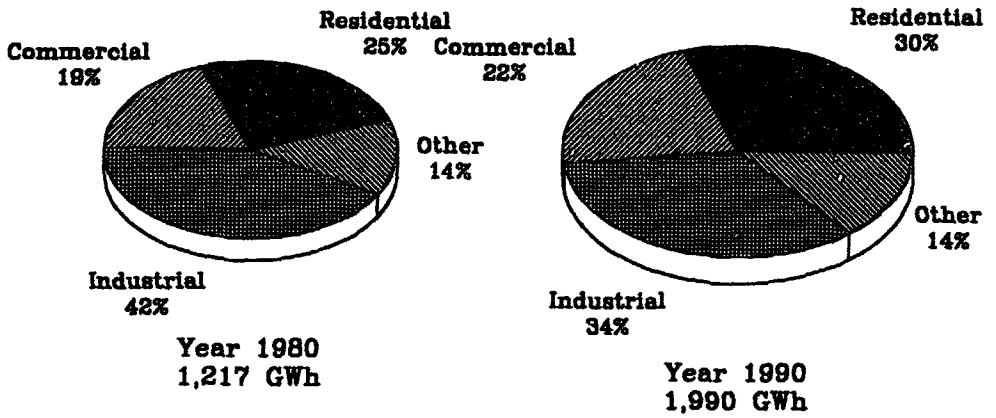

Figure 2.3 Guatemala: Electricity Sales, 1980 versus 1990

2.53 Demand seasonality in the interconnected power system is not significant (see Figure 2.4), but weekend and hourly load variations are important because of the high weight of the residential consumption. Demand modulation in the last years, and mainly in 1991, has been affected seriously by sabotage and climate conditions (see Figure 2.4). An improvement of load curves is expected in the future, when reliability of energy supply increases and economic recuperation expands industrial electricity demand.

2.54 **Demand Forecast.** The forecast prepared by INDE was based on the present trend of population growth of 2.9 percent. GNP was assumed to grow at about 4 to 5 percent. The latter would seem an optimistic view of Guatemala's future, and the final forecasts thus should be seen as possibly at the upper limit values. Still, the records of the last years show that forecasts have been within 5 percent of actual values.

2.55 Forecast growth rates of demand used as the basis for the national expansion plan show the following values:

1989-1991 (actual):	6.6 percent
1992-2000 (forecast):	6.2 percent

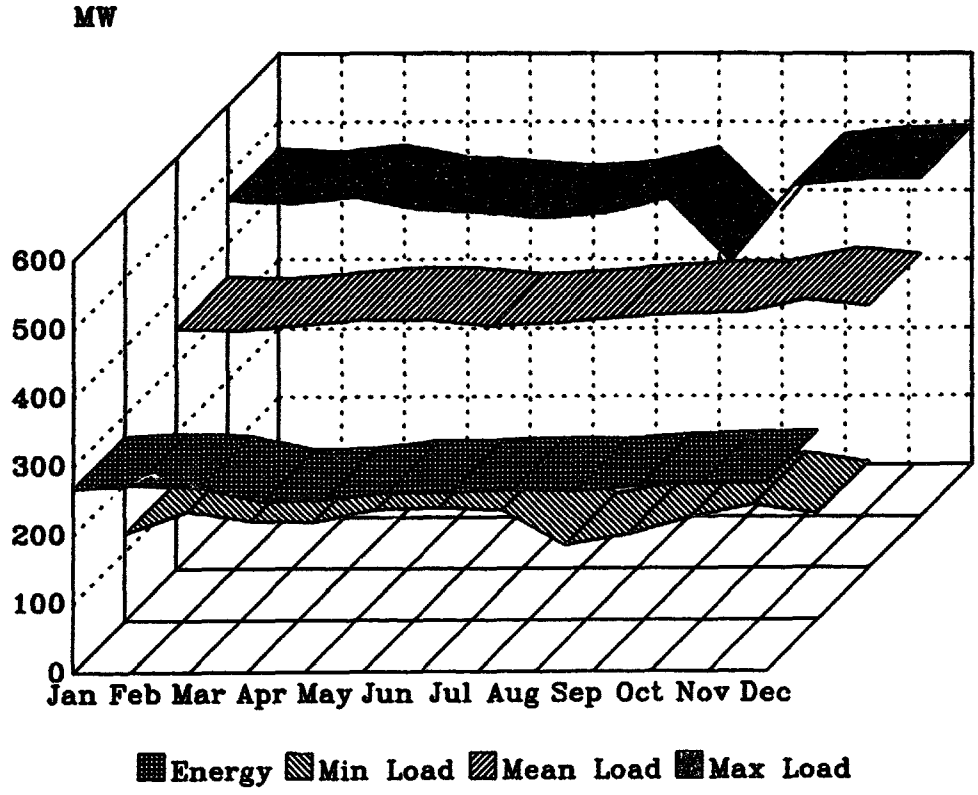

Figure 2.4 Guatemala: Seasonal Electricity Demand, 1991

2.56 These growth rates appear reasonable. However, there is the potential for higher growth (driven by the industrial sector recuperation) as well as the risk that actual demand will be lower than forecast if the economic recovery is slower than expected.

2.57 Although the demand forecast seems "reasonable," INDE and EEGSA should improve their models, increasing explicative variables and including short- and long-run price elasticity concepts. Intensity and substitution of energy products should be also considered.

C. Electricity Tariff Policy

Legal and Institutional Framework

2.58 In view of the importance of tariff levels and structure on electricity demand, and consequently investments, this section looks at past practices and future requirements. Tariffs for electricity in Guatemala are under the control of INDE's Board of Directors. They do not require an explicit government approval and are not promulgated as a decree. However, in practice, rate increases depend on government decision—because the Board of Directors is nominated by the government—so the rate changes are biased by Congress's attitude and public opinion. Electricity laws do not comprise any specific tariff regulations, such as rate of return requirements or marginal cost pricing. Procedures to revaluate assets or to calculate depreciation operation costs also are not regulated by subsidiary legislation.

Tariff Levels and Subsidies

2.59 Electricity rates for end-consumers deteriorated in real terms and were below production costs most of the time, since the Quetzal devaluation in 1984 (see Figure 2.5).[2] The average retail price for final consumers declined in constant 1991 dollars from US¢10.6/kWh in 1980 to US¢5.7/kWh in 1991. The price for bulk sales from INDE to EEGSA also deteriorated from US¢7.5/kWh to US¢3.2/kWh in the same period. The average ratio between retail and bulk prices—the main source of revenues for EEGSA and INDE, respectively—dropped from 71 percent in 1980 to 56 percent in 1991.[3] These two factors largely explain the financial difficulties of INDE and the huge government cash transfers to fund INDE's current expenditures.

2.60 Electricity rates were increased by about 47 percent in August 1991, and an automatic mechanism to adjust prices in response to fuel cost variation was applied beginning in January 1993. After these increases tariffs were about 79 percent of marginal cost (see Table 2.3). An adjustment proposed in March 1993 to align tariffs with marginal costs is now being analyzed by the new government. End-consumer subsidies, begun in 1985, have amounted to about US$50 million per year over the last three years (see Annex 5). Further, bulk tariffs for INDE's sales to EEGSA have also been highly subsidized, amounting to about US$60 million per year in the last three years. To put it into context, this amount is almost 60 percent of INDE requirements for funding the investments needed by the power system expansion.

2.61 The level of subsidies were calculated as the difference between actual tariffs and marginal cost reference tariffs, as shown in Table 2.3 (in 1991 U.S. cents).

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2. Marginal costs are about US¢6.1 per kWh for generation level, US¢6.8 per kWh for interconnection level, US¢7.4 per kWh for high voltage, US¢8.3 per kWh for medium voltage and US¢9.2 per kWh for low voltage.

3. Based on generation/distribution marginal cost ratio, the rate for bulk energy sales should be at least 75 percent of the retail price.

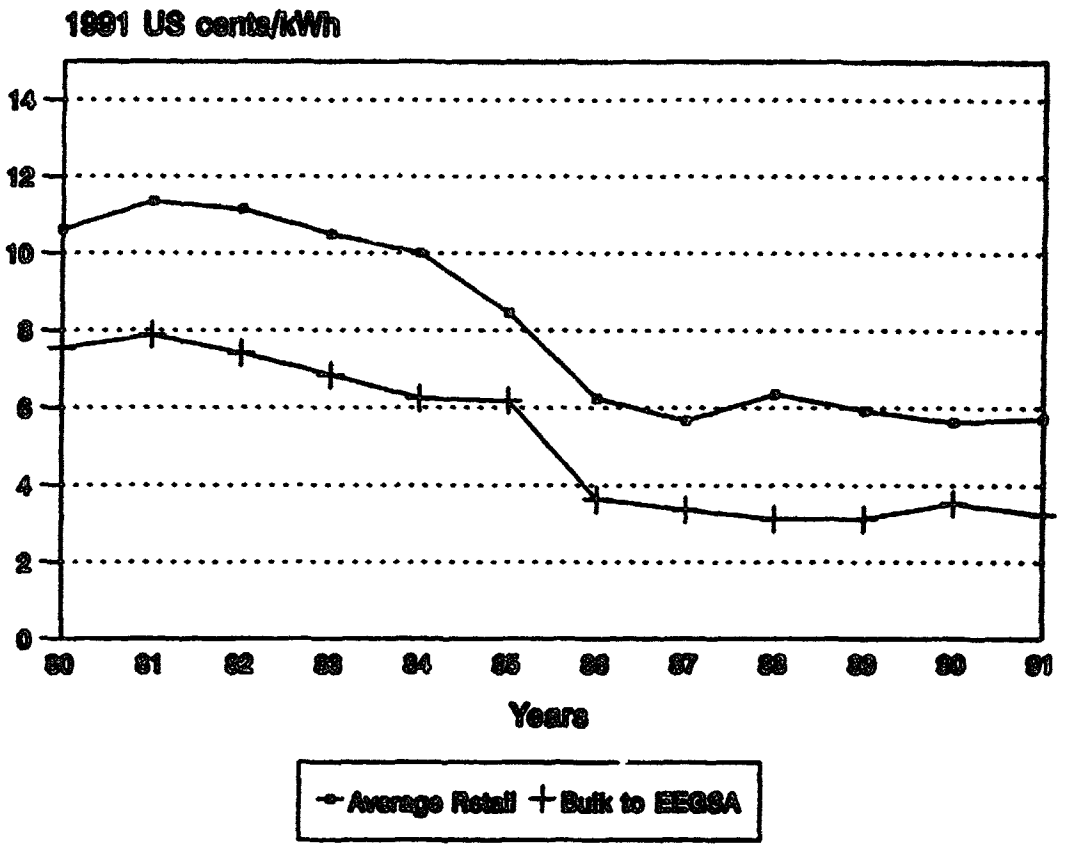


Figure 2.5 Guatemala: Evolution of Electricity Tariffs, 1980-1991

Table 2.3 Guatemala: Reference and Actual Electricity Tariffs (January 1993)

Consumer type	*Actual rate*	*MC reference tariff*	*Tariff ratio (%)*
Residential	5.4	9.2	59
Commercial-industrial (LV)	7.2	8.1	89
Commercial-industrial (MV)	6.4	7.1	90
Municipal-government	8.1	8.1	100
Bulk	4.3	6.7	64
Average retail	6.9	8.7	79

Sources: INDE, Mission estimates.

2.62 The conclusions of this analysis are as follows:

a. INDE has subsidized EEGSA at US¢2.4/kWh (US$36 million annually; 30 percent of its present operating revenues).

b. Residential consumers are subsidized by about US$24 million (more than 40 percent of their cost of service).

c. Subsidies are present in other tariff categories, but in smaller amounts.

Marginal Costs

2.63 Long-run marginal cost (LRMC) and short-run marginal cost (SRMC) are used as references to evaluate the economics of tariff systems (see Figure 2.6). In addition, one should take into account the financing structure of the project (i.e., to ensure a match between economic life of the asset and the amortization schedule to service the debt). In this analysis, LRMC has been used to define marginal cost. Table 2.4 shows the values used by the mission for the evaluation of tariffs.

Table 2.4 Guatemala: Power System Marginal Costs

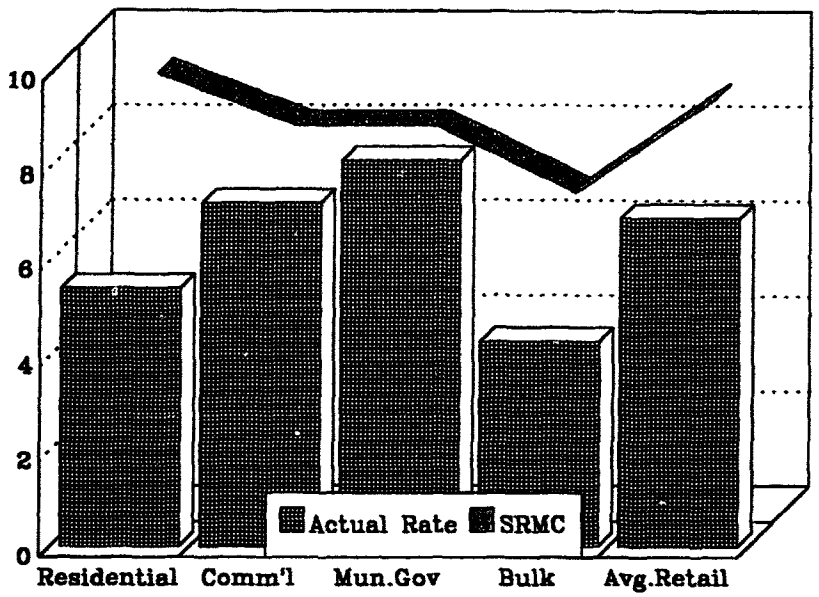
Energy supply level	*Capacity cost (US$/kW/year)*	*Energy cost (US¢/kWh)*	*Average cost (US¢/kWh)[a]*
Generation	59.4	5.0	6.2
Interconnection	84.0	5.1	6.7
High-voltage	113.5	5.2	7.4
Mid-voltage	152.7	5.4	8.4
Low voltage	178.3	5.9	9.2

Source: Mission estimates (Annex 6). [a]Load Factor = 60 percent

Tariff Structure

2.64 Annex 6 presents preliminary estimates on reference service costs by voltage level, user category, and peak/off-peak periods. Although INDE rationalized the electricity tariff structure in 1991, a comprehensive marginal cost and tariff analysis is still needed. Using the reference tariff values from Annex 5, the following observations can be made:

- The rate for bulk energy sales, as of June 1992, was 64 percent of the benchmark cost (US¢4.3/kWh versus US¢6.7/kWh). Further, the tariff structure should be revised to incorporate demand charges, and seasonality and peak/off-peak modulations. Special tariffs for emergency and maintenance should also be defined.



Actual Rate	5.4	7.2	8.1	4.3	6.9
SRMC	9.2	8.1	8.1	6.7	8.7

Figure 2.6 Guatemala: Electricity Rates and Marginal Costs

- The MV rates (tariff with reduction for off-peak demand) are about 68 percent below the reference tariff in the peak demand charge and 89 percent below in the energy charge. As a charge accounts for off-peak demand, average rate is just 90 percent of benchmark tariff. This tariff should specify different rates according to voltage levels.

- Low-voltage residential tariffs are uniformly too low, including those oriented presumably to higher-income groups. This means that in effect all income groups receive a subsidy of about US¢3.8/kWh. If, at a minimum, marginal-cost tariff-setting criteria are to prevail, residential rates will have to be increased by about 70 percent (average rate is US¢5.4/kWh instead of US¢9.2/kWh).

- Low-voltage nonresidential tariffs are also below reference tariffs. In the case of the tariff without demand charge, the average rate is about 90 percent of the reference tariff. In the case of the tariff with a low demand charge, the demand charge is almost 56 percent and the energy charge about 94 percent of the reference tariff. In the case of the tariff with a high demand charge, the demand charge is 73 percent and the energy charge is about 90 percent of the reference tariff. The average rate is 89 percent of the average reference tariff (US¢7.2/kWh versus US¢8.1/kWh).

Tariff Levels and Financial Performance

2.65 Low tariff levels from 1985 onward, as compared to their marginal cost of supply, were, undoubtedly, an important contributing factor that led the sector into financial troubles and, consequently, its inability to even cover its debt service out of its internal cash generation. However, even if tariffs had been adjusted at their average incremental cost levels through the 1986-91 period, the sector would have still required government transfers of about US$380 million: this points out to financial costs well above marginal costs, or a financing structure highly vulnerable to fluctuations in operating income; indeed, a combination of both appears precisely to have happened in Guatemala's power sector.[4]

2.66 Consequently, the following section looks at the past financial structure and performance of the power sector and at indications on the financial impact of alternative strategies for the future, including entrusting total responsibility for generation to private sector capital.

D. Power Sector Finances

2.67 This section breaks down the analysis in three components: (a) the consolidated operations of the sector as a whole; (b) INDE's operations; and (c) EEGSA's operations. Annex 7 presents summarized financial statements for each one of the components.

Past Performance

2.68 As seen during the 1980s, the power sector in Guatemala was besieged by an array of adverse factors: lack of clear objectives and an adequate institutional framework to carry out those objectives; cost overruns in the two major hydro projects; declining tariffs in real terms; tariff levels below their marginal and financial cost; and lower than expected electricity demand. As in any business, the bottom line effect of these factors was a deteriorating financial situation, which, by the end of 1991, had led to a sector unable to cover even interest payments on its debt service (see Figure 2.7) out of its cash generation (defined as cash flow before debt service and adding back depreciation), therefore also unable to contribute to the sector's investment plan. By 1991, INDE alone had accrued debt service arrears of about US$114 million, twice its gross internal cash generation.

2.69 After 1985, the currency devaluation without a corresponding electricity tariff adjustment further exacerbated the financial shortfalls, as shown in Figures 2.7 and 2.8: consequently, the sector operated with a negative net income in the 1988-91 period.

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4. It must be remembered that in the presence of economies of scale, as is the case in power plants, marginal cost is below average cost; therefore, prices must be raised to at least their average cost level to allow the firm to remain in business.

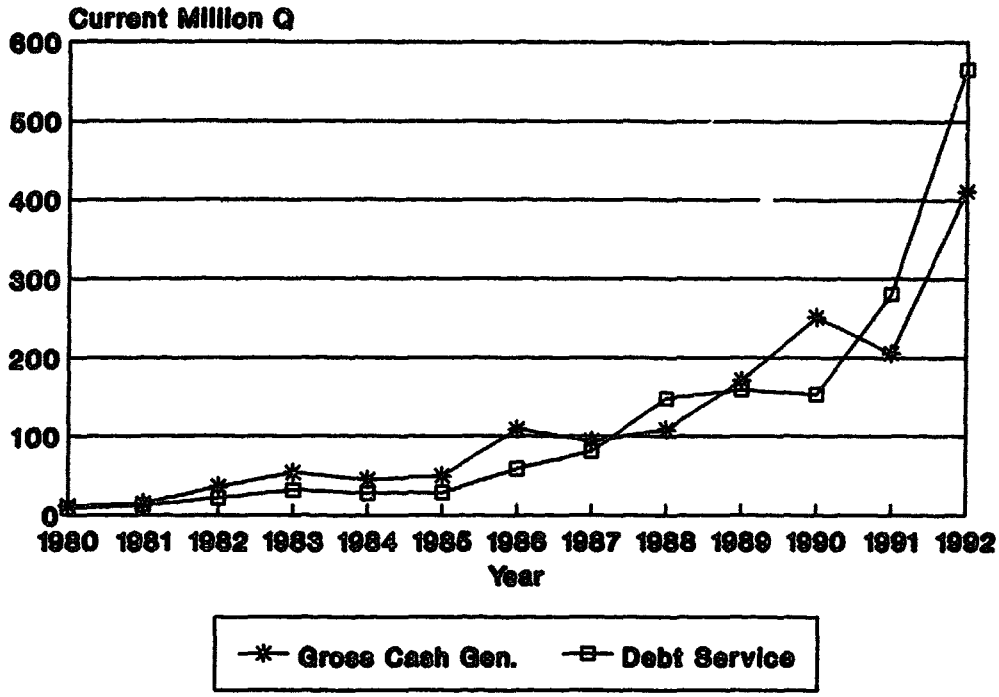


Figure 2.7 Guatemala: Power Sector Consolidated Financial Structure, 1980-1992

Consolidated Financial Overview of the Sector

2.70 By and large, the finances of the consolidated power sector during the last decade can be described as follows:

- The pattern chosen for the expansion following the oil shocks of the 1970s, which divided power sector finances in two periods. A period of intense investment in hydro projects and high operating costs which lasted until around 1985; and then starting in 1986, a period of high debt service in U.S. dollars, low operating costs, but also a drop in revenues as expressed in U.S. dollars.

- A stable parity of the exchange rate against the dollar until 1985, followed by a devaluation of the Quetzal that eroded tariffs and consequently the power sector income.

- A persistent transfer of funds from INDE to EEGSA through bulk tariffs. As seen in the tariff analysis section before, just the bulk tariff subsidy amounted to about US$ 364 million in the 1983-91 period.

2.71 As a result of these factors, the power sector at the end of 1991 is in a financial quagmire. INDE did not generate enough funds to cover its debt service and had accrued debt service arrears of around Q 565 million (US$113.5 million), twice its gross internal cash generation in 1991. Of these arrears, Q 330 million (US$66 million) were with financial institutions, Q 65 million (US$13 million) with BCIE that are being refinanced, and Q 172 million (US$34.5 million) were credits from the government to cover debt service during 1988 and 1989.

2.72 Fuel costs, which had reached US$88 million in 1980 and US$101 million in 1981, were reduced to about US$7 million in 1990. The collapse of oil prices in 1986, and the reduction in fuel consumption made an important contribution to the gross internal cash generation growth in the second half of the 1980s. Gross internal cash generation increased almost tenfold from Q 29 million in 1980 to Q 284 million in 1990. However, in current US dollars, debt service grew at about 20 percent per year in the 1986-91 period, while operating income went from US$21 million in 1986 to US$19 million in 1991.

2.73 The power sector obtained important government contributions in the 1980s. Between 1980 and 1984 the government contributed Q 593 million, equivalent to US$593 million (US$120 million per year), mainly to the investment program. From 1985 to 1987 the government reduced its contributions to the sector to Q 50 million (US$18 million), but starting in 1988, the government had to resume significant contributions or loans to INDE to cover debt service for Q 421 million (US$101 million) in the period 1988-91. For 1993, it will again be necessary for the government to make contributions or loans to the sector. The amount of Q 700 million (US$140 million) will include some loans made in 1988 and 1989 to INDE, which were not repaid.

INDE's Financial Performance

2.74 INDE has been the main vehicle by which the sector has expanded, and therefore contracted new debt, as well as the main bearer of risk in the sector, whether related to finances or operations (e.g., geology and construction cost overruns). However, despite having the bulk of generation and transmission, INDE's revenues have lagged behind EEGSA's. In summary, INDE's performance has mirrored the situation of the sector as a whole.

2.75 Despite improvements in gross internal cash generation, those were not enough to cover increases in debt service (see Figure 2.8). High debt service was a result of (a) persistent low levels of self financing of projects; the contribution-to-investment ratios shown in the financial statements tend to mask the reliance of INDE on government contributions and short term borrowing; (b) a maturity mismatch, derived from the need to amortize external debt rapidly on assets of longer economic asset life, which was not related to much shorter loan life; (c) devaluation of the Quetzal; and (d) inadequate tariff adjustments to reflect economic and financial costs. As a result, net internal cash generation became negative after 1988.

EEGSA's Financial Performance.

2.76 EEGSA's distribution margin has played an important role in the deterioration of power sector finances (see Figure 2.9). EEGSA had a margin higher than required according to the relation between the interconnection level and the distribution level costs, which is about 28 percent. In 1991 this margin was 37 percent, allowing EEGSA to capture part of the rent which otherwise would have been obtained by INDE. As result, EEGSA was able to finance its investment program with internal funds, while INDE had to borrow abroad and obtain contributions from the government for the investment program and to cover its debt service.

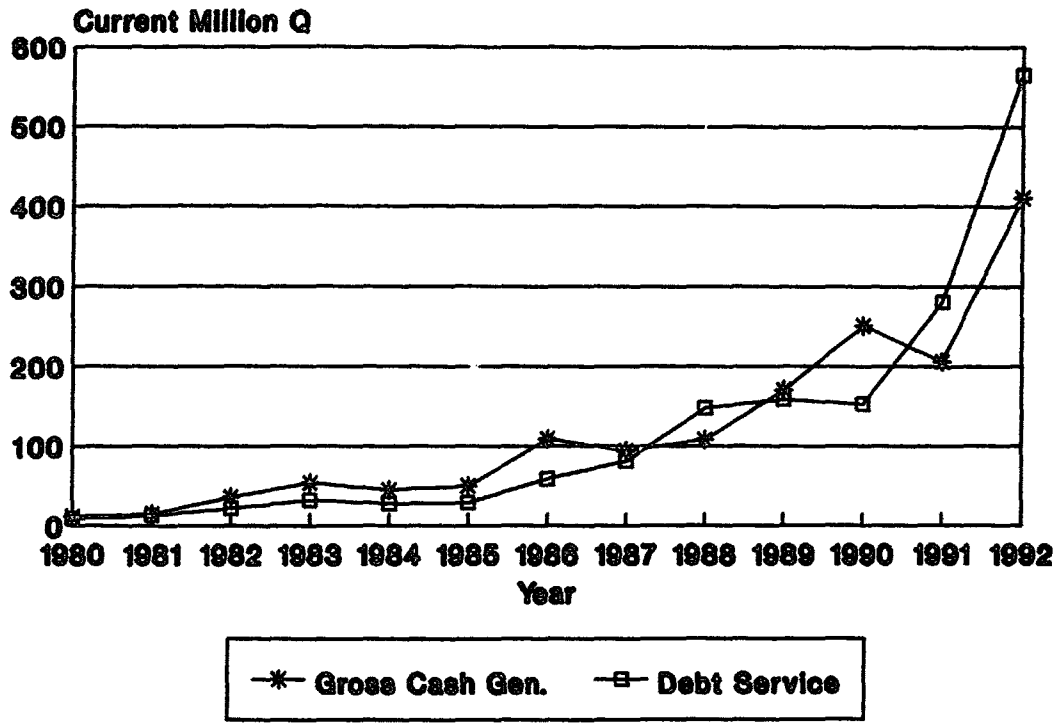


Figure 2.8 Financial Structure of INDE, 1980-1992

Financial Perspectives

2.77 To estimate the implications of alternative institutional strategies, financial results for the Guatemalan power sector were analyzed under two different scenarios: The "INDE" alternative assumes that INDE will continue to execute future expansion in generation, whereas the "private sector" alternative assumes that electricity required will be purchased from the private sector. The scenarios represent extreme cases; hence, a third case (see Annex 8) shows mixed participation of the state and the private sector in construction of new generation capacity.

2.78 Table 2.5 shows the results of the consolidated sector, INDE and EEGSA, respectively, under the INDE alternative. It shows that the consolidated power sector will face a continual shortage of funds, even if tariffs are adjusted to marginal costs; this is not surprising, since the sector will continue to be burdened by the Aguacapa and Chixoy debt. Whether the shortage of funds would be caused by an overdimensioned investment program, an underestimation of the level of marginal and financial costs, or both, can be determined only after a more detailed examination.

2.79 The financial projections show that INDE would have a US$548 million financial gap between 1992 and 2000, even after considering the disbursements of loans to finance projects for US$1,266 million. The financial gap could reach more than US$700 million if the generation projects were financed from new loans. This would be an unacceptable alternative under which INDE would remain a drain on government resources.

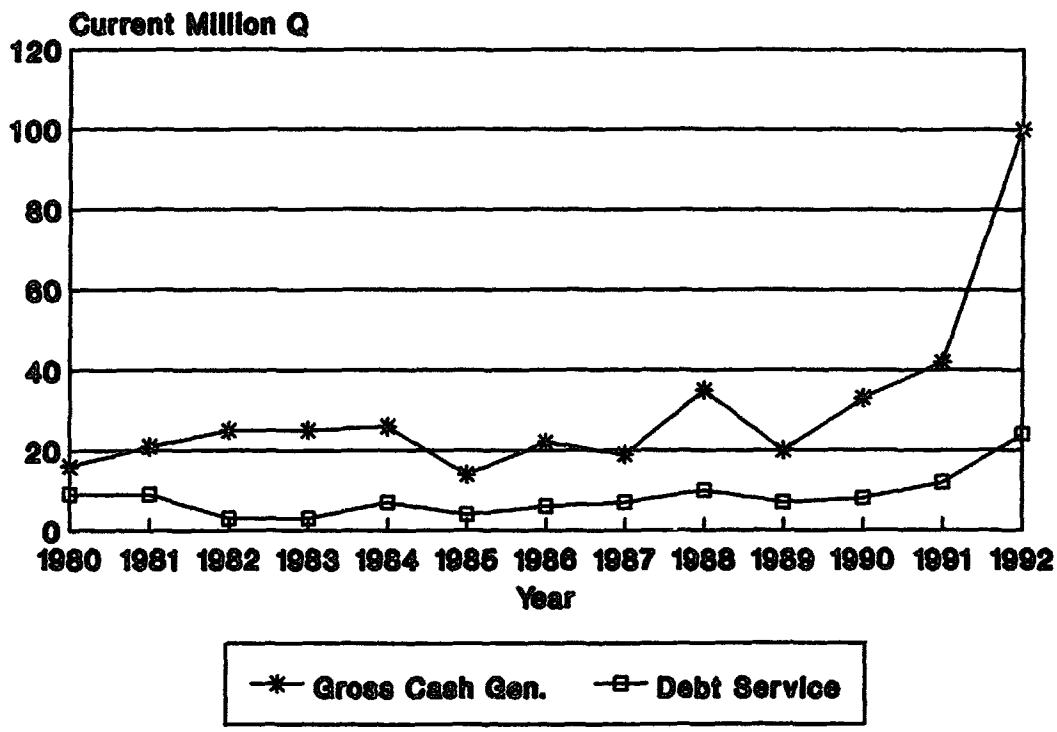


Figure 2.9 Financial Structure of EEGSA, 1980-1992

2.80 EEGSA's projection shows that with a distribution margin of ABOUT 28 percent after tariff adjustments, it will be able to generate enough funds to contribute to the investment program. However, about 50 percent of the investment would have to be financed by loans.

Table 2.5 Power Sector Financial Projections
Forecasted Financial Indicators, "INDE Alternative," 1992-2000

Indicator	*1992*	*1995*	*2000*	*Total 1992-2000*
Consolidated Sector				
Operating ratio (%)	65.7	64.4	62.5	
Rate of return (%)	8.74	11.11	9.99	
Contribution to investment (%)	-16.0%	52.3%	12.9%	19.3%
Financial gap (US$ millions)[a]	0[b]	17	166	560
INDE				
Operating ratio (%)	58.6	49.7	50.4	
Rate of return (%)	8.49	11.22	10.04	
Contribution to investment (%)	-29.5%	51.9%	11.8%	17.1%
Financial gap (US$ millions)[a]	0[b]	16	164	548
EEGSA				
Operating ratio %	93.3	94.6	95.2	
Rate of return %	10.46	10.31	9.48	
Contribution to investment (%)	84.5%	55.7%	43.9%	51.0%
Financial gap (US$ millions)[a]	0	1	1	4

Note: INDE is assumed to build and operate according to the least-cost expansion plan.

[a]Financial gap does not include financing costs of the gap. Financial projections assume that only external component of projects will be financed with loans.
[b]Contributions from government of Q 200 million for 1992 and Q 100 million, and a loan from government of Q 220 million in 1992, have been assumed for both alternatives.

2.81 The private sector alternative assumes that INDE does not execute any of the future generation plants but that it buys all its future requirements of electricity from private sector suppliers at a rate similar to the one recently obtained by EEGSA, Q¢ 30.5/kWh (6.1 US¢kWh).[5] Under this assumption, INDE will generate a surplus of Q 1,209 million (US$240 million) during the period 1992-2000. The size of the surplus depends on the actual prices charged by private suppliers.

2.82 Table 2.6 compares both options: the INDE and private sector alternatives.

5. This tariff level was taken as a reference, not as an indication of the financial cost to the sector.

Table 2.6 Consolidated Power Sector Financial Indicators, 1992-2000

Indicator	*1992*	*1995*	*2000*	*Total 1992-2000*
INDE alternative[a]				
Operating ratio (%)	65.7	64.4	62.5	
Rate of return (%)	8.7	11.11	9.9	
Financial gap (US$ million)[b]	0	17	166	560
Private sector alternative[c]				
Operating ratio (%)	65.7	64.3	73.8	
Rate of return (%)	8.7	11.43	10.36	
Financial surplus (US$ millions)	0	25	52	235

[a]INDE will build and operate according to the least-cost expansion plan.
[b]Financial gap does not include the financing costs of the gap. Financial projections assumes that only external component of projects will be financed with loans.
[c]INDE will buy electricity required from private sector suppliers. The indicators correspond to the consolidated public power sector.

E. Lessons of Experience

2.83 This chapter began by evaluating the institutional structure and regulatory framework under which the power sector has been operating during the late 1970s and early 1980s. Subsequently, the chapter showed the operational and financial impact of not having clear sectoral objectives, a strategy to carry them out, and the institutional framework to do it. Further, those objectives should have included economic, operational, and fiscal elements.

2.84 Implicitly, the sector has been structured institutionally to rely on government contributions without questioning what level of demand it could afford to supply. In the past, the financial problems, and all risks, were concentrated in INDE, as EEGSA obtained a distribution margin higher than required according to the interconnection level cost, thus draining resources from INDE. It appears as though the electricity pricing system in place with the private suppliers—cost-plus pricing—perpetuates the concentration of risk in INDE rather than encouraging equilibrium and viability in the medium to long term.

2.85 It appears as though no consideration was made regarding management of financial risk. As a result, the sector contracted debt to be amortized rapidly while tariffs were at levels both below their economic and financial costs. Given these circumstances, tariffs in the future will have to be above their marginal cost until efficiency is improved and equilibrium is reached. In terms of the institutional structure, the implications may call as a first step for an integration of generation and transmission under performance contracts. Overall, the issues to

tackle require a process for reform, as against a set of ad-hoc actions, as appears to be the case today.

2.86 The contracting of new generation to the private sector has alleviated the short-term investment requirements, but the fundamental source of problems has not been addressed: the absence of a legal context (i.e., an electricity law) to encourage an accountable and reliable power system and the separation of regulatory and operational functions.

3

Hydrocarbon Sector

3.1 Guatemala has had an active oil upstream sector with a history of exploration and production since the late 1970s, as well as a growing downstream sector. Guatemala imports all of its oil requirements of about 28,000 barrels/day (bd), and it is also a marginal oil-producer—about 8,000 bd, which is mostly exported by the oil companies. Although the power sector has periodically received government transfers to cover investment and debt service, the hydrocarbon sector has been a constant source of government revenues in the energy sector, peaking at about Q 700 million in 1991, or 16 percent of government revenues. However, the main source of revenue incorporated in the petroleum price structure, the compensation fund, has gone from Q 476 million raised in 1992 to zero revenues in 1993.

3.2 Upstream, the government's promotion exploration campaigns have met with limited success. On the latest promotion in 1991, only one company, Pentagon of Louisiana, presented a proposal for exploration permits. The main causes of this lack of success are (a) the inconsistent and absent government regulation regarding the environmental impact of oil companies' operations; (b) the lack of adequate preparation at the MEM to organize and follow up a promotion campaign; and (c) the lack of proper legislation to use the only pipeline in the main oil-producing region (El Petén), which is privately owned, on a common-carrier basis.

3.3 Downstream, the sector has become a major source of government revenues. Although consumption dropped from 31,000 bd in 1980 to a low of 20,000 bd in 1986, it is now rebounding to 1980 levels; this increased demand will bring greater investment requirements to expand and rehabilitate the current infrastructure. The government has stated its goal to restructure the downstream sector to make it more efficient, both in terms of more efficient supply arrangements as well as internal distribution. As in other Central American countries, the core of the inefficiencies in the downstream sector is a regulatory structure based on a cost-plus pricing system for the private sector companies.

3.4 Within this context, the objective of this chapter is to assess the performance of the hydrocarbon sector, and, based on this assessment, to propose components that should be included in the government's strategy to (a) attract greater private sector investment in a more competitive environment, both upstream and downstream; (b) ensure that the sector maintains and

increases its fiscal contribution; and (c) ensure that this is achieved in an environmentally and economically sound way.

3.5 The chapter is divided into two main parts: upstream operations and downstream operations. After an introduction on past exploration and production, a section on operations gives an assessment of current production practices and proposes an alternative production strategy to attract greater exploration by oil companies. The section on the downstream segment of the industry focuses on the regulatory aspects of downstream operations and on the changes needed to bring about a more efficient market. This includes discussion of the including roles to be played by the public and private sectors.

A. Upstream Petroleum Operations

Background

3.6 **Geology**. Guatemala contains three sedimentary basins (See Map 1): the Petén basin (50,000km^2), the Amatique basinal trend (10,000km^2), and the Pacific basin. The Petén basin has a high hydrocarbon potential, which, despite various oil discoveries in the Rubelsanto and Xan areas, is still largely untapped. The northwest area—against the Arco de la Libertad—could also contain larger oil deposits and might yield higher levels of production than the western area of the basin. Oil shows have been identified as well in the Amatique basin, where interest has been focussed on the Izabal sub-basin. The hydrocarbon potential of the Pacific basin has not yet been established and remains speculative.

3.7 Proven remaining recoverable reserves, estimated on the basis of currently producing oil fields, amount to about 21 million barrels. This yields a reserves to production ratio (R/P) of seven years. Current production is about 8,000 bd, more than half of it yielded by the newly developed Xan oil field, in the northeast portion of the Petén basin. However, current petroleum demand levels of around 28,000 bd are supplied by imported crude and refined products.

3.8 In the Rubelsanto area, at current production rates, proven reserves and production are approaching the final stage of depletion. Secondary and enhanced recovery programs could counteract this decline. The specific type of secondary or enhanced recovery needed (i.e., water and/or gas injection) depends on geology and reservoir behavior.

3.9 The geology and reservoir behavior in the Rubelsanto area is characterized by lack of porosity in reservoirs. An integrated reservoir and well performance study should be carried out in both Rubelsanto and Caribe fields to identify incremental reserves based on an improved knowledge of the reservoir. The study should examine the nature of the fracture system, identify production and recovery factors, and make recommendations regarding the least cost method for draining almost all recoverable oil in relatively shallow reservoirs and to ascertain the most appropriate technique—and economics—for exploring the deeper reservoirs in Rubelsanto.

3.10 **Past Exploration and Production.** Despite interest in the country's oil potential since the 1930s, actual exploration started only in the late 1950s. In 1974, a joint venture of several oil companies produced oil in Rubelsanto (30° API oil). In 1980, a 240 km pipeline with a 50,000 bd capacity (astonishingly large for a country with a peak production of 8,000 bd) was built from Rubelsanto to the Atlantic port of San Tomas. The pipeline is to be owned by the present operator (Basic Resources) until the year 2002, when it will be transferred to the government.

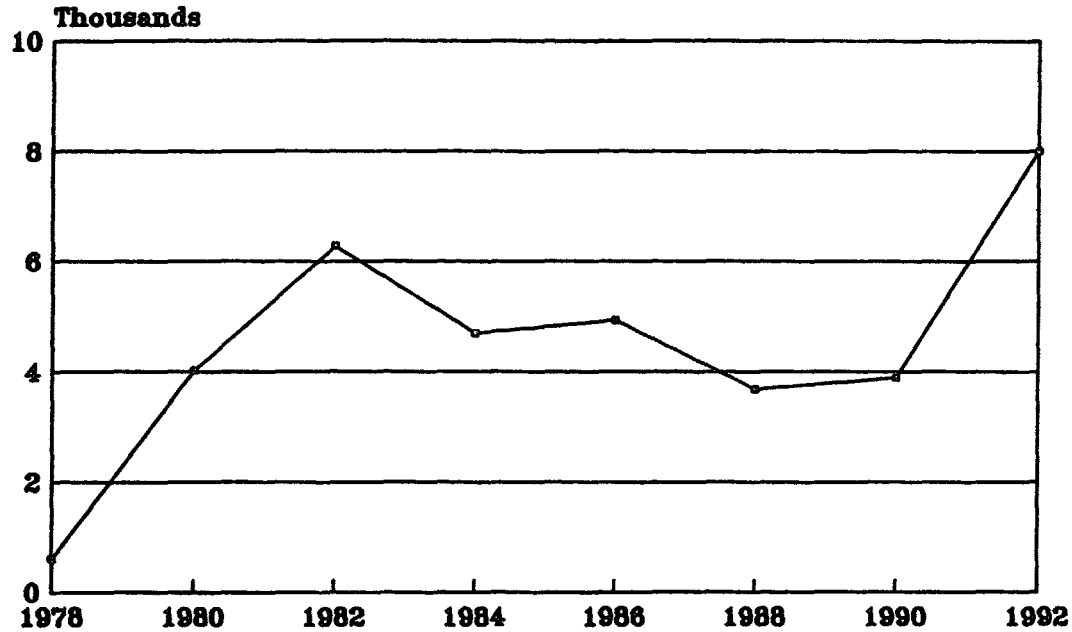


Figure 3.1 Guatemala: Oil Production (thousands of barrels per day) 1978-1992

3.11 In 1990, the oil company Basic Resources took over the area of Xan, where a well previously drilled by Texaco had produced heavy oil. Basic drilled two more wells on the structure, and established production from what was progressively uncovered as the biggest oil field discovered to date in the Petén basin. In spite of a low recovery rate resulting from the density of the oil, the aggregate proven and probable recoverable reserves (21 million barrels) are equivalent to the total of past production in Guatemala.

3.12 Other enterprises formerly involved in exploration in Guatemala include Texaco, Repsol, Exxon, Amoco, Pam Petroleum (a small independent company), and Shell (in the Lake Izabal area). Texaco and Repsol drilled wells that produced oil in noncommercial quantities (in the view of big companies; Exxon carried out a seismic survey and drilled the first of two contractual wells but pulled out for reasons related in part to questions about environmental regulation and unclear institutional jurisdiction in the government. With an undefined

environmental protection policy on the part of the government and the lack of coordination between CONAMA, the commission in charge of environmental policy, and the Ministry of Energy and Mines (MEM), this situation affects the normal course of petroleum operations and deters oil companies from entering the Guatemalan exploration scene.

Impact of Regulation on Exploration

3.13 Past exploration activity has been influenced by four marked changes in petroleum legislation:

- In 1949, the first phase of exploration activities was brought to an end by legislation with no incentives for investment.

- In 1955, a new government took office and issued a Petroleum Code under which government participation amounted to no more than 24 percent of the production from the concession area. As a result of this soft fiscal regime, 29 groups of oil companies filed 91 applications for exploration, and 15 exploration wells and 3 production wells were drilled.

- In 1975, the government enacted a new petroleum law incorporating a heavier fiscal regime. (This seemed to be warranted by the first oil discoveries and the soaring oil price trend that followed the 1973 oil price shock.) Under this regime, the government lifted a minimum of 55 percent of the crude produced on a sliding scale basis related to increasing production. At this time, two major oil companies that had made discoveries or were producing oil relinquished their rights and left the country.

- The latest change, in 1983, brought in the Hydrocarbon Law and a Production Sharing model contract, which has alleviated many of the critical deterrents to oil exploration. Essentially, they provide for:

  - Payment of a sliding scale royalty on production, at rates ranging from 5 percent to 20 percent, depending on the API gravity of the oil concerned.

  - Recovery of the company's expenditures out of total oil produced, net of royalty payment.

  - Sharing between the government and the company of remainder oil ("shareable oil") left after royalty payment and recovery of the company's expenditures, such sharing to be accomplished according to a sliding scale set as a function of levels of production.

  - Payment of an income tax at the rate of 34 percent on the company's taxable income (practically, its share of "shareable oil").

- Introduced in 1991, a seismic option under which the companies have a limited time (two years) to conduct seismic surveys, with the option to relinquish the acreage or commit to drilling an exploration well.

3.14 The new fiscal framework graphically represented in Annex 9 could still be refined, particularly in terms of its fiscal terms and regulatory provisions (Para 3.33).

Institutional Structure

3.15 At the policy level, the Ministry of Energy and Mines (MEM) is in charge of supervising and managing all aspects of oil operations in Guatemala. The National Petroleum Commission (NPC), which is chaired by the Minister of Energy and Mines and includes the Attorney General and representatives from the Ministries of Defense, Finance, and Economy, and the Central Bank, acts as an advisory body for the MEM. At the technical level, the General Directorate of Hydrocarbons within the MEM monitors compliance with laws, regulations, and contractual stipulations relative to petroleum operations.

3.16 The separation of policy, advisory, and technical-auditing roles is a good measure, provided that the attributions are properly defined and that resources are available to carry out those attributions. This is not the case in Guatemala. The institutional structure currently lacks communication among the different units.

3.17 The lack of communication raises two issues that make MEM inefficient in the activities of an appropriate promotion campaign. First, at the advisory level, NPC plays a blurred role, and it has no resources to carry out its responsibilities. The NPC is responsible for (a) "expressing opinion" with respect to petroleum operation contracts, the establishment of petroleum prices, and the engagement of consulting firms requested by the ministry; and (b) conducting studies to evaluate and establish the overall petroleum policy. To do so, the Directorate of Hydrocarbons within the MEM is the NPC's ex-officio advisor. This practice establishes a conflict of interests between those regulating and those being regulated.

3.18 Second, at the technical level, even though the Directorate of Hydrocarbons is suitably structured in theory to monitor and regulate petroleum industry operations, it does not have the experienced and trained personnel to implement an active promotion campaign; this became clear during the last promotion campaign.

Need for a Focused Promotional Effort to Exploit Hydrocarbon Potential

3.19 Future production estimates take account only of the fields that the current oil producing companies, Basic Resources and Pam Petroleum, plan to set on production, and excludes any potential oil discoveries that could result from new exploration efforts. Projected production until the year 2000 was assessed, showing for each field a nine-year production forecast based on proven, probable, and possible reserves. The depletion rate was estimated at between 15 and 25 percent for oil fields and 50 percent for individual wells (Annex 10).

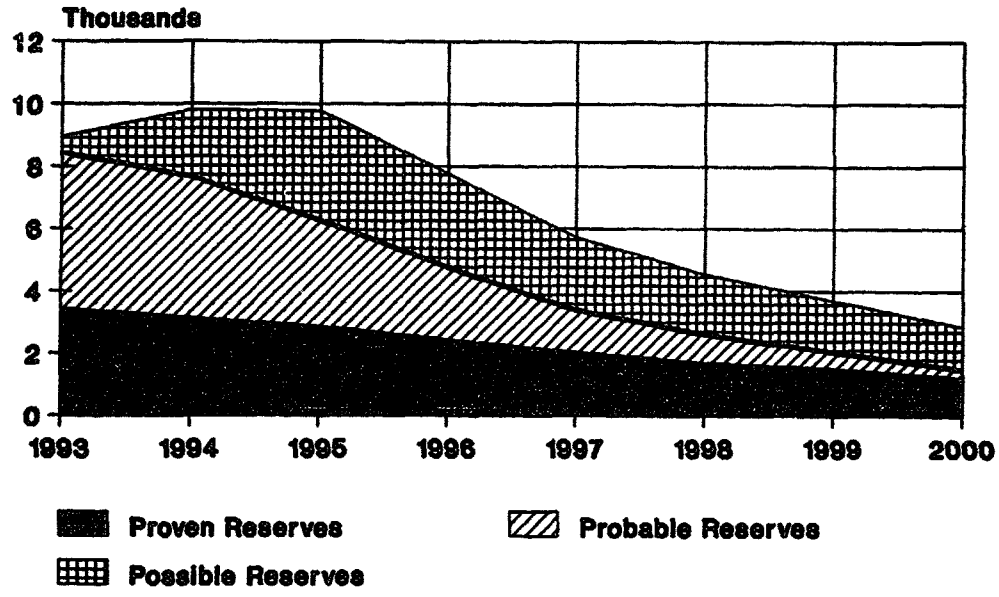


Figure 3.2 Guatemala: Oil Production Forecast, 1993-2000

3.20 The estimated "technical" depletion rates of 15 to 25 percent per year for oil fields, and 50 percent for individual oil wells do not necessarily reflect the optimal "economic" depletion rate. Because production cost data were not available, the mission did not conduct a marginal cost analysis for individual fields. Such knowledge would enable better decisions regarding the adjustment of production levels of individual fields and the development of new ones vis-à-vis international oil prices. Marginal cost analysis is not presently performed by the staff at the Ministry of Energy. However, this information is critical to evaluate rates of return for hydrocarbon development properly.

3.21 This estimated depletion rate shows that proven remaining recoverable reserves, established according to oil industry practice, amount to about 21 million barrels. The Xan field accounts for more than 50 percent in this estimation. Probable remaining recoverable reserves, geologically estimated as a reasonable complement to the already proven recoverable reserves, would reach 18.5 million barrels. Possible remaining recoverable reserves, appraised on the assumption that all geological forecasts prove out to their most optimistic option, amount to 17.5 million barrels.

3.22 The oil production profile in Annex 10 shows oil production from proven reserves maintained at a level of approximately 8,000 bd until 1994, declining to about 5,000 bd in 1997, to about 3,000 bd in 2000, and continuing until reaching the economic limit for a few years

thereafter. Exploitation of probable reserves would result in maintaining a production of approximately 8,000 bd until 1997, when production would begin declining to about 4,500 bd by year 2000.

3.23 If possible reserves are brought to light in the near future, a high production rate would be maintained longer and the decline would be to 6,000 bd by the turn of the century.

3.24 As a very preliminary estimation, based on the discovery of new fields in the southwest portion of the Petén Basin, south of the Mexican border, and the existence of two provinces of oil producing patch reefs, the hydrocarbon potential of the Petén basin may be up to nine times higher than current proven oil reserves, or about 180 million barrels of oil recoverable in place.

3.25 As can be seen, the estimated hydrocarbon potential of the Petén basin justifies a new—well-designed and appropriately focused—promotional effort. In this effort, the government should take stock of the factors that have elicited negative responses from the oil companies proposals for exploration or that have forced the companies out of the country. In 1987, 85 oil companies attended a promotion seminar organized by the MEM, and 6 of them bought the technical-contractual package, yet no contract was finalized. In November 1991, 120 companies attended another seminar in Houston, and 34 sent teams to Guatemala to deepen their evaluation, yet only one presented a proposal to explore. One of the reasons for the lack of success has been the weak institutional capacity of the MEM—more specifically of the Directorate of Hydrocarbons—to organize and supervise the promotion campaigns.

Alternative Promotion and Production Strategy: Current Production and New Promotion

3.26 The proposed strategy has two objectives: to reverse the current decline in production and to increase exploration efforts. Rather than focusing only on a new promotion campaign—a strategy that has proved has proved unsuccessful in the past— the mission has recommended efforts to reverse the trend in current production while a new exploration campaign, designed along lines described below, is undertaken in parallel. As a first step toward reversing the decline in production, a consulting firm with experience in production from fractured dolomite with pressure problems should undertake an enhanced study.

3.27 To address new exploration as an objective, a sustained promotion effort should aim at small and medium-sized oil companies with substantial experience in production from fractured dolomite with pressure problems, for the western part of the Petén basin, and at medium-sized or major companies interested in the development of frontier areas such as the northeast portion of the Petén basin.

3.28 To implement this objective, the strategy to promote exploration should include components related to the organization of the campaign and components addressing regulatory and institutional issues. On the former, the promotion team, properly advised, should aim at

medium to small-sized independent oil companies, and be supported by an updated data package and with individual or small group presentation sessions.

Box 3.1 Oil Industry Incentives

Oil companies are mostly attracted by proven oil provinces (i.e., countries where substantial oil potential has been ascertained). In favorable conditions, companies are willing to invest exploration risk capital and to operate under relatively stringent contractual terms to the benefit of the host country. Conversely, where exploration risks are high, they may agree to gamble against dubious chances of success if the host country's legislation provides some incentives to compensate for the risk. Guatemalan exploration appears to be between the two extremes, but the oil finds are confined to a relatively restricted area (the Petén Basin) and so far seem small. It is therefore in the country's interest to stimulate further exploration so that its petroleum potential can be assessed fully. This can be done through a set of actions aimed at attracting risk capital to an insufficiently known geologic environment.

3.29 This should be supplemented by having the Directorate of Hydrocarbons reorganized and properly staffed and by improving relevant information, including reprocessing selected seismic sections in the north Petén basin to define exploration plays and as an appropriate tool to oil companies. Reprocessing data on oil potential in the northeast Petén basin, where seismic data is scarce, is also recommended.

3.30 At the regulatory level, the MEM and the environmental agency, CONAMA, should jointly establish specific guidelines for the operation of the oil industry.

3.31 Annex 11 shows the impact of the introduction of a flat royalty, rather than a royalty rate based on the API gravity, tied with an earlier government participation in production and recovery of capital costs for the company. Table 3.1 summarizes the results. Overall, though the government's share is reduced, the loss is compensated by an earlier participation in production sharing, which is particularly attractive at a time when the government is trying to increase its fiscal revenues. Annex 12 shows other recommended changes to current regulatory provisions.

Table 3.1 Summary of Simulation Showing Financial Impact on Government and Company of Actual and Revised Contract

Recoverable reserves (MMbs)	30.0
Field life (years)	8.0
Exploration investment (MM$)	31.5
Operation expenditures (MM$)	28.0

Factor	*Measure*	*Present contract*		*Revised contract*[a]	
		Case A	*Case B*	*Case A*	*Case B*
Development investment	MMUS$	60	78	60	78
Technical cost	$/bbl	4	4.6	4.8	4.6
Selling price	$/bbl	13.8	16.6	13.8	16.6
Company's position					
Net cash flow	MM$'90	97.8	120.4	104.4	128.6
NPV at 10%	MM$'90	16.3	22.1	18.9	25.4
IRR	%	14.9	15.8	15.6	16.5
Government take	MM$'90	196.2	238.3	189.6	230
Government to company profit ratio	%	67/33	66/34	65/35	64/36

Note: NPV = net present value; IRR = internal rate of return.

Source: Mission estimates (see Appendix 11).

[a]Application of flat royalty 10 percent, allocation of 10 percent production to shareable oil (to government). From startup of production and recovery of interests (e.g., 10 percent) on development investment.

3.32 **Lessons from the Past.** Guatemala still has a large, untapped petroleum potential. The current legislation requires minor adjustments to make it more attractive to prospective exploration companies; however, to increase the chances of success actions must be taken on both the regulatory and institutional fronts regarding regulatory reform. The following actions should be taken:

- *Preparation and implementation of environmental regulation regarding petroleum exploration and production.* Inaction on this front will be an obstacle to attracting serious and professional oil companies.

- *Modification of the current fiscal regime by setting a flat royalty rather than the current sliding scale system, and allocation of a percentage of production as profit oil from the beginning of production.* Annex 11 shows the financial results for both the government and the oil companies.

- *Preparation and implementation regulation to use the Basic Resources–owned pipeline in the Petén Basin on a common carrier basis.* As it is today, Basic has a de facto monopoly for exploration and production in the Petén basin.

3.33 In addition, on the institutional front, the country should launch a new promotion campaign aimed at both secondary recovery and exploration. However, to ensure a greater probability of success, there is a need, first, to organize the Ministry of Mines and Energy so that is more fully prepared to attract new oil companies to Guatemala and so that it can effectively monitor the activities of the oil companies currently operating in the country. This will require better efforts to retain trained and qualified staff, build up the capacity in economic and environmental assessments, and improve communications both internally and with the National Environmental Comission (CONAMA).

B. Downstream Petroleum Operations

3.34 This section focuses on regulatory reform in downstream petroleum operations, including modifications of barriers to entry, operation, and exit. First, some background is given on the current size of the market and on suppliers and regulation; Annex 13 provides basic statistics about the downstream petroleum sector. The discussion then turns to the genesis of the current regulatory framework and options to increase efficiency.

The Government's Role and Its Effects

3.35 The government, through the MEM and the Ministry of Defense, is responsible for proposing and enforcing regulatory aspects related to entry and exit, namely: ex-refinery and retail prices (MEM), taxation systems to be approved by Congress, the importation of crude and petroleum products (MEM), and construction of bulk terminal facilities and gas stations (Ministry of Defense). Indeed, one could conclude that the regulatory system has all the characteristics of a cartel, but in this case established by the government (i.e., prices and margins set by the government, allocation of demand quotas by the government, and regulation of admission to the industry also by the government).

3.36 As shown in Annex 14, the current pricing structure was designed to ensure certain levels of fiscal revenue through the introduction of compensation funds in the pricing structure. In practice it is a very straightforward breakdown, but without economic basis for its determination. The result is a price structure without transparency and under the discretion of the political momentum. In terms of its effect on market behavior, the price structure eliminates any incentive on product importers to be competitive, for prices are set at the level of the ex-refinery price, which tends to be higher than import prices. In addition, it locks the market into a cost-plus system without consideration for efficiency. As an indication, Table 3.2 compares ex-refinery prices with ex-terminal prices of imported products.

Table 3.2 Comparison between Prices Ex-refinery and Prices Ex-terminal of Imported Petroleum Products, 1990
UNITS: Qt/gal

Products	*Ex-Refinery*	*Ex-Terminal*	
		Ex-S. Jose	*Ex-GUATCAL*
Premium	2.33304	2.21296	2.19954
Regular	2.15630	2.04894	2.03660
Jet-Kerosene	2.82793	2.39088	2.18533
Diesel	2.40374	2.20295	2.07847

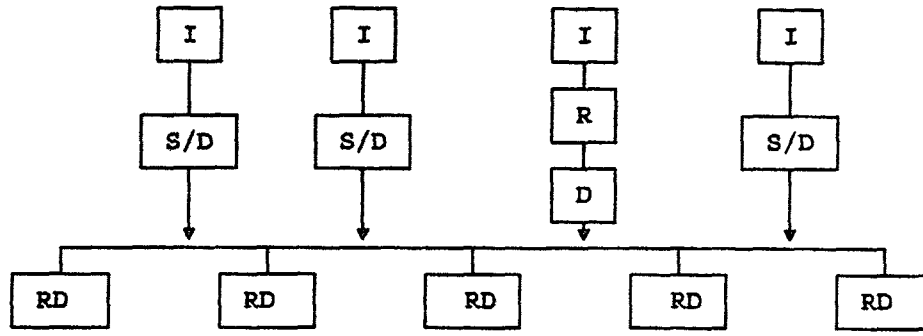
Source: Ministry of Energy and Mines.

3.37 The government has also had an exclusive role in the importation of crudes under the San Jose Accord. Under the accord, 20 percent of the petroleum bill is available as a credit with a fixed interest rate of 8 percent over a period of five years. Currently, 50 percent of these funds comes in the form of lines of credit; the rest is financed from the FIV (Venezuelan Investment Fund), which the Ministry of Finance allocates for a term of 12 years and an interest rate of 6 percent. In 1991, about 50 percent of crude imports came from Venezuela at a cost of US$62 million. Thus, foreign funds of about US$12 million were available. Between 1976 and 1990, this form of financing has been used almost exclusively (77 percent) by INDE. About US$18 million of INDE's US$653 million debt, as of end 1991, is with the FIV.

3.38 The benefits and costs of the San Jose accord go beyond the energy sector. As long as foreign exchange is in short supply, any scheme that provides foreign exchange credit acquires a value in excess of alternative options to import petroleum products. The experience of other countries has shown that the San Jose accord is becoming less relevant as the economic adjustment programs take place. In some ways, the original justification for the accord—to provide balance of payments support—is becoming less of an issue.

Structure of Private Sector

3.39 As structured, private companies operate under a vertical or integrated structure in terms of imports, storage, and distribution, as shown in Figure 3.3.



Legend

I = Imports
S = Storage
D = Wholesale Distribution
R = Refinery
RD = Retail Distribution

Figure 3.3 Current Institutional Structure of the Guatemalan Petroleum Sector

3.40 The level of vertical integration observed in Figure 3.3 indicates both the limited size and the restricted nature of the downstream business in Guatemala. As market demand grows in the future, one could expect the emergence of new local marketers, as has happened in countries with conditions similar to Guatemala's (i.e., Jamaica and Honduras).

Demand

3.41 Guatemala presents the conditions for a growing petroleum market that will average growth rates of about 5 percent in the next five years. Petroleum demand is rebounding to the level reached in 1980.

3.42 Total market demand for oil products in 1991 was about 27,500 bd (10 million barrels), still below peak demand of about 30,136 bd (11 bbl million per year) in 1980. As Figure 3.4 shows, market demand in the last 12 years has been biased toward automotive fuels. Even though the 1982-91 period recorded growth rates for petroleum products of just 1.6 percent annually, the economic recovery has brought in the 1988-91 period growth rates of about 6 percent annually. Based on past demand patterns and future economic growth, total demand is expected to grow at 5.2 percent annually for clean products and about 4 percent annually for fuel oil. Thus, by 1995, total demand is expected to be about 34,000 bd, an 11 percent increase above the 1980 level.

3.43 The drop in demand in 1986 to 7.4 bbl million coincided with a GDP decline of about 1.4 percent per year in the 1980-85 period. By 1988, petroleum demand had increased at an average rate of 5 percent per year. In 1986 fuel oil consumption was 27 percent of 1980 levels; this is explained by the entrance in operation of the hydroelectric plant Chixoy. Ironically, the drop in fuel oil consumption also coincided with a drop in crude oil prices in the petroleum markets.

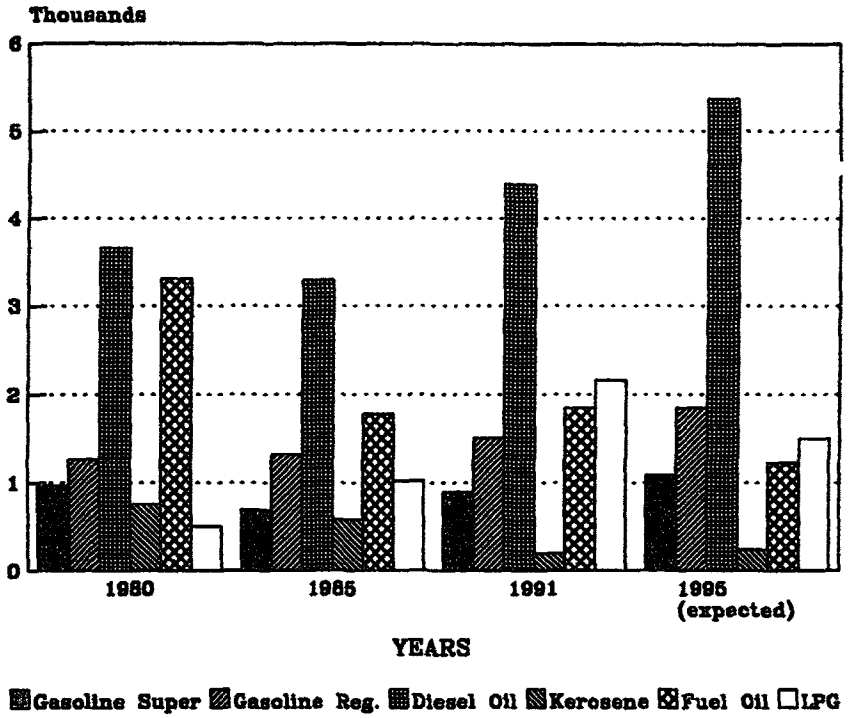


Figure 3.4 Historical Petroleum Demand (KB)

3.44 In terms of the geographic concentration of demand, in the metropolitan area of Guatemala City, 65 percent of the total consumption is concentrated, whereas the population represents only about a quarter of the total population. The per capita consumption of petroleum products in the metropolitan area is four times higher than the national average. The South Coast area represents 25 percent of the total market and the Petén area 10 percent. Vehicles are likewise concentrated in the metropolitan area.

Supply

3.45 **The Distributors.** Overall, the private sector is in charge of all logistical aspects related to the importation, refining, and distribution of petroleum products and crude, with the government playing the role of policymaker and regulator. The supply of petroleum products and crude is accomplished through two main channels: imported refined products and locally refined crude in an average proportion of about 50/50. The local refinery is owned by Texaco and operated by its local affiliate "TEXPET," but the crude, or spike, processed in the refinery is purchased by the government from Venezuela or Mexico under the San José Accord. Under the San José Accord, Guatemala has access to up to 20 percent of its petroleum bill at an interest rate of 8 percent and a payback period of five years. If the funds are to be used in economic development projects, particularly regional integration projects, the interest rate is 6 percent and the payback period is 20 years. Up to now, INDE has been the main user of this credit facility.

3.46 **Market Shares.** Petroleum products are currently distributed by the local affiliates of four major oil companies: Esso, Shell, Texaco, and Chevron see Figure 3.5. Chevron has recently withdrawn from the regional market (i.e., Guatemala, Nicaragua, and El Salvador), and sold its assets to Shell, which will have close to 50 percent of the market. The number of outlets in Guatemala (about 500) appears to be too high relative to the market's size and geographic concentration.

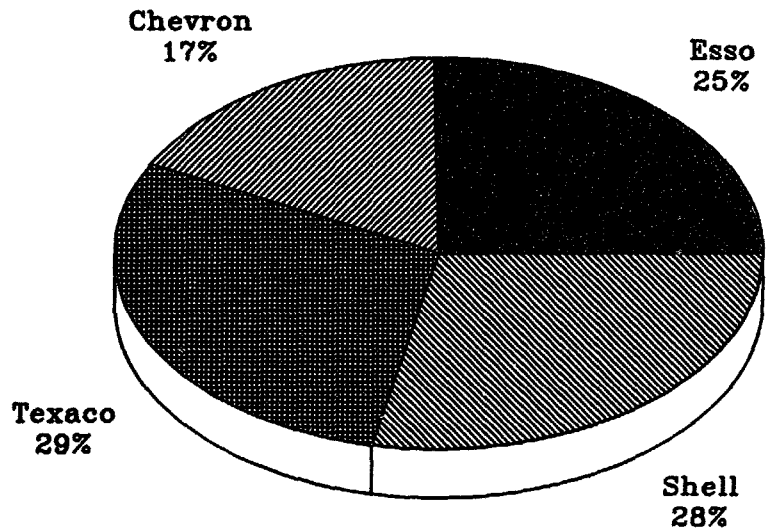


Figure 3.5 Market Share by Distribution Companies, 1991

3.47 **Import Ports.** Guatemala is in a very good position vis-à-vis import terminals, both in terms of the number of terminals—three—and in terms of days of available capacity—about 50 (see Tables 3.3 and 3.4). Hence, provided there is adequate regulation, storage facilities should not be a barrier to entering the market. To put it into a regional context, Honduras started the deregulation of the petroleum market with one terminal and an installed capacity of 200,000 barrels versus 1.7 million barrels in Guatemala.

Table 3.3 Guatemala Storage Facilities: Storage Capacity by Product

Product	*Total capacity (1000's bbls)*
Crude	610.0
Premium gasoline	127.3
Regular gasoline	237.8
Aviation gasoline	38.6
Kerosene	77.3
Jet fuel	20.4
Gasoil (Dicul oil)	517.2
Fuel oil	164.4
SUBTOTAL	1795.0
LPG	57.4
SUBTOTAL	1852.4
Nonutilized tanks	128.7
TOTAL	1981.1

Source: Departments de Transformation y Distribution, MEM Informe Estadistico 1988.

3.48 There are currently three active oil import terminals. Puerto Barrios on the Atlantic coast, operated by Chevron and Shell, has a total working capacity of about 500,000 barrels, or about 57 days of available capacity for the critical petroleum product, regular gasoline. Puerto San José on the Pacific coast, operated by Esso, has a working capacity of about 220,000 barrels. Texaco also has a facility on the Pacific coast, which produces about 500,000 barrels, mainly for crude imports, as well as a refinery in Escuintla that produces an additional 500,000 barrels. The installed storage capacity of fuel oil will be increased by about 200,000 barrels by the private operator of the power plant on the Pacific coast.

Table 3.4 Guatemala Storage Facilities, Crude and Products

Terminal	*Owner*	*Location*	*Capacity (1000's Bbls)*
GUATCAL	SHELL/CHEVRON	Puerto Barrios	508.2
TEXACO	TEXACO/GUATEMALA	Puerto Barrios1	23.7
Refinery	TEXPET	Escuintla	513.6
Terminal	TEXPET	Puerto S. José	508.8
Terminal	ESSO	Puerto S. José	219.6
DEPOTS	ESSO, SHELL, TEXACO, CHEVRON	Guatemala City	

Note: DEPOTS = Transit depots of each company.

Source: Departments de Transformation y Distribution, MEM .

3.49 With the exception of "Terminales de Gas" in the harbor area of the port of St. Tomas de Castilla (29,800 barrels), the LPG depots are relatively small, consisting of tanks connected to filling plants. Field visits to LPG plants revealed poor maintenance and hazardous conditions, particularly at the terminal in Puerto Barrios.

3.50 **Local Refining.** Texaco has the only active refinery, a 17,000 bd hydroskimming facility with the yields of production given in Table 3.5.

Table 3.5 Petroleum Product Demand and Production, 1990

	Local production		*Imports*	
Product	*kbbl*	*%*	*kbbl*	*%*
Gasoline	1170	45	1450	55
Jet/kerosene	376	66	193	34
Diesel	1665	46	1967	54
Fuel oil	1042	100		
LPG	59	5	1042	95
Other			190	100
TOTAL	4311	47	4842	53

Source: MME.

3.51 As in other Central American countries, the refinery operates under an unwritten cost-plus arrangement that guarantees a US$3.5 million net income provided the refinery operates above 10,500 bbl/d capacity. Any increase above that threshold provides the refinery with a premium. In an open market, the profitability of the refinery would be given by the spread between the unit cost of the feedstock and the average selling price, and its opportunity cost would be given by direct product imports from larger refineries with secondary conversion capacity in the Caribbean and the U.S. Gulf coast. Overall, in an open market, hydroskimming refineries operate at a loss when running Mexican and Venezuelan crudes; the refinery in Guatemala is no exception.

3.52 A comparison of refining spike crude versus product imports through the Pacific shows a benefit of about 1 to 1.5 US$/bbl of importing products. At an average refinery load of 70 percent, this amounts to about US$6 million per year. This situation can change depending on the type of crude, load at refinery, and price differential between crude and products.

3.53 However, rather than evaluating the least cost supply option – a moving target in the petroleum business – the government should create the environment to allow that decision to be taken by the private sector participants. Under that scenario, profits and losses will be a consequence of the refinery's level of efficiency vis-à-vis import parity prices. The refinery may be able to compete given its logistical position by a good import port in the Pacific and the San José-Escuintla pipeline, which will reduce internal transportation costs.

3.54 Hence, the proposed regulatory and institutional structure would aim at increasing efficiency by encouraging competition. However, to ensure that the proposed framework is better than today's, competition requires certain conditions. Most important, the market must contain many firms with none dominant, allow free entry and exit, and exhibit no externalities; among these conditions, free entry and exit is perhaps the most critical. Unfortunately, intervention in the market is sometimes required to ensure that profit objectives do not conflict with social welfare; this is the case with a natural monopoly (when it is optimal, from a cost perspective, to have only one firm). In the petroleum business, transportation of products in pipelines and refining show natural monopoly characteristics under certain levels of outputs. The levels of government intervention are described below.

Strategy for a More Competitive Market

3.55 To move toward a more competitive environment will require explicit government intervention in the transition phase, namely: (a) modification of current legal framework to allow free entry and exit in the sector; and (b) modification of the government's role to focus on quality control and safety and environmental standards, ensuring that competitive conditions exist while penalizing cartel behavior. Both aspects are dealt with in more detail below.

3.56 Regarding the first point, the government, through the MEM, already has capable staff to deal with the downstream sector; to change the focus of their work would require strengthened capabilities in regulatory economics. However, an enforcing agency dealing with dumping or cartel practices would still be needed. This should be approached on a multisectoral basis. In the interim, a modification of the law of commercialization of petroleum products could satisfy the immediate needs of moving to a more open market.

3.57 The government, petroleum industry, and consumers of Guatemala may legitimately ask many questions for which the experience and evidence in other countries with similar characteristics to Guatemala (i.e., Bolivia, Jamaica, and Honduras) could offer some answers. Some of these questions include the following: What will likely happen to retail prices and margins once they are liberalized? How will fair competitive conditions between gas stations owned by wholesale distributors and local investors be ensured? Will the refinery survive? Will government revenues drop? Will the opening of the market to importers without safety standards lead to oil spills?

3.58 As a point of departure, it must be remembered that the main objective is to increase the efficiency of the supply and distribution system. Efficiency is seen in the quality and reliability of products, cost of products, investment capacity to expand and satisfy growing demand, and economic prices. The last 15 years have seen negligible investment, local cost of products above their competitive price, and prices that are inefficiently manipulated by the government.

3.59 To move forward, the evidence has shown, efficiency through competition must take place at three levels: quality of products, quality of service, and prices. To achieve that, the industry will have to adjust. This implies the following:

a. The refinery will have to structure its operations to use the import parity of petroleum products as a yardstick. When this change took place in Honduras (January 1993), the Texaco refinery there had to shut down operations, mothball the refinery. and convert to a products terminal.

b. Prices will have to be liberalized. In Jamaica, liberalization led petroleum companies to react to their FOB cost and to adjust margins upward in order to consolidate. In Chile, price wars broke out in the Santiago area, while quality and service became the competitive basis in other areas. In Honduras, distribution margins were adjusted upward, but some of the gas stations started to play with their retail prices to consolidate greater volumes and market share.

3.60 There are also different modalities to follow, according to specific circumstances. In Honduras, the first phase of the liberalization was the opening of petroleum imports, since about 60 percent of supply cost is allocated on the CIF portion; in the interim, the institutional and regulatory conditions were changed to allow a full liberalization of prices and margins. In Jamaica, the first phase included the liberalization of the domestic distribution market, including prices and margins, plus the establishment of an import parity formula. The second phase will tackle the operations of the state-owned refinery.

3.61 The lessons learned in other countries indicate the need to prepare a minimum set of conditions to open the petroleum markets, both during the transition phase as well as during the fine tuning required in full implementation. Institutionally, it requires a strong government entity to ensure that the market operates within established standards (i.e., safety, environmental, and quality).

Free Entry and Exit and the Private Sector's Role

3.62 To be able to compete effectively in the market place, private companies need a level playing field with no preference for any particular company or group; this includes equal access to foreign exchange, environmental standards to ensure that substandard operators are not allowed to continue in the business, and no fixing of prices and margins. The oil industry lends itself to competition, and it also lends itself to oligopolistic behavior when unchecked. Hence, the need is for clear legislation spelling out rewards for efficiency and penalties for inefficiency.

3.63 The main factors affecting entry and exit are the subsidiary legislation for the construction of bulk storage terminals, the construction of gas stations, and the commercialization of hydrocarbons (decree #130-83). Such legislation should only establish the technical, safety, and environmental conditions under which such facilities should operate; as it is, the legislation gives unnecessary discretion to the government in terms of commercial risks—i.e., limiting

distances between gas stations, requiring an economic analysis from the Ministry of Economy to authorize construction of oil terminals; (Article 20).

3.64 Under the current structure, the oil companies' import and distribution operations are vertically integrated, including storage of imports (Figure 3.6). Experience in other countries has shown that in the initial phases of market liberalization, some companies with storage facilities tried to retain a de facto monopoly by blocking access to their facilities or raising thruput fees to a level at which it was uneconomical for other companies to import. In such a situation (provided that the law has been streamlined), new construction of oil terminals occurs.

3.65 In the case of Guatemala, the government has given concessions to Shell/Chevron in the Atlantic and Esso in the Pacific; the former is under litigation and the latter has to be renewed in the next three years. Additionally, the government is the owner of the El Penate facilities in the Pacific. To remove barriers to storage facilities in the initial years, the government should begin negotiations to renew the concessions with Esso and Shell or any other private sector company willing to operate as only a terminal operator, or willing to give access to third parties under agreed economic rules to be established by the government. The distinction here is that unlike under vertical integration for imports and transport/storage, the terminal operator would have no incentive to block potential importers.

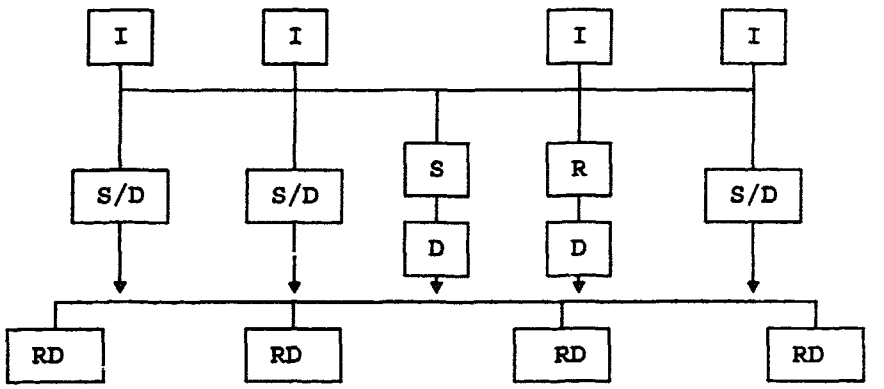


Figure 3.6 Institutional Structure of Petroleum Sector under Open Access to Storage Facilities

3.66 **Taxation.** Another barrier to a free market is the current pricing and taxation system. As structured today with the adjustment/compensation fund, revenues to the government could erode rapidly in an environment of changing international prices without adjustment of retail prices; indeed, that is exactly what has happened in the last eight months. To tackle this issue, pricing and taxation system must be established that responds to changes in

international prices and that keeps government revenues at current levels while being easy to administer.

3.67 At the import level, it has been argued that local refining provides added value and should therefore be protected from product imports by differentiation of import duties for crude and imported products. This argument does not apply to Guatemala, however, since it is not a refining center.

3.68 At the consumer level, retail prices have been set by the government as a function of fiscal revenues required; indeed, price formation starts at the retail level and works backward to accommodate fiscal requirements (see annex 14). The government receives the difference between the cost of the retail product and the retail price as revenue. To allow for cross-subsidization, government revenues, and the difference between ex-refinery and import prices, the price structure encompasses two compensation funds, named compensation refinery and compensation fund.

3.69 To make petroleum product price determination more rational and more in line with taxation of other products in the economy, the government proposed the following changes in 1992:

- Replacement of the variable sales tax with a 7% VAT.
- Introduction of a 10% import tax on petroleum products as well as crude oil.
- Replacement of the compensation fund ("ajuste compensatorio") with a specific tax with the following rates (in Quetzales per gallon):

-	Gasoline (premium and regular)	3.0
-	Kerosene, diesel, fuel oil, and LPG	0.5
-	Turbo jet	4.0

- Continuation of the refinery compensation.

3.70 To assess the effect of tax reform on petroleum product prices, consumption expenditures, and government revenues, a simulation analysis was performed. It can be shown that the reformed system is a step in the right direction, in the sense that it makes the structure of retail prices more similar to the structure of CIF prices, which can be regarded as opportunity costs. But the reformed system will still provide incentives for uneconomical fuel substitution between gasoline and diesel. Additional reforms should be implemented to eliminate this unwarranted feature while keeping fiscal revenues at similar levels.

3.71 The main areas for improvement in the government's enacted system are to substitute the refinery compensation fund for an explicit tax and to structure the specific taxes as a function of the cost of supply of imported petroleum products.

3.72 Under 1991 prices, costs, and consumption of petroleum products, the old tax and pricing system, called system A, generated Q 768 million revenue, about 63 percent of which (Q 484 million) in the form of the compensation fund. The reformed tax system, called B1, generates 25 percent more revenue, 54 percent of which (Q 964 million) is in the form of the specific petroleum product tax. If one were to eliminate the refinery surcharge, leading to a new tax system, B2, revenues would be slightly higher—3 percent (Q 24 million)—than under the old system A (see Figure 3.7).

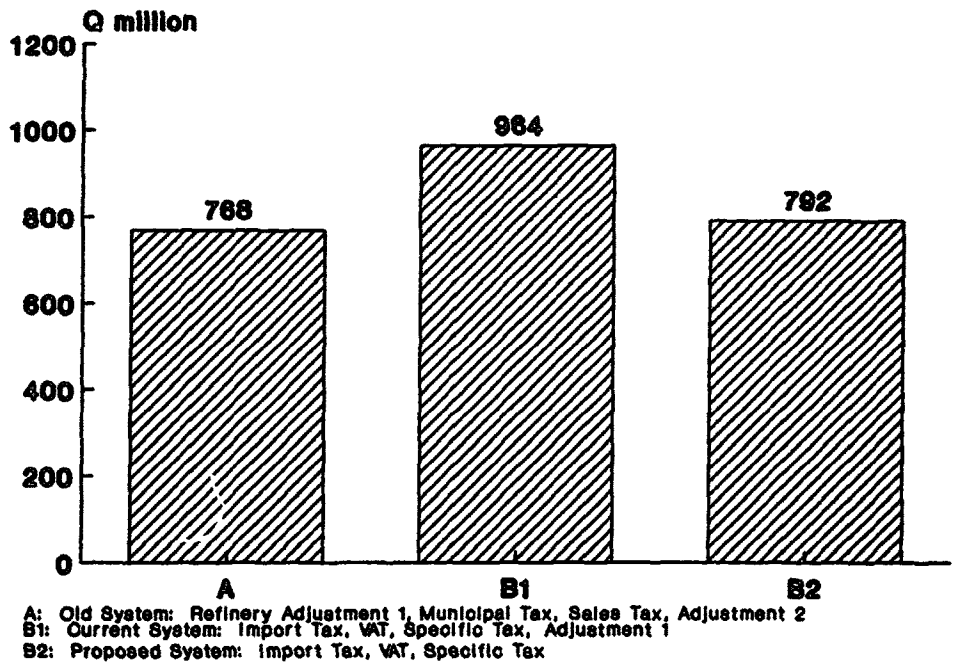


Figure 3.7 Guatemala: Government Revenue under Alternative Taxation System Downstream Petroleum Sector

3.73 The selected tax and price reform should result in the "correct" price level and structure of petroleum products. However, criteria for correct price level and structure have to be established. The most important ones are:

- *Economic growth.* Economically efficient allocation of resources in the energy sector should be based on the full, long-term marginal social opportunity costs. This principle should be applied if the rest of the economy is exposed to undistorted prices. This is most likely not the case and may be a reason to diverge from the efficiency principle.

- *Social objectives.* Welfare and income distribution considerations may warrant the subsidization of certain products in order to ascertain a minimum level of energy supply for poorer segments of society.

- *Financial objectives.* The energy sector should preserve its viability and autonomy by earning a fair rate of return and being able to self-finance investment; taxes on energy resources can be a means to raise required government revenue.

- *Other objectives.* Energy conservation, simplicity of energy pricing structure, promotion of energy price stability are representative.

3.74 The opportunity costs of fuel consumption in Guatemala, which is a net importer of petroleum products, are best approximated by the border (CIF) prices of petroleum products. As shown in Table 3.6 below, price systems A and B1 result in a price structure that diverges from that given by the international market. The substitution of the LPG subsidy for household use (under A) by a tax (under B1) is certainly a step in the right direction, resulting in prices that closer to the CIF structure. But while CIF prices are basically the same for gasoline, kerosene (jet fuel), and diesel, retail prices for gasoline and kerosene are at least 40 percent higher than diesel prices under system A. This large price difference between diesel and gasoline would be reduced only slightly by B1, while kerosene would only be slightly more expensive than diesel, reflecting the CIF price difference.

Table 3.6 Petroleum Products Price Structure under Alternative Taxation Systems

Parameters	*Regular*	*Kerosene*	*Diesel oil*	*Fuel oil*	*LPG cyl*
CIF price (Q¢/gal)[a]	361.9	350.6	330.3	156.3	275.26
Relative price (Diesel = 1)	1.09	1.06	1	.47	.83
Absolute retail price (Q¢/gal)					
A	895	845	595	340	300
B1	879	649	644	371	458
B2	879	583	566	362	458
Relative retail price (diesel = 1)					
A	1.5	1.04	1	.57	.50
B1	1.36	1.01	1	.57	.71
B2	1.53	1.03	1	.64	.80

Source: Mission estimates.

[a]CIF price is derived from 1991 weighted average SITCO FOB price, adding transport costs.

3.75 There are two obvious ways to deal with this issue: (a) a uniform tax rate (equal energy tax) on the CIF value of petroleum products; or (b) a differentiated tax rate to take account of externalities created by individual petroleum products (i.e., user fees). Both scenarios have been developed and are presented in Annex 15. Under the latter, the difference between

gasoline and diesel prices is much reduced, thus eliminating the incentive to switch from gasoline- to diesel-powered passenger cars. The second important change occurs with respect to LPG prices, which increase considerably, especially for household use. Since LPG is obviously not primarily consumed by poor households, there is no reason for subsidization or very low taxes. Poor households, especially in rural areas, consume fuelwood almost exclusively, with some kerosene and LPG. Thus, by lowering the kerosene price to 75 percent of its current retail price by taxing it relatively little (only 28 percent compared to the average 37.5 percent), there may be some incentive to switch from fuelwood to kerosene. This substitution could be further encouraged by a comprehensive stove program (see chapter 4). The government might consider subsidizing such stoves for the poorest households, instead of reducing fuel prices indiscriminately for all consumers through lower taxes or even subsidies (as in the case of LPG under system A).

Table 3.7 Petroleum Products Retail Prices under Different Specific Tax Rates

	Gasoline					*LPG*		
Rate	*Super*	*Regular*	*Kerosene*	*Diesel*	*Fuel oil*	*Cyl.*	*G+A*	*Jet fuel*
Tax rate	0.40	0.40	0.28	0.38	0.30	0.30	0.38	0.58
Retail price (Q¢/gal)	739	706	635	648	358	494	517	753
In % of current price	81	80	97	100	96	107	112	75

Source: Mission estimates.

3.76 It is proposed that in the process of deregulation, the government consider the introduction of additional reforms to the current taxation system with the objectives of narrowing the difference between gasoline and diesel prices and achieving revenue neutrality relative to the current system. The tax should continue to be levied as a specific tax, but with rates that are closer to those proposed in Table 3.7. To be more precise in the design of the taxation system, an end-use survey should be commissioned to analyze the use of petroleum products by different consumer and income groups in Guatemala.

Lessons Learned

3.77 Past practices of regulating the downstream petroleum sector through allocation of demand quotas, fixing margins and prices throughout the industry's chain, and establishing cumbersome rules to enter and operate in the market have led the sector to operate well above its economic cost, hampering investment, distorting the relative price structure at the consumer level, and, consequently, reducing government revenues in the absence of an explicit taxation system. Overall, the downstream sector has had negative effects on consumers, suppliers, and the central government. To reverse this trend, the introduction of competition and liberalization of prices and margins is a feasible tool for a country with an infrastructure, human resources, institutions, and a market like Guatemala's.

3.78 To proceed with the liberalization of the downstream sector, the following actions are required:

- Establish regulation that will define streamlined and safe procedures for authorizing the installation of bulk storage terminals and gas stations. Current procedures are cumbersome and create barriers to entering the market by establishing minimum distances between gas stations.

- Phase out the current pricing structure, including the refinery compensation fund, by establishing a direct taxation system along the lines defined above, including the establishment of equal import duties for crude and petroleum products.

- Shift the functions of the MEM from price fixing and allocating quotas to quality control and supervision of competitive practices. This will require modifications to the current regulation pertaining commercialization of petroleum products and training for the current staff in the MEM.

- Eliminate price controls, guaranteed margins to the oil companies in the supply and distribution chain, and the cost-plus system to the refinery, allowing it to operate as a free market enterprise.

4

Fuelwood and Household Energy Demand

4.1 Fuelwood accounts for the largest share of total energy demand in Guatemala (about 60 percent of total energy consumption). In the household sector alone, fuelwood accounts for about 95 percent of energy consumption. The industrial sector also consumes fuelwood. For the near future, fuelwood will remain the main energy source. Hence, a steady supply of fuelwood must be provided in an environmentally and economically sound way. The design of the National Forestry Plan (PAF) is a step in the right direction, but much remains to be done.

Objectives of the Chapter

4.2 The objectives of this chapter are to present an overview of supply and demand of fuelwood and its impact in the forestry sector, and to assess the weight of fuelwood demand in the energy demand structure of the household sector with respect to expenditures and interfuel substitution.

4.3 The assessment of these two objectives reveals that even though fuelwood consumption is significant, it is by no means the main cause of deforestation (colonization and forest fires are). In addition, the energy pricing policy for the 1980s in the household sector provided subsidies to electricity and LPG. This policy benefited only about 5 percent of the households because the bulk of households consume fuelwood, the price of which is market determined (indeed, fuelwood is the most expensive source of energy under current supply conditions).

4.4 The chapter is broken down into two sections: (a) fuelwood supply and demand, and (b) household energy demand.

A. Fuelwood Supply and Demand

Institutional Aspects of the Forestry Sector

4.5 Several government agencies and NGOs are involved in the sector. The Directorate General of Forestry Services (DIGEBOS), in the Ministry of Agriculture, is the leading institution in the sector. It has three main responsibilities:

- *Control and development of the forest.* Protect against fires, disease, insect attacks and illegal grazing; collect, clean, store, distribute, and sell forest seed; and supervise, and evaluate, and support forest-based industries.

- *Reforestation.* Protect watersheds and water sources for consumption and irrigation; back community forests for fuelwood production; conduct silvicultural research and support the planting of fast-growing multipurpose tree species by small and medium-sized farmers; disseminate improved cookstoves; and support natural forest management and reforestation of commercial forests and semi-arid areas through tree seedling production as well as agroforestry activities.

- *National parks and wildlife.* Carry out administration and development of parks and recreation areas; protect the flora and fauna threatened by extinction and promote their reproduction for conservation and commercial purposes; and participate in environmental education of the general population.

4.6 The implementation of these tasks has proved beyond DIGEBOS' capabilities. Part of the problem is that DIGEBOS has too many roles. Apart from DIGEBOS, the executive branch, through the vice president, has a series of forestry projects and the MEM participates in energy plantations. Even though fuelwood is the main energy source in Guatemala, the issue of concern is that the forestry sector, including fuelwood supply, has not been managed as a crop-oriented business but rather as a mining operation. This is shown by the high rate of deforestation, the low aggregate value of the forestry sector in the economy, the low rates of reforestation, and the inadequate quality and quantity of human resources in DIGEBOS.

Fuelwood Supply

4.7 Traditionally, the fuelwood market has been classified as noncommercial. However, in Guatemala about 51 percent of fuelwood demand is obtained through established commercial markets, which leads to a commercially active market with sales of about US$250 million in 1991, almost twice the electricity sales for that year.

4.8 **Regional Availability.** No nationwide comprehensive forest inventory exists for Guatemala. According to the latest estimates, 43,700 km^2 (40 percent) of Guatemala's total land area of 108,889 km^2 is tree-bearing land (see Map 22711). In international terms, this is a relatively high percentage of forest cover. It suggests that fuelwood shortages in particular areas result from distribution problems rather than a general supply shortfall.

4.9 For an indication of the country's forest productivity, mean annual increments were estimated (Table 4.1). The figures were derived from discussions with foresters involved in the development of the forest action plan and they take into account experiences in other countries.

Box 4.1 Basic Facts about the Forestry Sector and Fuelwood Markets

- Forests cover 37,620 km^2 or 34.5% of Guatemala's total land area.
- Annual deforestation rate 500-600 km^2.
- Deforestation: 16% takes place in the Petén area, due mainly to clearing for agriculture and fires.
- Annual consumption of forest products:
  - Fuelwood:15.0 m^3- to 16 m^3 million
  - Forestry industry 0.11 m^3 million.
- Mean annual increment: 16.5 m^3 million.
- Forest Engineers in the country: 8
- Forest products trade in 1988:
  - imports:US$ 43.8 million.
  - exports:US$ 9.4 million.

Table 4.1 Supply/Demand Balance
(Excluding El Petén)

Forest type	*Area (Ha)*	*Annual growth* of biomass (m^3/ha/yr)*	*Total growth (m^3/yr)*	*Demand (m^3/yr)*
Broadleaf	838,000	1.4	1171200	
Coniferous	460,000	2.6	1196000	
Coffee Plantation	204000	6	1224000	
Matorrales	3735000	2	7470000	
Farmland, hedge rows, river banks	3702000	.5	1851000	
Forest plantations	25,000	15	375000	
TOTAL	8,964,000		13,289,200	15,041,000

*The stem growth rate is taken to average 3.5 m^3/ha/yr, and 10.5 m^3/h/yr for broadleaf and coniforeus species, respectively. The growth rates used in this table take note only of the tops and branches of these trees.

Sources: Mission Estimates, DIGEBOS.

4.10 In determining fuelwood supply in Guatemala, supply from the Petén region was excluded. The Petén encompasses approximately 21,700 km^2 of forest area, with a mean annual increment of biomass of about 3 million m^3. The Petén generates a timber surplus, but it is neither a source of fuelwood for the rest of the country nor a demand center for fuelwood. Thus,

annual consumption and growth of fuelwood in Guatemala, excluding the Petén, are about 15 million m^3 and 13.3 million m^3, respectively. This results in a deficit of sustainable supply over demand of 2 million m^3. In this circumstance, demand could be satisfied only by reducing the stock of standing trees, thus contributing to deforestation. But since adequate data on forest inventory and growth rates are not available, growth estimates may be underestimated. Regional deficits can be found, particularly around Guatemala City.

4.11 A *critical area* is defined as an area where the harvesting methods of trees result in average yields lower than normal. The fuelwood-short regions either import it from the surplus regions or cut more wood from their own reserves than can be sustained by natural regrowth. The areas around Guatemala City and Quezaltenango are classified as "very critical," whereas the Altiplanos Occidental and Central and the watersheds of the Rios Chixoy and Motagua are "critical."

Box 4.2 Basic Economics of Forestry

The essential characteristic of *supply* is that fuelwood is part of a long-lived asset. The capital used in the production of fuelwood are trees/forests, which are subject to certain biological rates of growth. This aspect leads to a dynamic supply and demand picture in which current use affects subsequent production. In perfect markets, where individual farmers own the trees, the rate of production of fuelwood would be such that its price would be equated to the price of other capital goods (i.e., the interest rate). It, in turn, would be equal to the social rate of discount. The socially optimal rate of depletion of the asset tree/forest may lead to a constant stock, but it may also be growing or declining. This depends, among other things, on the opportunity costs of the forest-bearing land. In reality, markets are not perfect. This is certainly true for capital markets in developing countries. Producers as well as consumers normally can borrow only at very high rates. The result is the overexploitation of forests. This effect is exacerbated by the common ownership of forests and the existence of environmental externalities.

4.12 **Supply Measures.** One way to reduce the supply deficit is to increase supply via agroforestry projects. For example, the Piramide project, as proposed by the Forest Action Plan, is designed to promote the self-sufficiency of 148,700 small and medium-sized farmers in fuelwood and other wood products. The plan projects the annual production of 1.5 million m^3 of woody biomass through the planting of 74,350 ha of fast-growing multipurpose trees. Agricultural crops may be planted between the rows of the saplings during the initial two-year period. The drawback of the plan is the lack of a trained technical staff to supervise its implementation and to monitor production. Although an NGO may act as the executing agency of the project, it must still draw from the same pool of scarce forestry expertise.

4.13 In financial terms, fuelwood from the multi-use plantation earns a positive return. All costs incurred during growing, harvesting, storing, and transportation are allocated to other wood products such as poles, which fetch higher prices.

4.14 A dedicated fuelwood plantation yields a greater volume of woody biomass and commands a higher fuelwood sales price. Its operation yields a negative net revenue, since all growing and logging costs are allocated to the fuelwood crop. The analysis indicates that dedicated fuelwood plantations are not financially viable and cannot compete with either multi-use forest plantations or natural collection from matorral and coffee plantations (Annex 16).

4.15 **Fuelwood Market: Prices and Distribution Channels.** Fuelwood prices have increased in constant terms in the last six years at a rate of about 10 percent annually. By contrast, the prices of petroleum products and electricity have remained constant.

Table 4.2 Fuelwood Prices, Guatemala City, 1980-1992

Year	*in current q/carga*	*in constant 1980 q/carga*
1980	6.1	6.1
1982	5.9	5.2
1984	5.5	4.5
1986	8.4	4.2
1988	10.6	4.6
1990	22.0	7.4
1992	25.0	7.6

Sources: INE, Mission Estimates.

4.16 Fuelwood is usually transported to the capital and to other urban locations in pickup trucks or in larger vehicles. In this informal market, truck owners set prices at the wholesale and at the retail level according to market conditions. Truckloads are described as containing so many "tareas," each the equivalent of 1.5 steres (1.5 piled m^3) of fuelwood. A tarea contains five "cargas," the basic unit for pricing. For domestic sale, the wood is usually split into smaller pieces called "leños," each weighing from 0.6 to 0.8 kg. For use in small-scale industries, the wood is sold as received from the trucker.

4.17 A closer analysis of the distribution channels for fuelwood and wood logged for industrial purposes shows that a significant portion of the economic rents are captured by the truckers and the owner of the woodyard (Annex 17). The annual volume of wood logged for industrial purposes is 200,000 m^3, exceeding the 120,000 m^3 for which permits were issued by DIGEBOS in 1989. A way to capture that part of the rent for society (government) is through a stumpage fee.

4.18 The new forest law establishes a stumpage fee, but the new rates are not related to the costs of logging, extraction, or manufacturing. They are based on the price that experienced loggers and sawmillers say they would be willing to pay for standing timber. Rates are fixed for each region and make no allowance for differences in access or logging conditions within that region.

4.19 **Lessons Learned.** The weak institutional structure for managing fuelwood supply is the main issue affecting the forestry sector. The strengthening of the management of fuelwood supply would seek to transform the fuelwood market from the current extractive or mining characteristics to a more open business- or crop-like market through agroforestry projects. The introduction of multiuse tree plantations or agroforestry projects is one of the most effective ways to supply fuelwood and reverse ecological damage, particularly on steeper slopes. The area required to eliminate the gap between sustainable fuelwood supply and demand is relatively small, around 100,000 to 150,000 hectares. However, even this modest amount will require a stronger institutional framework to provide extension services.

B. Fuelwood and Household Energy Demand

4.20 The household sector is the single largest consumer of energy in Guatemala. Fuelwood, which is utilized above all for cooking purposes, represents the most important energy source (see Table 4.3). Still, reliable surveys on demand patterns by fuels and by income group are not available; this is an area requiring urgent attention from the government, particularly in view of the links between tax and price reforms related to the deregulation of downstream petroleum operations, and opening the power sector to private sector participation in distribution.

4.21 Despite this caveat, the analysis of the last energy survey, carried out in 1985, shows an energy demand structure in the household sector with the following characteristics:

a. Fuelwood is almost completely used for cooking purposes (93 percent); 77 percent of fuelwood is consumed in the rural region, while the Guatemala City region consumes only 6 percent.

b. Kerosene is mainly used for lighting (70 percent), all of which is in the rural region. The remaining 30 percent is for cooking purposes, only 4 percent of which is in the rural region.

c. Nearly all (99 percent) of LPG consumption is used for cooking. LPG use is concentrated in the Guatemala City region (54 percent) and in the urban region (30 percent), but is marginal in the rural region (16 percent).

Table 4.3 Energy Consumption in the Residential Sector by Use and Fuel (Tcal)

End use	*Fuelwood*	*LPG*	*Kerosene*	*Electricity*	*TOTAL*
Cooking	22745	540	126	65	23476
Illumination	-	-	281	91	372
Heating	1472	3.5	-	62	1537.5
Other uses	-	-	-	227	227
TOTAL	24217	543.5	407	445	25612.5

Source: UNDP/GUA/81/002- 1987 Survey.

4.22 Interfuel substitution trends have shown a transition from fuelwood use directly to LPG, but with kerosene's participation declining. An explanation for this transition is the structure of energy prices, and accessibility to stoves and fuels.

Energy Prices

4.23 Relative energy prices play an important role in affecting demand patterns. Analysis of energy prices for the different fuels during the last decade indicates that fuelwood is the only energy source that maintained its value in real terms, while electricity prices for the residential sector declined about 65 percent and petroleum prices, with the exception of kerosene, declined by an average of 30 percent (Table 4.4).

4.24 To evaluate the options for a sound household energy policy, a proper comparison of the cost of energy services to households should be based on useful energy, the economic cost of energy, and overall costs (including capital costs).

Table 4.4 Guatemala: Energy Prices, 1980-1990

	Electricity (Qc/Kwh)	*LPG Q/100 (Pounds)*	*Fuelwood (Q/carga)*	*Kero (/gal)*	*D.O. (Q/gal)*	Gasoline (Q/gal)
In Quetzales/Original units						
1980	13.90	20.40	6.1	0.83	1.03	1.91
1984	12.90	20.30	5.5	1.09	1.17	1.90
1986	11.90	23.00	8.4	2.05	1.70	2.90
1988	13.00	23.00	10.60	2.42	2.25	3.05
1990	18.30	33.20	22.00	9.10	5.95	9.40
IN 1980 Q/Original units						
1980	13.90	20.40	6.1	0.83	1.03	1.91
1984	10.97	16.79	5.2	0.90	0.97	1.57
1986	6.06	11.72	4.2	1.04	0.87	1.48
1988	5.32	9.41	4.6	0.99	0.92	1.25
1990	4.80	8.71	7.4	2.39	1.56	2.47

Source: MEM.

Useful Energy

4.25 Table 4.5 compares the regulated prices of different fuels burnt in different stove types in terms of useful energy. This comparison is restricted to Guatemala City and its environs. It shows that such traditional fuels as fuelwood are more expensive than the modern fuels, including electricity. If an improved woodstove is used, the price per useful Mcal is almost three times as high as for LPG, and close to the price of kerosene.

Table 4.5 Energy Price Comparison Guatemala City, Market Prices in Centavos as of August 1992

Fuel	*Market price (CQ/Mcal)*	*Stove type*	*Efficiency*	*Price of useful energy (CQ/useful Mcal)*	*Relative price to the cheapest fuel (LPG = 1.00)*
Fuelwood (Guatemala City)	11.69	Open fire	7%	166.95	6
		Improved	14%	83.48	3
LPG	12.51	Table top stove	45%	27.79	1.00
Kerosene	25.10	Wick burner	35%	71.73	2.6
		Pressurized[a]	40%	62.76	2.2
Electricity (Group C)	24.49	Electric stove	65%	37.67	1.3

[a]Stove presently not available in the market. Figures based on assumption stove was imported from Colombia.

Sources: MEM, Mission estimates.

Economic Cost of Fuels.

4.26 Table 4.6 uses the border prices of LPG and kerosene, adjusted for transportation costs; since cooking coincides with the system's peak, the cost of electricity corresponds to the estimated marginal cost at system peak (chapter 3) for low- voltage domestic users. The costs for nontraded energy such as fuelwood and charcoal were taken to be equal to their current market prices, assuming that they reflect the economics of a competitive market. The results show that when comparing economic costs, LPG loses much of its cost advantage and kerosene in particular becomes more competitive with LPG. Fuelwood is still the most expensive fuel.

4.27 Government pricing policies have led not only to significant abuse of subsidies (i.e., industrial users of LPG acquire the fuel at the preferential price intended for household consumers) but also to some extent to fuel switching from fuelwood to LPG, especially among urban dwellers. A switching to kerosene has not occurred for two reasons. First, the price distortion favors LPG; and, second, at present only wick burners, which are not only very sooty but also less convenient to use than pressurized kerosene stoves, are available on the local market.

Table 4.6 Economic Cost Comparison (CQ/Useful Mcal), Guatemala City, as of August 1992

Fuel	*Economic cost (CQ/Mcal)*	*Stove type*	*Efficiency*	*Cost of useful energy (CQ/useful Mcal)*	*Relative cost to the cheapest fuel (LPG = 1.00)*
Fuelwood (Guatemala City)	11.69	Open fire	7%	166.95	4
		Improved	14%	83.48	2
LPG	19.13	Table top stove	45%	42.52	1.00
Kerosene	17.32	Wick burner	35%	49.3	1.2
		Pressurized[a]	40%	43.3	1.01
Electricity (Group C)	65.88	Electric stove	65%	101.35	2.3

Source: Mission estimates.

[a]Stove not presently available in the market. Figures based on assumption stove was imported from Colombia.

Overall Costs

4.28 Finally, total household expenditures, including the capital costs associated with the purchase of a stove, are examined. Calculations are based on an average fuelwood consumption of 2,956 kg/household/year and assumes the use of an open fire. The quantities of the other fuels consumed per year using various appliances with differing end-use efficiencies were determined on the basis of the useful energy consumption computed for the base case. The

cost figures for the end-use appliances reflect their average prices, and for LPG non recurring costs of US$50 were added to cover the purchase of the cylinder (25 lbs.) and installation fees.

4.29 Table 4.7 shows that an open fuelwood fire is by far the most expensive energy source for cooking. LPG is least expensive, and kerosene is twice as expensive as LPG at current prices. Kerosene is competitive with LPG on economic costs. Cooking with improved fuelwood stoves is still more expensive than with kerosene stoves, though only slightly. In terms of total household energy expenditures it is clear that it would be profitable for households to switch from fuelwood to LPG, and also to kerosene, provided that prices were at their economic cost.

Table 4.7 Household Energy Expenses as of September 1992

				Total annual cost (US$)	
Fuel	*Stove type*	*Stove life (Years)*	*Capital cost (Quetzales)*	*At market price[a]*	*At economic cost[a]*
Fuelwood	Open fire	0	0	247 (5)	247 (3.5)
	Improved	5	155	129 (2.6)	129 (1.8)
LPG	2-3 burners	10	155	48 (1)	70 (1)
Kerosene	2-3 burners	4	167	114 (2.4)	81 (1.15)
	Pressurized	4	112	98 (2)	70 (1)
Electricity	4 burners	10	640	68 (1.4)	162 (2.3)

Note: Exchange rate: Q5.34/US$.

[a]Relative cost to cheapest fuel.

4.30 Given the above relative prices, one would expect a massive shift from fuelwood to LPG. LPG turns out not to be a realistic alternative for most low-income households, since it cannot be bought in small amounts (10-lb. cylinders are the smallest available size), and its use requires a substantial investment in end-use equipment. Based on current regulated prices, cooking with a kerosene stove is still cheaper than with a fuelwood fire. However, low-income households continue to use fuelwood, above all because it can be purchased or gathered in very small amounts, making it a much more accessible source of energy.

4.31 If the price were set at its economic level, kerosene would be a more attractive alternative for low-income households; aside from the purchase price of the stove, no additional investment costs are involved (with LPG, outlays for the cylinder and installation fees are also incurred), and there is no minimum purchase requirement. Further, as seen in chapter 3, under a liberalized downstream petroleum sector, the pricing and taxation system would be structured so that the kerosene price would be at about 75 percent of its current level, thus encouraging the switch from fuelwood to kerosene.

Lessons Learned

4.32 From the evidence of the 1980s, government attempts to affect fuelwood supply and demand through energy pricing and woodstove programs were unsuccessful. The rationale for subsidies in LPG and electricity was to reach the poor, but the poor in Guatemala consume

fuelwood, and fuelwood is now the most expensive fuel used for cooking in the residential sector. Although the high relative price of kerosene deterred its use as an alternative fuel, the relatively low price of LPG appears to have done little to encourage its use as an alternative for low-income consumers. The analysis shows that a demand reduction through improved woodstove programs or switching to commercial fuels is not very likely to occur. It follows that in the medium- to long-term, increasing the supply of fuelwood will be more successful in closing the gap between demand and sustainable supply.

4.33 In hindsight, artificially high kerosene prices had two effects: First, they hampered its use as an alternative fuel for the fuelwood consumers; and second, they indirectly allowed the rise of fuelwood prices. Recent energy surveys in Bolivia and other countries show that kerosene prices work as a capping mechanism to keep fuelwood prices at competitive levels.

4.34 The rising level of fuelwood prices in Guatemala is indicative of a combination of fuelwood scarcity around the main consumer centers, government energy pricing policies that have discouraged the use of modern fuels, and a distribution system of kerosene and LPG that appears not to have been accessible to consumers. Consequently, and to ensure that resource problems do not become widespread, action is needed both on the supply and demand side. On the supply side, conditions must be created to support the introduction of multiuse tree plantations. Moreover, a mechanism to implement a stumpage fee or resource tax on fuelwood entering the city must be designed. On the demand side, the liberalization of the petroleum market must make sure that the taxes on the substitute fuels for fuelwood, particularly kerosene and LPG, do not put more pressure on local wood resources. The empirical evidence in other countries shows that higher taxes on petroleum fuels results in a higher percentage of people using traditional fuels. Hence, reliable end-use surveys are needed on fuel choices by income, household size, availability of fuels, and region. MEM will require substantial assistance in these efforts.

4.35 Overall, the analysis, though not comprehensive enough to capture the dynamic nature of fuel choices in time, confirms that the poor spend a greater percentage of their income on energy but purchase less and lower quality energy.

5

Energy and the Environment

Links between Energy Activities and Environmental Effects

5.1 The main environmental effects of energy activities are caused by the generation of pollutants.[1] Burning fossil fuels generates acid gases (e.g., SO_2, NO_x, halogen), greenhouse gases (e.g., CO_2, CH_4, N_2O), and various carcinogenic and mutagenic agents. Pollution per unit of energy produced depends on the type of fuel used, the conversion efficiency of the process used, and the mitigatory measures applied. The production and transport of oil and coal may cause environmentally harmful accidents. Transport and distribution of gas can lead to release of CH_4 and greenhouse gases. Hydro-production of electric power can lead to large-scale resettlement of populations, changes in water quantity and quality, soil erosion, and sedimentation. The use of fuelwood for energy consumption contributes to deforestation, which can lead to soil erosion and sedimentation, among other effects.

Objectives of the Chapter

5.2 This chapter assesses the environmental impact of energy-related operations along with the different phases of exploration, production, transformation, transportation, and consumption. It also reviews the institutional and legal aspects of environmental policy vis-à-vis the energy sector. As will be shown, the current legal and institutional setup is one of the principal obstacles to the formulation and implementation of an environmentally sound energy policy.

5.3 The level of energy-related atmospheric emissions in Guatemala does not pose a serious threat to the environment either at the national or at the regional level. The most serious environmental risks are (a) deforestation, which is at least partly caused by fuelwood consumption; (b) petroleum exploration (test drilling); (c) maritime transport of crude oil; and (d) operations at the Laguna power plant.

1. Environmental issues go well beyond the energy sector alone. The World Bank prepared an environmental issues paper in June 1990.

Deforestation

5.4 One of Guatemala's most pressing environmental problems is the high rate of erosion following the clearing of forest cover, particularly in the highlands. Table 5.1 shows that more than 60 percent of the country is highly eroded. Because the slope of land and the risk of erosion are directly related, high and very high rates of erosion, occur mainly in the mountainous areas. Observation in the field indicates that most of the upper slopes in Guatemala are almost bare of topsoil.

5.5 Protective forest land occupies about 13,000 km^2, excluding El Petén (see chapter 4). However, 50 percent of this land carries no tree cover. It is therefore degenerating rapidly because of agricultural clearing, poor cropping practices, and overgrazing.

Table 5.1 Degree of Erosion, Guatemala

Grade of erosion	*Area (Km^2)*	*% of country*
None	29,986	27.4
Light	4801	4.4
Moderate	4096	3.8
High	35936	33.0
Very high	32691	30.1

Note: The remaining 1.3 percent of the country is taken up by lakes and other bodies of water.
Source: CATIE, mission estimates.

5.6 Deforestation contributes to erosion.[2] On average, annual deforestation from all causes (agriculture, commercial logging, fuelwood consumption) approximates 500 km^2, or 1.3 percent of forest-covered land. Although the rate of deforestation has not reached a level that requires the immediate adoption and implementation of emergency measures, forest depletion will occur within the next 75 years, if left unchecked.

5.7 Even though deforestation is predominantly caused by agricultural and commercial logging activities, fuelwood consumption may exacerbate the problem in regions where the levels of deforestation have reached critical points in terms of the forests' protective

2. Throughout the text, *deforestation*, or the clearing of forests, is understood as an overexploitation of a natural forest that in time leads to the extinction of the resource base.

functions and self-generating capacities.[3] These regions include Centro Sur, Altiplano Occidental, Costa Sur, and Coban. In Centro Sur, only 7 percent of the area classified as protective forest actually bears tree cover. Altiplano Occidental has 28 percent of forest cover, Costa Sur 33 percent, and Coban 37 percent.

5.8 In the case of the Rio Chixoy power plant development, deforestation and its environmental effects are having a negative impact on the economics of the project. Preliminary calculations based on the soil loss rate and potential sediment inflow in the Chixoy watershed indicate that forest cover is decreasing by about 2 percent per year, mainly because of agricultural clearing. At this rate, the dead volume of the dam would be silted up by the year 2017. If this were to happen, substantial costs (turbine damage, rehabilitation, reduced operating life) would be incurred before the end of the plant's economic lifetime. These would be attributable to the degradation of the natural resources in the catchment area. In other words, environmental costs would have to be borne by the energy sector even though they were not caused by energy sector operations. Watershed management is therefore of particular importance.

Petroleum Sector

5.9 At the level of petroleum exploration, test drilling that is undertaken to determine the production potential of prospective oil fields carries the potential risk of environmental damage. Up to several thousand barrels of crude can be discharged from a single test well, and, as a rule, this initial oil output is not collected. Thus, it seeps into the ground in the immediate vicinity of the drilling site. This will not necessarily lead to soil or water contamination, however, because crude oil migrates into the pore spaces of the earth, traveling only over short distances. Moreover, during migration, it may be decomposed by microorganisms.

5.10 The environmental damage caused by exploratory drilling in Guatemala has not been documented completely. It is clear, however, that such damage did occur in the case of the Xan I field (North Petén) where a nearby lake was contaminated by crude oil discharged into it. The company that was drilling the test wells recovered most of the oil, but an analysis of the ecological impact has not been carried out.

5.11 Crude oil production itself, which in Guatemala is generally carried out in accordance with international technical standards, poses little risk of soil or water contamination. Safety equipment reduces the danger of contamination as a result of technical malfunctions or accidents to a minimum. The water that is generated during the production process is contaminated with crude oil, but it is collected in special pits excavated for this purpose. When the water evaporates, the petroleum is left as a deposit at the bottom of the pit. Part of it decomposes, and, if necessary, compacted layers are burnt off.

3. A FAO survey attributes only about 3 percent of deforestation to fuelwood consumption.

5.12 However, the transport of the crude from the oil fields to the terminals or other users does pose a potential contamination threat to soil and water. From the oil field in Rubelsanto the crude is moved almost exclusively by pipeline to the Santo Tomás terminal. Generally speaking, this is the most environmentally sound mode of transportation. The situation is different with respect to road transport of crude oil. Crude is currently being trucked from Yalpemech to the Progreso cement plant, but in the future it will presumably be moved by road from Xan to Rubelsanto as well. A fleet of 60 tank trucks is to be used on the Xan-Rubelsanto route, and the danger of local soil or surface water contamination as a result of road accidents is much greater than the pollution risk posed by the operation of a pipeline.

5.13 These same comments apply to the transport of refined products from the refinery at Escuintla to the main market at Guatemala City. A pipeline might be both economically justified and environmentally more benign than the present system of tanker trucks. However, under the current system of regulated prices and transport margins, there is no incentive by the various economic agents to minimize operating costs or increase investment levels.

5.14 The maritime transport of petroleum and petroleum products is a potential source of contamination for Guatemala's coastal waters. However, even the 1975 oil spill, which was caused by the sinking of a tanker in the Bay of Amatique, did not lead to implementation of adequate standards, binding norms, or monitoring and enforcement systems. Indeed, standardized anti-pollution measures and monitoring facilities have not even been developed for the coastal or port terminals, where the various petroleum products are stored and transshipped. This area is particularly important if, as recommended in chapter 3, the country adopts the proper competitive framework for the supply and distribution of petroleum products in order to attract safe and environmentally sound investment. The failure to set proper standards for maritime transport and to develop proper contingency plans could lead to a major environmental disaster.

Power Sector

5.15 Since only about one-third of the power generated in Guatemala is produced by fossil-fuel based plants, the overall level of emissions in the electricity subsector is relatively low (Table 5.2). This situation may change now that a privately operated 110 MW power plant has begun operations (1993). The mission was not informed whether environmental standards had been applied to the evaluation of the original proposal.

Table 5.2 Emission in Power Subsector, Guatemala, 1990

Measure	*CO*	*NOx*	*SOx*	*HC*	*Part.*	*Co. Org.*	*PAHs*
Tons/year	2394	2391	2042	232	632	1290	63
% of total	26.5	26.4	22.6	2.5	7	14.3	--

Source: Mission estimates.

5.16 These apparently reassuring figures do not mean that emissions pose no threat whatsoever. Concentrations of individual pollutants, such as SO_x, lead, and particulates may exceed acceptable levels in specific local areas. For example, this could be the case in the vicinity of the Escuintla and Laguna thermal power stations. However, to determine the extent of health risks, data concerning concentrations at given points in time should be complemented with parameters relative to climatic conditions such as wind regime, inversions, and the presence of other emissions.

5.17 Risks of water and soil pollution within the power sector can arise from environmentally unsound disposal of used oil generated by the operation of steam power plants, diesel generating sets, or gas turbines. In addition, the disposal of cooling water directly into lakes or rivers can lead to substantial temperature increases with possible detrimental effects. The disposal of used oils from the Laguna power plant directly into Lake Laguna will lead to a significant reduction in the quality of the water and will damage the local aquatic flora and fauna over the medium to long term. This in turn will give rise to environmental costs in the form of a decrease in tourism and a decrease in the income of local fishermen. The Laguna power plant also has an open-water cooling cycle that discharges directly into the lake, causing some thermal pollution.

Environmental Effects of Energy Consumption

5.18 On the consumption side, the bulk of the pollution caused by the utilization of traditional and commercial energy resources in Guatemala takes the form of atmospheric emissions. The household sector is the single most important source of energy-related emissions in Guatemala, mainly because it accounts for 65 percent of the country's total energy consumption (1990) and because of the almost exclusive reliance on fuelwood. Since approximately 75 percent of all fuelwood consumption takes place in rural areas (i.e., on a decentralized basis), high concentrations of toxic emissions are not produced.

Table 5.3 Percentage Share of Energy-Related Emissions Attributable to the Various Sectors

Sector	*CO*	*NOx*	*SOx*	*HC*	*Part.*	*Cond.*	*Org.*	*Pb*
Electricity generation	0.5	3.9	11.1	0.1	1.2	0.9	2.1	0
Transport	12.3	22.8	11.3	4.1	0.8	0.2	24.1	98.6
Households	86.7	62.5	39.9	95.4	94.4	96.4	70.1	0
Commerce	0.1	0.5	0.5	--	--	--	0.5	0.6
Industry	0.3	9.2	36.2	0.2	3.5	2.6	2.0	0
Agriculture and Mining	0.1	0.6	0.6	--	--	--	0.7	0.3
Public	0.1	0.4	0.4	--	--	--	0.4	0.6

Source: Mission estimates based on Energy Balance of MEM, 1988.

5.19 The situation is different at the micro level (i.e., at the level of individual end-users). Especially in the rural areas of Guatemala, most households cook on open fires in closed, poorly ventilated rooms. Women and children in particular are exposed to CO concentrations of more than 50 ppm for several hours a day. Health risks are also created by the large amount of particulates generated by fuelwood combustion and the production of carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs), which are adsorbed by the particulates and can be transported by them directly into the lungs.

Table 5.4 Household Sector Emissions, 1988
(Total emissions in tpy)

Fuel	*Combustion technology*	*Consumption (tons)*	*CO*	*NOx*	*SOx*	*HC*	*Part.*	*Co. Org.*	*PAHs*
LPG	direct comb.	54,664	11	98	5	27	11	0	0
Kerosene	direct comb.	29,143	73	73	3	12	9	0	0
Fuelwood	direct comb.	7,331,000	439,860	38,121	7,331	183,275	48,385	134,890	586
Charcoal	production	28,000	2,604	0	0	8,400	140	5,964	1,484
Charcoal	direct comb.	28,000	168	0	6	56	42	0	0
TOTAL			442,716	38,292	7,345	191,770	48,586	140,854	2,070

Source: Mission estimates based on energy balances.

5.20 Transport accounts for the bulk of the emissions. Gasoline-powered vehicles produce most of the emissions. The high lead content of the gasoline used in Guatemala is a critical environmental problem. Measurements taken in 1980 and 1985 showed lead concentrations of 1.05-4.66mμg/m^3 on weekdays and of 0.55-0.82mμg/m^3 on weekends in zones in the vicinity of industrial parks, and an average value of 0.22mμg/m^3 in residential areas of Guatemala City.

5.21 The MEM has recognized the seriousness of this problem and has instructed the representatives of the TEXPET refinery and the petroleum product distributors to reduce the lead content through the importation of unleaded gasoline or substitution of ethyl alcohol for lead as a gasoline additive at the refinery.

Table 5.5 Transport Subsector Emissions, 1988

(tpy)

Fuel	*Combustion technology*	*Consumption (tons)*	*CO*	*NOx*	*SOx*	*HC*	*Part.*	*Co.Org.*	*PAH*	*Pb*
LPG	vehicles	1[illegible],853	3	29	2	8	3	0	0	0
Kerosene	vehicles	37,008	93	93	11	15	11	0	0	0
Gasoil	vehicles	322,147	5,799	5,476	1,611	741	322	74	322	0
Gasoline	vehicles	310,269	56,779	8,377	465	7,446	81	146	388	341
TOTAL			62,674	13,975	2,089	8,210	417	220	710	341

Source: Mission estimates.

5.22 The quantities of other emissions produced in the transport sector—above all, particulates, condensable organics, and PAHs—have almost certainly been underestimated. The figures presented in Table 5.5 are based on the current average toxic emission levels for U.S. vehicles. In Guatemala, however, technical inspections of motor vehicles are not mandatory. As a result, its buses and taxis as well as many of its private passenger cars are not only quite old but also poorly tuned and maintained, leading both to higher fuel consumption and to higher toxic emission levels per unit of fuel used.

Institutional and Legal Aspects

5.23 The basis of environmental legislation in Guatemala is Decree 68-86, the environmental law "Protection and Improvement of the Environment." This decree establishes the environmental agency CONAMA (Comisión Nacional del Medio Ambiente), which reports directly to the President of the Republic. Another environmentally relevant law is Decree 4-89, the "Protected Areas Law," which establishes CONAP (Consejo Nacional de Areas Protegidas). For a description of these laws and agencies see Annex 18.

5.24 The issues that need to be addressed in the near future to ensure an environmentally sound energy policy are as follows:

- The role of the environmental agency CONAMA, which is currently a mixture of a policymaking, executive, operational, and judicial institution.
- The areas of authority and responsibility for CONAMA and other governmental institutions.

- The organizational and administrative structure for the necessary interagency links and cooperative efforts between CONAMA and such relevant specialized institutions as MEM in matters of environmentally sound petroleum operations. Currently, the lack of clear legal demarcation and responsibilities between the MEM and CONAMA has become an obstacle to launching a successful promotion exploration campaign.

- The regulatory framework to address the question of the validity of rules and regulations that existed prior to the passage of the environmental legislation and a determination of whether existing and future legally binding contracts which are affected by new environmental legislation (e.g., petroleum exploration and production concessions) are valid and, if so, under what conditions.[4]

- Priorities or minimal standards for economic activities that are most common instead of establishing a general requirement for environmental impact analysis (EIA). Currently, the lack of a prioritization for carrying out EIAs leads to arbitrary actions and hampers legitimate economic activities while doing nothing to improve environmental protection.

- The balance between the number and size of areas that have been designated as protected areas and the availability of necessary administrative and technical resources in Guatemala to enforce the law.

- The supply of qualified specialists in the environmental sector.

5.25 The issues with which the PAL deals are also covered by the Environmental Law. Indeed, the PAL is a more elaborate version of one component of the Environmental Law. The stipulation that EIAs must be carried out for all ongoing or planned activities in protected areas is a duplication of the requirement already established in the Environmental Law. Currently, areas are deemed "protected" arbitrarily instead of by the procedure established by the PAL.

5.26 From the information provided by CONAMA, protected areas will ultimately cover 25 to 30 percent of the country's total surface area. Even though not all of the areas in question have been put in Category I, in which all forms of resource utilization are prohibited, Guatemala has neither the administrative nor the personnel resources required to administer such a vast amount of land in an appropriate manner.

5.27 The impact of the PAL—in particular, the designation of six biotopes and forty-four areas as "protected areas," in most cases without master plans or plans of operation—has been felt above all in the petroleum subsector. Since this law was passed, CONAMA/CONAP has had the right to halt all activities, including those being undertaken on the basis of legally valid contracts. Even when EIAs have been carried out, CONAMA/CONAP is under no

4. Prior to the passage of the Environmental Law, there were 285 laws and regulations in Guatemala dealing with environmental protection.

obligation to permit the continuation of these contractually sanctioned activities. Even if firms are willing to comply with new standards or meet new conditions, their operations can still be terminated.

5.28 The problem in this context is that the legally mandated annual plans of operation virtually eliminate the possibility of any further contracts being granted for petroleum exploration and production in protected areas. The petroleum industry requires a much longer planning horizon for its activities.

5.29 The situation is even more precarious for petroleum operations in North Petén, which is presumed to have the most extensive petroleum deposits in Guatemala. In January 1990, a special decree was issued that designated the "Reserva Maya," which covers approximately 1 million ha, most of the Petén, as a protected area. The entire area was classified as a "reservation of the biosphere" and subdivided into regional core areas (biotopes and national parks) in which all activities are prohibited, as well as cultural areas, multi-use areas, and recreation areas. Neither a master plan nor a plan of operation was prepared for any part of this huge area. The extraction of resources is permitted until further notice in areas that have not been defined as core areas and for which valid contracts are in effect. However, even where legally binding contracts are in force, the authorities still have the right to impose restrictions and conditions prior to the preparation of the master plan in order to prevent contamination that might be caused by the activities of the contractor. The MEM was neither seriously consulted nor given sufficient opportunity to present its views prior to the adoption of this law.

5.30 In order to find a compromise between environmental protection and petroleum operations, the existing environmental legislation should be revised and supplemented in view of the special requirements of the petroleum industry. Clear and comprehensive standards and norms not only would simplify the approval process for petroleum exploration and production activities in protected areas but would also provide a basis for more environmentally benign exploration and production activities.

5.31 The problems of the petroleum industry also highlight the need for MEM to play a more active role in the development of an environmentally sound energy policy, serving as the executive agency for environmental protection in the energy sector. If this goal is to be achieved, the MEM must be represented in CONAMA, and an environmental unit must be set up within the MEM.

Guatemala

Issues and Options in the Energy Sector

Annexes

Annex 1: Electricity Sales by Company and Customers

INDE: Sales and Number of Customers

Category	Number of Customers	Sales (GWh)	Share (%)	Growth from Previous Year (%)	
				Customers	Sales
Retail					
Residential	224,582	101.99	34.3	34.3%	11.7%
Commercial	19,964	38.66	13.0	13.7%	25.3%
Small Industry	681	10.90	3.7	-24.4%	-37.1%
Large Industry	162	117.18	39.4	50.0%	1.7%
Government/Municipal	3,618	6.41	5.5	-7.7%	-9.5%
Public Lighting	521	12.38	4.1	1.4%	9.2%
Subtotal Retail	249,542	297.51	100.0	1.1%	4.7%
Bulk					
EEGSA	1	1,303.68	91.7		3.1%
Municipal Companies	12	84.13	5.9		8.9%
Export (El Salvador)	1	34.63	2.4		293.2%
Subtotal Bulk		1,422.44	100.0		
TOTAL		1,719.95			

EEGSA, SALES AND NUMBER OF CUSTOMERS, 1989

Residential	262,867	434,56	30.6	5.7%	10.0%
Commercial	67,990	361,00	25.4	3.6%	6.4%
Industrial	1,716	477,94	33.6	9.4%	12.4%
Municipal	1,051	113,36	8.0	4.5%	5.5%
Government	1,403	33,89	2.4	-1.3%	2.5%
TOTAL	335,027	1,420,76	100.0	5.2%	9.3%

Annex 2:

Guatemala Power System Statistics

TABLE 1: GUATEMALA POWER SYSTEM - Annual Net Energy Demand

ANNUAL ENERGY (GWh)	Actual			Forecast									Growth (%)
	1989	1990	1991 1/	1992	1993	1994	1995	1996	1997	1998	1999	2000	1992-2000
1. INDE NET ENERGY GENERATION	2,113.6	2,227.6	2,167.2	2,290.3	2,218.2	2,337.1	2,439.3	2,619.3	2,808.5	3,007.8	3,217.7	3,438.9	5.26
(=) Detail Sales	346.9	383.8	412.2	480.7	549.3	571.7	606.3	642.8	681.3	722.2	765.5	811.5	7.82
(=) Residential	109.3	131.0	141.0	165.8	191.2	189.8	195.2	201.1	207.8	220.3	233.5	247.5	6.45
(+) Commercial	48.6	51.6	33.0	37.0	40.1	37.2	36.4	36.0	35.4	37.5	39.8	42.2	2.77
(+) Industrial	155.9	168.6	186.3	218.3	250.4	277.8	307.4	336.9	367.9	390.0	413.4	438.2	9.97
(+) Other	33.1	32.7	51.9	59.6	67.6	66.9	67.3	68.8	70.2	74.4	78.8	83.6	5.44
(+) Bulk Sales	1,596.4	1,680.1	1,585.0	1,631.0	1,501.5	1,594.7	1,660.6	1,797.3	1,941.3	2,092.9	2,252.7	2,421.1	4.82
(=) To EEGSA	1,509.6	1,585.0	1,485.0	1,517.0	1,378.4	1,461.7	1,517.0	1,642.2	1,773.8	1,912.0	2,057.3	2,210.1	4.52
(+) To Municipal Utilities	86.8	95.2	100.0	114.0	123.1	133.0	143.6	155.1	167.5	180.9	195.4	211.0	8.65
(+) Energy Losses	170.3	163.7	170.0	178.6	167.4	170.7	172.4	179.2	185.9	192.7	199.5	206.3	2.18
(% on Net Energy Generation)	8.1	7.3	7.8	7.8	7.5	7.3	7.1	6.8	6.6	6.4	6.2	6.0	-2.93
2. EEGSA NET ENERGY GENERATION	1,599.0	1,732.2	1,822.2	1,947.3	2,211.6	2,319.1	2,429.5	2,544.9	2,666.2	2,793.6	2,927.3	3,067.7	5.96
(=) Detail Sales	1,420.8	1,511.0	1,598.4	1,707.8	1,946.5	2,048.2	2,153.0	2,262.7	2,378.1	2,499.4	2,626.9	2,760.9	6.26
(=) Residential	434.6	473.6	500.6	535.2	609.1	641.9	674.7	709.1	745.3	783.3	823.3	865.3	6.27
(+) Commercial	358.8	393.4	406.8	447.3	512.0	536.4	563.9	592.6	622.8	654.6	688.0	723.1	6.60
(+) Industrial	477.9	497.5	538.4	562.4	640.0	674.5	709.0	745.1	783.1	823.1	865.0	909.1	5.99
(+) Other	149.5	146.5	152.6	162.9	185.4	195.4	205.4	215.9	226.9	238.4	250.6	263.4	6.25
(+) Bulk Sales	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
(=) To INDE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
(+) To Municipal Utilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
(+) Energy Losses	178.3	221.2	223.8	239.5	265.1	270.9	276.5	282.2	288.1	294.2	300.4	306.8	
(% on Net Energy Generation)	11.1	12.8	12.3	12.3	12.0	11.7	11.4	11.1	10.8	10.5	10.3	10.0	-2.26
3. TOTAL NET ENERGY DEMAND	2,203.0	2,374.9	2,504.4	2,720.7	3,051.4	3,194.5	3,351.8	3,522.0	3,701.0	3,889.4	4,087.7	4,296.5	6.18
(=) Total Sales	1,854.4	1,990.0	2,110.6	2,302.5	2,618.9	2,752.9	2,902.9	3,060.6	3,226.9	3,402.5	3,587.8	3,783.4	6.70
(+) Energy Losses	348.5	384.8	393.8	418.2	432.5	441.6	448.9	461.4	474.1	486.9	499.9	513.1	2.98
(% on Net Energy Generation)	18.8	19.3	18.7	18.2	16.5	16.0	15.5	15.1	14.7	14.3	13.9	13.6	-3.48

(1) Preliminary Data

TABLE 2: GUATEMALA POWER SYSTEM: Load Shape Factors and Monthly Net Energy and Peak Demand

ITEM	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Year 1991 Data:													
- Net Energy Demand (GWh)	208.8	188.0	199.7	202.0	206.3	198.9	212.8	210.8	165.7	208.7	207.5	215.1	2,424.5
- Mid-day Peak Load (MW)	350.3	348.1	355.0	368.4	362.7	354.8	358.0	365.9	371.8	373.0	392.5	383.6	392.5
- Afternoon Peak Load (MW)	462.0	457.0	467.1	448.9	443.7	436.2	443.5	464.0	372.3	483.4	492.5	495.1	495.1
- Minimum Daily Load (MW)	126.2	159.0	145.1	143.9	161.4	169.2	160.5	109.5	125.3	149.8	168.1	154.8	109.5
Load Shape Factors (%):													
- Net Energy Monthly Distribution	103.4	93.0	98.9	100.0	102.1	98.5	105.3	104.3	82.0	103.3	102.7	106.4	100.0
- Load Factor	60.8	61.2	57.5	62.5	62.5	63.3	64.5	61.1	61.8	58.0	58.5	58.4	55.9
- Mid-day Peak/Daily Peak Ratio	75.8	76.2	76.0	82.1	81.7	81.3	80.7	78.9	99.9	77.2	79.7	77.5	79.3
- Minimum Load/Daily Peak Ratio	27.3	34.8	31.1	32.1	36.4	38.8	36.2	23.6	33.7	31.0	34.1	31.3	22.1
Monthly Demand (GWh): 1/													
1992	234.4	211.0	224.2	226.7	231.5	223.2	238.8	236.6	185.9	234.2	232.9	241.3	2,720.7
1993	262.9	236.6	251.4	254.3	259.7	250.4	267.8	265.3	208.5	262.7	261.2	270.7	3,051.4
1994	275.2	247.7	263.2	266.2	271.8	262.1	280.4	277.8	218.3	275.0	273.5	283.4	3,194.5
1995	288.7	259.9	276.2	279.3	285.2	275.0	294.2	291.5	229.0	288.6	286.9	297.3	3,351.8
1996	303.4	273.1	290.2	293.5	299.7	289.0	309.1	306.2	240.6	303.2	301.5	312.4	3,522.0
1997	318.8	287.0	304.9	308.4	315.0	303.7	324.8	321.8	252.5	318.6	316.8	328.3	3,701.0
1998	335.0	301.6	320.4	324.1	331.0	319.1	341.4	338.2	265.7	334.9	332.9	345.0	3,889.4
1999	352.1	317.0	336.8	340.6	347.9	335.4	358.8	355.4	279.3	351.9	349.9	362.6	4,087.7
2000	370.1	333.1	354.0	358.0	365.6	352.5	377.1	373.6	293.6	369.9	367.8	381.1	4,296.5
2001	391.9	352.7	374.8	379.1	387.1	373.2	399.3	395.6	310.8	391.7	389.4	403.5	4,549.0
2002	414.9	373.5	396.8	401.3	409.9	395.2	422.8	418.8	329.1	414.7	412.3	427.2	4,816.4
2003	439.3	395.4	420.1	424.9	434.0	418.4	447.6	443.4	348.4	439.1	436.5	452.4	5,099.5
2004	465.1	418.6	444.8	449.9	459.5	443.0	473.9	469.5	368.9	464.9	462.2	479.0	5,399.3
2005	492.4	443.3	471.0	476.3	486.5	469.0	501.8	497.1	390.6	492.2	489.4	507.1	5,716.6
Monthly Peak Demand (MW): au1													
1992	513.3	507.8	519.0	498.8	493.0	484.6	492.8	515.5	413.6	537.1	547.2	550.1	550.1
1993	570.0	563.8	576.3	553.9	547.4	538.2	547.2	572.5	459.3	596.4	607.6	610.9	610.9
1994	590.8	584.4	597.4	574.1	567.4	557.8	567.2	593.4	476.1	618.2	629.8	633.2	633.2
1995	613.8	607.2	620.6	596.4	589.5	579.5	589.2	616.5	494.6	642.2	654.3	657.8	657.8
1996	638.6	631.7	645.6	620.5	613.3	602.9	613.0	641.3	514.6	668.2	680.7	684.3	684.3
1997	664.4	657.2	671.7	645.5	638.1	627.3	637.8	667.3	535.4	695.2	708.2	712.0	712.0
1998	691.3	683.8	698.9	671.7	663.9	652.7	663.6	694.3	557.1	723.3	736.9	740.8	740.8
1999	719.3	711.6	727.3	698.9	690.8	679.2	690.5	722.5	579.7	752.7	766.8	770.9	770.9
2000	748.6	740.5	756.9	727.4	718.9	706.8	718.6	751.8	603.3	783.3	798.0	802.2	802.2
2001	784.8	776.3	793.4	762.5	753.7	740.9	753.3	788.2	632.4	821.1	836.6	841.0	841.0
2002	822.7	813.8	831.7	799.3	790.1	776.7	789.7	826.2	662.9	860.8	877.0	881.6	881.6
2003	862.4	853.1	871.9	837.9	828.2	814.2	827.9	866.1	694.9	902.3	919.3	924.2	924.2
2004	904.0	894.2	914.0	878.4	868.2	853.5	867.8	907.9	728.5	945.9	963.7	968.8	968.8
2005	947.7	937.4	958.2	920.8	910.2	894.8	909.7	951.8	763.7	991.6	1,010.3	1,015.6	1,015.6

(1) Period 2001-2005 extrapolated with the average 1992-2000 growth rate. Load factor was improved by 1% per year from 1991.

GUATEMALA POWER SYSTEM - Charteristics of Existing and Future Thermal Power Plants

A. Existing Thermal Power Plants - Main Characterisitics

Thermal Power Plant	Installation Date	Owner Company	Capacity (MW)		Heat Rate (kcal/kWh)			Fuel Type	Heat Value (kcal/kg)	Fuel Price (US$/ton)▲u4	Production Cost (US$/MWh)		
			Installed	Dependable	Maximum	Mean	Minimum				Fuel	Var O&M	Total
Esquintla Vapor 2	1977	INDE	53.00	45.00	3,055	2,889	2,815	Fuel Oil	10,380	87.60	24.38	0.97	25.35
Esquintla Gas 1 & 2	1968	INDE	25.00	20.00	4,028	3,709	3,445	Diesel Oil	9,600	170.60	65.91	1.91	67.82
Esquintla Gas 3 & 4	1976	INDE	50.00	40.00	3,605	3,320	3,084	Diesel Oil	9,600	170.60	58.99	1.73	60.72
Esquintla Gas 5	1985	INDE	40.00	32.00	3,344	3,079	2,860	Diesel Oil	9,600	170.60	54.72	1.78	56.50
Esquintla Gas 6 (STIG)	1991	INDE	45.00	42.00	3,201	2,948	2,738	Diesel Oil	9,600	170.60	52.39	1.71	54.10
Laguna Vapor 1 & 2	1948	EGSA	7.00	7.00	3,819	3,612	3,519	Fuel Oil	10,380	87.60	30.48	2.46	32.94
Laguna Vapor 3&4 2/	1959	EGSA	26.00	21.00	3,347	3,166	3,085	Fuel Oil	10,380	87.60	26.72	1.42	28.14
Laguna Gas 1 3/	1964	EGSA	12.50	10.00	4,028	3,709	3,445	Diesel Oil	9,600	170.60	65.91	2.12	68.03
Laguna Gas 2 & 3	1978	EGSA	46.00	25.00	3,887	3,579	3,324	Diesel Oil	9,600	170.60	63.60	1.85	65.45
Laguna Gas 4	1989	EGSA	30.00	28.50	3,406	3,137	2,914	Diesel Oil	9,600	170.60	55.74	1.82	57.56
Diesel San Felipe	1965	INDE	1.44	1.20	3,718	3,718	3,718	Diesel Oil	9,600	170.60	66.07	2.00	68.07
Diesel Puerto Barrrios	1977	INDE	6.00	3.60	3,213	3,213	3,213	Diesel Oil	9,600	170.60	57.09	2.00	59.09
TOTAL:	---	---	374.94	305.30	---	---	---	---	---	---	---	---	---

(1) Rehabilitation scheduled by June 1993 (30MW)
(2) Unit 3 rehabilitated by April 1993 (10MW)
(3) Available by June 1993

B. Existing Thermal Pow·. Plants - Gross Energy Generation (GWh)

Thermal Power Plant	Years								Capacity Factor %		
	1984	1985	1986	1987	1988	1989	1990	1991	Maximum	Mean	Minimum
Esquintla Vapor I	0.00	12.80	5.30	23.30	6.70	6.40	0.00	0.00	8.06	2.36	0.00
Esquintla Vapor II	325.60	288.60	0.00	0.00	0.00	3.70	67.00	209.00	70.13	24.07	0.00
Esquintla Gas 1 & 2	14.90	30.50	0.20	9.20	6.40	2.20	1.70	42.00	19.18	6.11	0.09
Esquintla Gas 3 & 4	11.93	145.20	0.50	7.20	15.60	9.70	7.60	82.00	33.15	7.98	0.11
Esquintla Gas 5	0.00	2.10	1.60	16.10	5.00	0.10	0.00	0.00	4.59	0.89	0.00
Esquintla Gas 6 (STIG)	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.20	1.52	0.20	0.00
Laguna Vapor 1 & 2	5.00	5.10	0.63	9.25	14.80	6.83	5.75	19.68	32.09	13.66	1.02
Laguna Vapor 2 & 3	15.00	15.30	1.88	27.75	44.40	20.48	17.25	59.03	25.92	11.04	0.82
Laguna Gas 1	0.90	51.20	0.30	7.80	7.00	0.00	0.00	0.00	46.76	7.67	0.00
Laguna Gas 2 & 3	184.90	108.90	3.70	68.40	95.40	65.00	52.50	66.00	45.89	20.00	0.92
Laguna Gas 4	0.00	0.00	0.00	0.00	0.00	0.00	33.00	116.00	44.14	7.09	0.00
Diesel San Felipe	0.60	1.90	0.01	0.15	0.19	0.17	0.07	0.15	15.06	3.21	0.08
Diesel Puerto Barrrios	0.00	4.90	3.20	4.50	1.60	0.30	0.60	0.40	9.32	3.69	0.57
TOTAL:	558.83	666.50	17.31	173.65	197.09	120.87	185.47	594.45	27.37	8.30	0.28

C: Candidate Thermal Power Projects - Main Characteristics

Thermal Power Plant	Commission-ing Date	Owner Company	Capacity (MW)		Heat Rate (kcal/kWh)			Fuel Type	Heat Value (kcal/kg)	Fuel Price (US$/ton)▲u4	Production Cost (US$/MWh)		
			Installed	Dependable	Maximum	Average	Minimum				Fuel	Var O&M	Total
Zunil I	1995	INDE▲u1	15.00	12.00	---	---	---	Geothermal	---	---	---	3.44	3.44
Vapor III	1996	INDE▲u1	100.00	90.00	2,811	2,659	2,590	Fuel Oil	9,600	87.60	24.26	0.69	24.95
Geothermal II	2000	INDE▲u1	55.00	45.00	---	---	---	Geothermal	---	---	---	2.82	2.82
TOTAL:	---	---	170.00	147.00	---	---	---	---	---	---	---	---	---

Annex 3: Characteristics of Future Hydro and Thermal Power Plants

1. The main characteristics of thermal existing power plants and thermal candidates for the expansion plan are described below:

Thermal Plants:

(a) The Zunil I (15 MW) geothermal plant was supposed to start operations in 1989 but it has been delayed until 1995. It will be the first geothermal plant in the system and experience with its operation could provide guidelines as to whether or not this resource should be developed more intensively.

(b) Two possible alternatives exist for a second geothermal plant (55 MW): Zunil II or Amatitlán. At present pre-feasibility studies for both projects are being executed in order to determine which is more attractive.

(c) A steam unit of about 100 MW can be installed within the existing thermal station at Escuintla. Units at this project would use bunker fuel; this would be the last unit that can be added to the station. No further conventional steam units were envisioned as part of the expansion program.

2. EEGSA has acquired considerable expertise in operating combined cycle systems in its Laguna station. Further additions of this type of thermal plants should be also put into service in future owned by EEGSA or private investors.

Hydro Power Plants

3. Project candidates merit the following comments (cost data referenced below are in 1991 US$ and does not include interest during construction):

(a) Santa María II (68 MW) and El Palmar (55 MW) are located on the Samala river and are relatively simple developments which do not entail significant risks. Costs are around US$ 1,600/kW for Santa María II (based upon feasibility studies) and US$ 1,300/kW for El Palmar (based upon pre-feasibility studies). Based on average production, and 12% of opportunity capital cost, their equivalent energy cost is on the order of US$ 53/MWh, for Santa María II, and US$ 50/MWh for El Palmar. Based on firm energy, these production costs increase by about 35%.

(b) Bobos is a small (9.0 MW) project on the Bobos river, with a high investment cost (on the order of US$ 1,900/kW). However, its energy cost is only US$ 34/kWh based upon its average production and US$ 40/kWh based upon its firm energy. Its feasibility study is ready.

(c) Serchil (80 MW) is located on the middle Chixoy river basin. Its unit cost is on the order of US$ 1,500/kW. Based on average and firm production, energy costs are around US$ 72/kWh and US$ 120 US$/kWh, respectively. Its large reservoir would permit to generate the energy in peak demand hours and to regulate Chixoy plant inflows.

(d) Jocotán is a 40 MW project with relatively high costs (around US$ 2,250/kW) which, in energy cost terms, represents roughly US$ 107/kWh (average) and US$ 156/kWh (firm). These values obviously call into question the economic feasibility of its development.

(e) Chulac (334 MW) and Xalalá (320 MW) are large developments with costs of about US$ 1,500/kW and energy costs on the order of US$ 54/kWh. Technical feasibility studies must be complemented, particularly in terms of geological surveys.

(f) Camotan and Oregano are two identified hydro projects in cascade on the river Grande de Zacapa. Their cost is about US$ 1,700/kW and generation costs could be around of US$ 84/kWh.

4. Geological studies for Chulac and Xalalá were to be funded by the V Energy Project (World Bank's loan 2724-GU), which disbursement was suspended in 1989. It is expected that this loan could be re-activated in the second semester of 1992, consequently the complementary studies of Chulac and Xalalá should be launched.

Energy Balances

5. Load dispatching simulation was carried out using 5.6% as operating reserve. This value is an intermediate value between loss-of-load-probability (LOLP) for the existing system (5.2%) and for the expanded system (6.0%). The operation of the original proposed expansion plan gave the following unacceptable supply shortages for dry hydro conditions.

(% of demand)

YEAR	CAPACITY	ENERGY
1993	2.2	0.3
1994	5.6	0.3
1995	8.1	0.4
1996	5.0	0.2
1997	7.8	0.4
1998	19.5	2.9
1999	21.0	3.5
2000	19.0	2.8

6 Energy deficit higher than 1.5% and capacity higher than 7.0% are unacceptable, as they cannot be alleviated with only operation measures, but by disconnecting loads and no attending consumers. Plant retirements scheduled for 1995 were postponed and 100 MW steam additional plants were installed in 1997 and 1998. Supply situation from 1997 improved as follows:

(% of demand)

YEAR	CAPACITY	ENERGY
1993	2.2	1.4
1994	5.6	1.3
1995	7.4	2.3
1996	5.0	1.2
1997	0.0	0.0
1998	0.0	0.0
1999	0.3	0.0
2000	0.0	0.0

Annex 4: Characteristics of Transmission Projects

PROJECT	YEAR	COST (US$ million)	DESCRIPTION
Center-West Region Interconnection System (Phase I)	1993	24.7	230 kV and 110 km line connecting the existing Esquintla S/E with a new S/E in San Sebastian.
Atlantic Region Interconnection System	1995	27.2	230 kV and 165 km line connecting two new substations: Las Verapaces and Río Dulce, through Chulac.
Peten Region Interconnection System (Phase I)	1998	17.3	138 kV and 201 km line connecting the reinforced substations Río Dulce, Poptún and Santa Elena.
Enlargement of the Substation Guate-Este	1994	11.2	Enlargement of the existing 230/69 kV Guate-Este substation, installing a 150 MVA transformer.
Center-West Region Interconnection System (Phase II)	1995	19.8	230 kV and 50 km line connecting the substations San Sebastián and La Esperanza.
Interconnection of the Santa María II Hydro Project	1996	3.6	Step-up 13.2/230 kV substation with a 80 MVA transformer sectionalizing the San Sebastián-La Esperanza line.
Interconnection of the El Palmar Hydro Project	1998	5.2	230 kV and 20 km line and 80 MVA 13.2/230 kV substation connecting El Palmar to San Sebastián S/E.
Erection of the Jutiapa Substation	1995	5.7	230/69 kV substation with a 50/60 MVA transformer sectionalizing the Guatemala-El Salvador line.
Interconnection of the Serchil Hydro Project	1999	12.2	230 kV and 55 km line and 150 MVA 13.2/230 kV substation connecting Serchil to La Esperanza S/E.
Center-West Region Interconnection System (Phase III)	1999	10.3	230 kV and 110 km line connecting La Esperanza and Guate-Sur substations.
Interconnection of the Zunil II Geothermal Project	1999	4.9	13.2/230 kV 80 MVA step-up substation sectionalizing the San Sebastián-La Esperanza line.

GUATEMALA - Energy Sales (GWh)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991 1/
Retail Sales:												
- Residential	307.28	319.77	325.38	342.601	359.85	374.98	411.10	451.99	487.10	539.61	600.30	565.62
- Commercial	231.11	240.29	242.55	245.30	255.08	260.38	276.84	338.96	376.25	404.44	442.32	416.77
- Industrial	511.86	481.74	381.07	361.36	369.42	400.70	456.25	534.57	551.21	633.56	664.73	626.33
- Government	107.86	110.91	119.58	126.03	127.95	131.43	132.50	146.88	152.26	164.04	159.94	150.70
- Public Lighting	7.11	7.61	8.89	9.18	9.63	9.96	10.33	10.61	11.59	12.90	14.04	13.23
Total Retail Sales	1,165.22	1,160.32	1,077.47	1,084.47	1,121.92	1,177.45	1,287.01	1,483.00	1,578.40	1,754.56	1,881.34	1,772.66
Bulk Sales: 2/												
- To EEGSA	695.62	663.20	641.27	819.43	742.45	788.12	1,228.24	1,264.873	1,303.68	1,509.63	1,584.95	1,493.39
- To Municipalities	58.28	56.13	55.87	54.67	56.76	60.83	67.38	77.272	84.13	86.76	95.18	100.02

1/ Preliminary data.
2/ Sales from INDE

GUATEMALA - Annual Subsidy (1991 US$ million)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	19911/
Retail Consumers:												
- Residential	(5.52)	(7.94)	(3.88)	(7.43)	(0.38)	4.98	14.27	17.44	19.45	23.03	28.46	28.50
- Commercial	(4.80)	(6.60)	(6.92)	(5.58)	(4.28)	0.06	6.92	9.97	8.52	9.90	12.23	10.34
- Industrial	(11.26)	(14.44)	(13.09)	(10.05)	(8.48)	(2.54)	8.53	13.70	5.44	10.50	12.79	10.11
- Government	0.43	(0.44)	(0.53)	0.18	0.67	2.43	5.09	6.06	5.98	6.98	7.26	5.02
- Public Lighting	0.10	0.05	0.04	0.06	0.09	0.22	0.42	0.46	0.56	0.48	0.43	0.53
Total Retail Consumers	(21.05)	(29.36)	(24.38)	(22.81)	(12.38)	5.16	35.22	47.64	39.95	50.90	61.17	54.49
Bulk Consumers: 2/												
- EEGSA	(0.98)	(3.25)	(0.11)	4.50	8.59	9.60	46.20	51.04	55.75	64.42	61.35	62.29
- Municipalities	0.69	0.20	0.70	0.84	1.10	1.89	3.20	4.02	4.29	4.41	5.49	5.88

1/ Preliminary data.
2/ Sales from INDE
3/ Marginal Cost (US cent/kWh): HV= 7.40 MV= 8.30 LV= 9.20

GUATEMALA - Subsidy Distribution for Residential Consumers

EXISTING TARIFF:

Range (kWk/month)	Number of Consumers (%) 1/	Monthly Consumption		Average Rate 3/ (US cents/kWh)	Consumer Cost ('000 US$)	Consumer Revenue 4/ ('000 US$)	Consumer Subsidy ('000 US$)	Consumer Subsidy (%)	Average Monthly Bill (US$)	Increase Rate (%)
		Average (kWh)	Total 2/ (MWh)							
0-14	5.7	4.5	69.7	10.7	7.4	6.4	(1.0)	(13.8)	0.5	n/a
15-60	26.9	34.6	2,527.7	5.2	131.9	232.5	100.6	76.3	1.8	n/a
61-100	20.0	72.8	3,956.5	5.0	197.4	364.0	166.6	84.4	3.6	n/a
101-200	28.5	129.2	10,007.5	4.8	480.0	920.7	440.7	91.8	6.2	n/a
201-300	9.2	220.2	5,505.5	4.7	256.1	506.5	250.4	97.8	10.2	n/a
301-400	3.4	313.0	2,892.2	5.1	147.5	266.1	118.6	80.4	16.0	n/a
401-500	1.8	405.8	1,985.2	5.1	101.3	182.6	81.4	80.4	20.7	n/a
501-750	2.1	551.4	3,146.9	6.9	217.4	289.5	72.1	33.2	38.1	n/a
751-1,000	1.0	783.4	2,129.1	6.9	146.2	195.9	49.6	34.0	53.8	n/a
1,001-1,500	0.8	1,066.4	2,318.5	6.8	158.7	213.3	54.7	34.4	73.0	n/a
1501-2000	0.3	1,559.6	1,271.5	6.8	86 7	117.0	30.3	34.9	106.4	n/a
>2,000	0.3	4,480.4	3,652.8	6.8	248.0	336.1	88.1	35.5	304.2	n/a
Total	100.0	145.2	39,463.2	5.4	2,178.7	3,630.6	1,451.9	66.6	7.8	n/a

1/ Total Number of Residential Consumers: 271,767.5
2/ EEGSA Residential Year 1990 Sales (MWh) 473,567.0
3/ Exchange Rate (quetzal/US$): 5.06
4/ Marginal Cost for Distribution (US cents/kWh): 9.20

PROPOSED TARIFF:

Range (kWk/month)	Number of Consumers (%)	Monthly Consumption Average (kWh)	Monthly Consumption Total (MWh)	Average Rate 5/ (US cents/kWh)	Consumer Cost ('000 US$)	Consumer Revenue ('000 US$)	Consumer Subsidy ('000 US$)	Consumer Subsidy (%)	Average Monthly Bill (US$)	Increase Rate (%)
0-14	5.7	4.5	69.7	6.0	4.2	6.4	2.2	53.3	0.3	(43.8)
15-60	26.9	34.6	2,527.7	6.0	151.7	232.5	80.9	53.3	2.1	15.0
61-100	20.0	72.8	3,956.5	6.6	262.2	364.0	101.8	38.8	4.8	32.8
101-200	28.5	129.2	10,007.5	7.9	791.0	920.7	129.7	16.4	10.2	64.8
201-300	9.2	220.2	5,505.5	9.3	510.6	506.5	(4.1)	(0.8)	20.4	99.4
301-400	3.4	313.0	2,892.2	10.1	291.6	266.1	(25.5)	(8.8)	31.6	97.7
401-500	1.8	405.8	1,985.2	10.5	208.9	182.6	(26.2)	(12.6)	42.7	106.3
501-750	2.1	551.4	3,146.9	10.9	343.4	289.5	(53.9)	(15.7)	60.2	58.0
751-1,000	1.0	783.4	2,129.1	11.2	239.2	195.9	(43.3)	(18.1)	88.0	63.6
1,001-1,500	0.8	1,066.4	2,318.5	11.4	265.2	213.3	(51.9)	(19.6)	122.0	67.1
1501-2000	0.3	1,559.6	1,271.5	11.6	147.7	117.0	(30.7)	(20.8)	181.1	70.3
>2,000	0.3	4,480.4	3,652.8	11.9	433.4	336.1	(97.4)	(22.5)	531.6	74.8
Total	100.0	145.2	39,463.2	9.2	3,649.0	3,630.6	(18.4)	(0.5)	13.4	71.9

5/ PROPOSED RESIDENTIAL RATE:

Rate Range	kWh/month	US cents/kWh
First:	50.0	6.0
Following:	50.0	8.0
Following:	100.0	11.0
Following:	200.0	12.0
Following:	400.0	12.0
Higher than 800 kWh:		12.0

Annex 6: Guatemala - Marginal Cost and Reference Tariffs

Marginal Cost

Network Level	Capacity (US$/kW -year)	Energy Cost (US$/MWh)			Average Cost (US$/MWh)[1]		
		Peak	Off-Peak	Total	Peak	Off-Peak	Total
Generation							
- Cost	39.40	55.10	48.60	50.23	66.40	59.90	61.53
Transmission							
- Losses (%)	3.20	3.00	2.00	2.25			
- Cost	22.70						
Accumulated	84.00	56.75	49.57	51.37	72.73	65.55	67.35
Subtransmission							
- Losses (%)	3.00	2.50	2.00	2.13			
- Cost	27.00						
Accumulated	113.52	58.17	50.56	52.47	79.77	72.16	74.06
Medium Voltage							
- Losses (%)	5.00	4.00	3.80	3.85			
- Cost	33.50						
Accumulated	152.70	60.50	52.48	54.49	89.55	81.54	83.54
Low Voltage							
- Losses (%)	9.00	8.00	7.20	7.40			
- Cost	11.90						
Accumulated	178.34	65.34	56.26	58.53	99.27	90.19	92.46

Reference Tariff

Supply Level	Capacity (US$/kW -month)	Energy (US cents/kWh)			Average Rate (US$/MWh)		
		Peak	Off-Peak	Total	Peak	Off-Peak	Total
Interconnection[2]	7.00	5.68	4.96	5.14	7.27	6.56	6.73
High Voltage[3]	7.57	5.82	5.06	5.25	7.30	6.54	6.73
Medium Voltage[4]	4.58	6.78	6.02	6.21	7.67	6.91	7.10
Low Voltage							
- Residential[5]	------	10.61	9.70	9.92	10.61	9.70	9.92
- Other[6]	4.32	7.83	6.92	7.15	8.82	7.91	8.14

1 Global Load Factor: 0.60

2 Full generation and transmission costs have been assumed.
- Load Factor: 0.60
- Coincidence Factor: 1.00

3 Full generation, transmission and subtransmission costs have been assumed.
- Load Factor: 0.70
- Coincidence Factor: 0.80

4 Generation and transmission have been considered as collective components.
- Load Factor: 0.70
- Coincidence Factor: 0.80

5 All system components have been assumed as collective
- Load Factor: 0.50
-Coincidence Factor: 0.80

6 Generation, transmission and subtransmission have been considered as collective components.
- Load Factor: 0.60
-Coincidence Factor: 0.80

7 Proportion of peak-period: 0.25

Annex 7

Guatemala Power Sector:

Actual Financial Statements Summary

Guatemala: Consolidated Sector (Current Q. Millions)

	1980 ACTUAL	1981 ACTUAL	1982 ACTUAL	1983 ACTUAL	1984 ACTUAL	1985 ACTUAL	1986 ACTUAL	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 —
AVERAGE EXCHANGE RATE (Quetz.)	1.00	1.00	1.00	1.00	1.00	2.74	2.85	2.69	2.63	3.40	4.30	5.06	5.06
SALES TO EEGSA (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS (Gwh)	1243	1220	1135	1147	1188	1242	1363	1571	1675	1860	1990	2104	2303
AVERAGE RATE TO EEGSA (/Kwh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVER. RATE TO OTHER UTIL. (/Kwh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVER. RATE FINAL CONSUM. (/Kwh)	11.28	13.77	13.37	13.10	12.78	12.83	12.74	12.74	15.62	16.05	21.65	27.32	39.70
SALES TO EEGSA	0	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS	140	168	152	150	152	159	174	200	262	299	431	575	914
OTHER REVENUES	6	5	3	3	2	3	6	(2)	(5)	1	1	2	67
TOTAL REVENUES	146	173	155	153	154	162	179	198	257	299	431	577	982
FUEL	88	101	71	45	57	59	3	21	25	20	39	190	282
OPERATING EXP. (Exc. Fuel.) 1/	45	56	62	65	67	79	115	135	154	244	289	294	363
TOTAL OPERATING EXPENSES	133	158	133	109	124	138	118	156	179	264	328	484	645
OPERATING INCOME	12	16	22	44	30	24	61	41	78	35	103	94	337
OTHER NET INCOME	0	0	12	7	(1)	0	(2)	4	(5)	17	(361)	(13)	4
INTEREST CHARGED TO OPERATIONS	4	3	11	11	4	5	29	32	77	96	127	135	107
INCOME TAXES	0	0	0	0	0	0	0	0	0	1	3	5	20
NET INCOME	9	13	23	39	25	19	30	14	(5)	(45)	(387)	(59)	213
GROSS INTERNAL CASH GENERATION	29	36	61	79	71	64	131	113	143	191	284	248	511
Less: INTEREST CHARGED TO OPERAT.	4	3	11	11	4	5	29	32	77	96	127	135	107
AMORTIZATION	13	19	14	24	31	29	36	57	81	70	34	159	482
DEBT SERVICE	17	22	25	35	35	33	65	89	158	167	161	294	589
NET INTERNAL CASH GENERATION	11	15	36	44	36	31	66	24	(14)	24	123	(46)	(78)
GOVERNMENT CONTRIBUTION	120	213	93	119	52	17	28	5	41	96	29	255	259
OTHER CONTRIBUTIONS	(2)	(3)	(7)	(11)	(2)	10	9	11	26	9	7	12	4
TOTAL OWN FUNDS	118	211	86	109	50	27	38	16	67	106	36	268	263
LOAN DISBURSEMENTS	35	55	162	63	15	72	43	14	28	22	66	83	576
TOTAL SOURCES	165	280	284	215	102	130	146	54	81	151	226	304	760
INVESTMENTS	206	261	247	117	118	114	83	67	112	119	219	250	605
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	9	10
INC.(DECR) WORKING CAPITAL	(41)	18	36	43	(34)	17	36	(13)	(50)	31	4	45	114
OTHER USES	1	0	0	56	17	0	27	(1)	19	1	4	0	37
TOTAL USES	165	279	284	215	101	131	147	53	80	151	226	304	766
(FINANCIAL GAP) OR EXCEDENT	0	0	0	0	1	0	0	1	0	0	0	0	(5)
FIXED ASSETS 1/	696	949	1,179	1,276	1,374	2,082	2,194	2,242	2,339	3,016	4,287	4,395	4,823
CURRENT ASSETS & OTHER ASSETS	119	154	164	221	218	244	327	351	432	646	720	884	896
TOTAL ASSETS	815	1,104	1,343	1,496	1,592	2,326	2,521	2,593	2,771	3,661	5,007	5,279	5,719
LONG TERM DEBT	203	239	387	417	388	428	458	422	842	930	1,259	1,034	1,361
SHORT TERM & OTHER LIABILITIES	130	157	133	97	144	125	130	172	303	454	813	1,048	692
TOTAL LIABILITIES	333	396	520	514	531	553	588	594	1,145	1,385	2,072	2,082	2,052
EQUITY	481	708	823	983	1,060	1,773	1,933	1,999	1,626	2,277	2,934	3,197	3,666
TOTAL EQUITY PLUS LIAB.	815	1,104	1,343	1,496	1,592	2,325	2,521	2,593	2,771	3,661	5,006	5,279	5,719
PERFORMANCE INDICATORS													
TARIFF INCREASE FINAL CONSUMERS	n/a	22.07%	-2.87%	-2.05%	-2.45%	0.41%	-0.74%	0.01%	22.64%	2.76%	34.88%	26.20%	45.30%
OPERATING RATIO	91.47%	90.93%	85.80%	71.33%	80.35%	85.05%	65.90%	79.03%	69.76%	88.16%	76.02%	83.78%	65.69%
RATE OF RETURN ON REV. ASSETS	7.22%	5.96%	6.18%	12.26%	8.42%	2.23%	3.26%	2.13%	3.92%	1.47%	-7.58%	2.05%	8.74%
% INTERN.GEN./CONSTRUCT.	5.58%	5.57%	14.50%	37.64%	30.95%	27.14%	79.24%	36.40%	-12.97%	20.29%	56.44%	-17.79%	-12.76%
DEBT SERVICE COVERAGE	1.66	1.67	2.44	2.26	2.05	1.93	2.01	1.27	0.91	1.14	1.77	0.84	0.87
DEBT/(DEBT+EQUITY) RATIO	40.9%	35.9%	38.7%	34.3%	33.4%	23.8%	23.3%	22.9%	41.3%	37.8%	41.4%	39.4%	35.9%
DISTRIBUTION MARGIN	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

1/ Includes assets revaluation.

GUATEMALA - INDE (Current Q. Millions)

	1980 ACTUAL	1981 ACTUAL	1982 ACTUAL	1983 ACTUAL	1984 ACTUAL	1985 ACTUAL	1986 ACTUAL	1987 ACTUAL	1988 ACTUAL	1589 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 ---
AVERAGE EXCHANGE RATE (Quetz.)	1.00	1.00	1.00	1.00	1.00	2.74	2.85	2.69	2.63	3.40	4.30	5.06	5.06
SALES TO EEGSA (Gwh)	696	663	641	819	742	788	1228	1265	1304	1510	1585	1493	1517
SALES TO OTHER UTILITIES (Gwh)	58	56	56	55	57	61	67	77	84	90	90	100	114
SALES FINAL CONSUMERS (Gwh)	177	188	149	153	158	179	235	284	298	349	389	406	481
AVERAGE RATE TO EEGSA (/Kwh)	8.03	9.37	8.83	8.22	8.03	9.89	7 61	7.56	8.51	8.71	13.86	17.26	27.30
AVER. RATE TO OTHER UTIL. (/Kwh)	8.54	10.48	9.47	9.40	9.35	9.31	9.32	8.96	10.27	8.71	13.86	16.86	27.30
AVER. RATE FINAL CONSUM. (/Kwh)	12.97	16.17	15.66	14.96	14.32	14.23	13.60	13.79	18.18	17.10	22.24	29.66	39.94
SALES TO EEGSA	56	62	57	67	60	78	93	96	111	131	220	258	414
SALES TO OTHER UTILITIES	5	6	5	5	5	6	6	7	9	8	12	17	31
SALES FINAL CONSUMERS	23	30	23	23	23	25	32	39	54	60	87	120	192
OTHER REVENUES	0	(3)	(4)	(2)	(2)	(1)	5	(3)	(5)	0	0	0	65
TOTAL REVENUES	84	95	82	93	86	108	137	139	169	199	319	395	702
FUEL	58	64	41	26	32	34	3	9	7	7	15	94	200
OPERATING EXP. (Exc. Fuel.) 1/	20	23	28	32	36	45	72	84	90	142	184	198	212
TOTAL OPERATING EXPENSES	78	87	68	59	68	79	74	93	97	148	199	292	412
OPERATING INCOME	6	8	13	35	18	29	63	46	72	51	120	103	290
OTHER NET INCOME	0	1	11	6	(2)	(1)	(4)	0	(9)	12	(364)	(18)	0
OTHER NET INCOME FROM SECTOR	0	0	0	1	18	0	8	7	11	7	6	16	0
INTEREST CHARGED TO OPERATIONS	2	1	10	11	4	4	27	29	68	91	120	124	83
NET INCOME	5	7	15	31	30	24	39	24	5	(21)	(358)	(23)	208
GROSS INTERNAL CASH GENERATION	12	15	36	54	45	50	109	94	108	171	251	206	411
Less: INTEREST CHARGED TO OPERAT.	2	1	10	11	4	4	27	29	68	91	120	124	83
AMORTIZATION	7	12	13	21	24	25	31	52	80	69	33	157	482
DEBT SERVICE	9	13	22	32	28	29	59	81	148	159	153	281	565
NET INTERNAL CASH GENERATION	4	2	14	22	17	21	51	13	(40)	11	98	(75)	(154)
GOVERNMENT CONTRIBUTION	120	213	93	119	52	17	28	5	41	96	29	255	259
OTHER CONTRIBUTIONS	(2)	0	1	0	0	12	7	38	21	6	2	0	0
TOTAL OWN FUNDS	118	213	94	120	52	29	35	43	62	102	32	255	259
LOAN DISBURSEMENTS	35	54	160	60	13	68	35	6	28	22	66	68	429
TOTAL SOURCES	158	269	267	202	82	118	121	61	50	135	195	247	533
INVESTMENTS	197	261	238	111	110	107	61	46	82	56	175	186	513
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	9	10
INC.(DECR) WORKING CAPITAL	(40)	8	29	35	(46)	11	33	16	(51)	79	21	52	15
OTHER USES	0	0	0	56	17	0	27	(2)	19	0	0	0	0
TOTAL USES	158	269	267	202	81	118	121	60	50	135	195	247	539
(FINANCIAL GAP) OR EXCEDENT	0	0	0	0	1	0	0	1	0	0	0	0	(5)
FIXED ASSETS 1/	644	898	1,124	1,223	1,321	1,931	1,999	2,048	2,107	2,638	3,797	3,911	4,316
CURRENT ASSETS & OTHER ASSETS	101	130	140	192	176	189	274	290	360	613	696	822	688
TOTAL ASSETS	744	1,029	1,264	1,415	1,496	2,120	2,273	2,338	2,467	3,251	4,494	4,733	5,004
LONG TERM DEBT	199	236	386	417	388	428	458	422	838	927	1,258	1,021	1,224
SHORT TERM & OTHER LIABILITIES	105	131	110	80	123	102	103	134	251	402	741	959	560
TOTAL LIABILITIES	304	367	496	496	511	529	561	555	1,089	1,329	1,999	1,981	1,785
EQUITY	441	661	768	919	985	1,590	1,713	1,783	1,378	1,921	2,495	2,752	3,219
TOTAL EQUITY PLUS LIAB.	744	1,029	1,264	1,415	1,496	2,119	2,274	2,338	2,466	3,251	4,494	4,733	5,004
PERFORMANCE INDICATORS													
TARIFF INCREASE FINAL CONSUMERS	n/a	24.68%	-3.16%	-4.48%	-4.26%	-0.64%	-4.40%	1.34%	31.87%	-5.93%	30.03%	33.38%	34.66%
OPERATING RATIO	92.42%	91.37%	83.48%	62.74%	79.13%	72.99%	54.34%	66.69%	57.55%	74.28%	62.39%	74.00%	58.63%
RATE OF RETURN ON REV. ASSETS	5.17%	3.83%	4.41%	11.36%	5.80%	2.96%	3.66%	2.62%	3.99%	2.41%	4.04%	2.98%	8.49%
% INTERN.GEN./CONSTRUCT.	2.01%	0.77%	5.83%	20.15%	15.72%	19.30%	82.61%	27.50%	-48.44%	19.90%	55.87%	-38.71%	-29.49%
DEBT SERVICE COVERAGE	1.47	1.15	1.62	1.70	1.63	1.71	1.86	1.15	0.73	1.07	1.64	0.73	0.73
DEBT/(DEBT+EQUITY) RATIO	40.8%	35.7%	39.2%	35.1%	34.1%	25.0%	24.7%	23.7%	44.1%	40.9%	44.5%	41.8%	35.7%
DISTRIBUTION MARGIN	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

1/ Includes assets revaluation.

GUATEMALA - EEGSA (Current Q. Millions)

	1980 ACTUAL	1981 ACTUAL	1982 ACTUAL	1983 ACTUAL	1984 ACTUAL	1985 ACTUAL	1986 ACTUAL	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 —
AVERAGE EXCHANGE RATE (Quetz.)	1.00	1.00	1.00	1.00	1.00	2.74	2.85	2.69	2.63	3.40	4.30	5.06	5.06
SALES TO EEGSA (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS (Gwh)	1008	976	931	939	974	1002	1061	1209	1293	1421	1510	1598	1708
AVERAGE RATE TO EEGSA (/Kwh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVER. RATE TO OTHER UTIL. (/Kwh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVER. RATE FINAL CONSUM. (/Kwh)	11.14	13.50	13.24	13.01	12.73	12.80	12.76	12.73	15.38	16.26	21.97	27.39	40.46
SALES TO EEGSA	0	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS	112	132	123	122	124	128	135	154	199	231	332	438	691
OTHER REVENUES	5	9	7	5	4	4	0	0	0	0	0	2	3
TOTAL REVENUES	118	140	130	127	128	132	136	154	199	231	332	440	694
FUEL	30	38	31	18	24	25	1	13	18	13	25	96	82
OPERATING EXP. (Exc. Fuel.) 1/	81	95	91	100	91	112	137	146	175	234	324	353	565
TOTAL OPERATING EXPENSES	112	133	122	118	115	137	137	159	193	247	349	449	647
OPERATING INCOME	6	8	9	9	12	(5)	(1)	(5)	6	(16)	(17)	(9)	46
OTHER NET INCOME	0	0	1	1	1	1	2	4	4	5	3	5	3
INTEREST CHARGED TO OPERATIONS	2	2	1	1	1	0	2	3	9	6	6	10	24
INCOME TAXES	0	0	0	0	0	0	0	0	0	1	3	5	20
NET INCOME	4	6	8	9	12	(5)	(2)	(4)	1	(17)	(24)	(20)	5
GROSS INTERNAL CASH GENERATION	16	21	25	25	26	14	22	19	35	20	33	42	100
Less: INTEREST CHARGED TO OPERAT.	2	2	1	1	1	0	2	3	9	6	6	10	24
AMORTIZATION	7	7	1	2	6	4	5	4	1	1	1	2	0
DEBT SERVICE	9	9	3	3	7	4	6	7	10	7	8	12	24
NET INTERNAL CASH GENERATION	8	13	22	22	19	10	15	12	25	13	26	29	76
GOVERNMENT CONTRIBUTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER CONTRIBUTIONS	2	2	2	3	2	3	4	6	7	10	11	16	21
TOTAL OWN FUNDS	2	2	2	3	2	3	4	6	7	10	11	16	21
LOAN DISBURSEMENTS	0	1	2	3	2	4	8	8	0	0	0	15	147
TOTAL SOURCES	10	16	26	27	23	17	27	26	32	23	36	60	244
INVESTMENTS	8	1	9	6	7	6	22	21	30	63	44	64	91
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
INC.(DECR) WORKING CAPITAL	(1)	10	8	7	12	6	4	(29)	1	(42)	(9)	1	99
OTHER USES	1	0	0	0	0	0	0	1	0	1	4	0	37
TOTAL USES	7	11	17	13	19	12	25	(7)	30	22	39	65	227
(FINANCIAL GAP) OR EXCEDENT	2	5	9	14	3	5	2	33	2	1	(2)	(5)	17
FIXED ASSETS 1/	52	51	55	53	53	151	195	194	232	378	490	484	507
CURRENT ASSETS & OTHER ASSETS	32	36	41	49	54	62	90	123	180	115	153	217	277
TOTAL ASSETS	84	88	96	102	107	213	284	317	412	493	643	701	784
LONG TERM DEBT	5	3	1	0	0	0	0	0	5	3	1	13	136
SHORT TERM & OTHER LIABILITIES	38	38	40	38	32	31	64	101	159	135	202	244	200
TOTAL LIABILITIES	43	41	41	38	32	31	64	101	164	138	203	257	336
EQUITY	41	47	55	64	75	182	220	216	248	355	440	444	447
TOTAL EQUITY PLUS LIAB.	84	88	96	102	107	213	284	318	412	493	643	701	784
PERFORMANCE INDICATORS													
TARIFF INCREASE FINAL CONSUMERS	n/a	21.12%	-1.87%	-1.74%	-2.18%	0.53%	-0.27%	-0.23%	20.79%	5.72%	35.09%	24.69%	47.74%
OPERATING RATIO	94.84%	94.65%	93.43%	92.83%	90.36%	103.78%	101.03%	103.15%	96.96%	106.86%	104.97%	102.07%	93.32%
RATE OF RETURN ON REV. ASSETS	12.41%	15.29%	16.71%	17.55%	24.49%	-5.02%	-0.85%	-2.71%	3.19%	-5.54%	-3.22%	-0.96%	10.46%
% INTERN.GEN./CONSTRUCT.	91.11%	2038.21%	236.11%	389.70%	258.09%	163.29%	69.82%	55.82%	84.17%	20.61%	58.61%	46.01%	83.06%
DEBT SERVICE COVERAGE	1.85	2.47	9.26	7.81	3.77	3.41	3.42	2.59	3.53	2.80	4.35	3.41	4.20
DEBT/(DEBT+EQUITY) RATIO	51.3%	46.9%	42.9%	37.5%	29.7%	14.6%	22.6%	31.8%	39.8%	27.9%	31.6%	36.6%	42.9%
DISTRIBUTION MARGIN	27.95%	30.61%	33.34%	36.86%	36.88%	22.72%	40.41%	40.64%	44.65%	46.44%	36.91%	37.00%	32.54%

1/ Includes assets revaluation.

Annex 8: Power Sector Financial Projections

1. This Annex includes a summary of financial projections elaborated to evaluate financial perspectives of Guatemala Power Sector. Two different scenarios were worked to analyze financial perspectives. First scenario called "INDE ALTERNATIVE" assumes that INDE will continue executing future expansion in generation, as it was in the past, and second scenario called "PRIVATE SECTOR ALTERNATIVE" assumes that electricity required will be purchased from the private sector. These scenarios represent extreme cases, and a realistic approach could be anyway between them, with private sector executing some projects and INDE executing some others according to its financial capabilities.

General assumptions: The following assumptions are common to both scenarios.

2. A tariff increase to reach average incremental cost of electricity in 1993 was assumed.

- 30% for all final consumers sales, to reach an average price of Q¢ 45.5 (US¢ 9).
- 51% for bulk sales to reach the interconection level cost Q¢ 32.8 (US¢ 6.5).

3. Government contributions for QM. 200 in 1992 an QM. 100 in 1993 were included. These levels were discussed with Government authorities. Additionally, it will be necessary to cover the debt service in 1992 a loan from the Government of QM. 232.

4. It was not scheduled a repayment program for the 1992 loan from the Government, neither it was scheduled to repay other loans made by the Government in 1988 and 1989, or the debt service of the Decree 13-81 Bonds.

5. It was assumed that the V Distribution program will be rescheduled and the grace period of the Loan will be extended by two years.

INDE Alternative Assumptions:

6. Generation expansion plan was assumed to be executed by INDE. Comissioned dates were adjusted to take acount of the energy sales aggreement from Texas-Ohio (about 100 MW).

New commission dates will be:

Proyecto	Type	Capacity	Commisioned
Zunil I	Geothermal	15 MW	1995
Vapor III	Steam	100 MW	1996
Rio Bobos	Hydro	8 MW	1997
Sta Maria II	Hydro	60 MW	1998
El Palmar	Hydro	23 MW	1999
Geotherm. II	Geothermal	55 MW	2000
Serchil	Hydro	110 MW	2001

7. 90% of the external component of the projects was assumed to be financed with external loans. All other investments were assumed to be financed with own resources. Under this assumption, 62% of the 1992-2000 investment program will be financed with loans.

PRIVATE ALTERNATIVE assumptions:

8. This alternative assumes that INDE won't execute any of the future generation plants and, instead, it will buy from private suppliers amounts of electricity similar to these that would be generated for those plants. Electricity purchases to private suppliers was assumed at a rate similar to the one obtained by EEGSA recently, Q¢ 30.5/Kwh (US¢ 6/Kwh).

GUATEMALA - INDE

(Current Q. Millions)

	1990 Actual	1991 Actual	1992	1993	1994	1995	1996	1997	1998	1999	2000	INDE Alternative 92-2000
AVERAGE EXCHANGE RATE (Quetz.)	4.30	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	
SALES TO EEGSA (Gwh)	1585	1493	1517	1378	1462	1517	1642	1774	1912	2057	2210	15,470
SALES TO OTHER UTILITIES (Gwh)	90	100	114	123	133	144	155	168	181	195	211	1,424
SALES FINAL CONSUMERS (Gwh)	389	406	481	549	572	0	0	0	0	0	0	1,601
AVERAGE RATE TO EEGSA (/Kwh)	13.86	17.26	27.30	32.84	32.84	32.84	32.84	32.84	32.84	32.84	32.84	32.30
AVER. RATE TO OTHER UTIL. (/Kwh)	13.86	16.86	27.30	32.84	32.84	32.84	32.84	32.84	32.84	32.84	32.84	32.40
AVER. RATE FINAL CONSUM. (/Kwh)	22.24	29.66	39.94	45.10	45.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SALES TO EEGSA	220	258	414	453	480	498	539	583	628	676	726	4,996
SALES TO OTHER UTILITIES	12	17	31	40	44	47	51	55	59	64	69	461
SALES FINAL CONSUMERS	87	120	192	248	259	0	0	0	0	0	0	699
OTHER REVENUES	0	0	65	0	0	0	0	0	0	0	0	67
TOTAL REVENUES	319	395	702	741	783	546	591	638	688	740	795	6,224
FUEL	15	94	200	143	185	0	0	0	0	0	0	527
OPERATING EXP. (Exc. Fuel.) 1/	184	198	212	214	218	0	0	0	0	0	0	645
TOTAL OPERATING EXPENSES	199	292	412	357	404	0	0	0	0	0	0	1,172
OPERA7"G INCOME	120	103	290	385	380	546	591	638	688	740	795	5,052
OTHER NET INCOME	(364)	(18)	0	0	0	0	0	0	0	0	0	4
OTHER NET INCOME FROM SECTOR	6	16	0	0	0	0	0	0	0	0	0	0
INTEREST CHARGED TO OPERATIONS	120	124	83	80	63	81	72	70	60	50	61	621
NET INCOME	(358)	(23)	208	305	317	465	519	568	628	691	734	4,435
GROSS INTERNAL CASH GENERATION	251	206	411	505	500	0	0	0	0	0	0	1,416
Less: INTEREST CHARGED TO OPERAT.	120	124	83	80	63	81	72	70	60	50	61	621
AMORTIZATION	33	157	482	226	232	154	123	126	126	118	86	1,673
DEBT SERVICE	153	281	565	305	296	235	195	197	186	168	148	2,294
NET INTERNAL CASH GENERATION	98	(75)	(154)	200	204	(235)	(195)	(197)	(186)	(168)	(148)	(878)
GOVERNMENT CONTRIBUTION	29	255	259	100	0	0	0	0	0	0	0	359
OTHER CONTRIBUTIONS	2	0	0	0	0	0	0	0	0	0	0	0
TOTAL OWN FUNDS	32	255	259	100	0	0	0	0	0	0	0	359
LOAN DISBURSEMENTS	66	68	429	252	209	79	34	51	29	2	5	1,089
TOTAL SOURCES	195	247	533	552	413	(156)	(161)	(145)	(157)	(166)	(143)	571
INVESTMENTS	175	186	513	398	289	152	108	125	105	65	65	1,820
INTEREST DURING CONSTRUCTION	0	9	10	14	34	15	18	14	18	20	0	144
INC.(DECR) WORKING CAPITAL	21	52	15	113	55	0	0	0	0	0	0	183
OTHER USES	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL USES	195	247	539	525	377	168	126	139	123	84	65	2,146
(FINANCIAL GAP) OR EXCEDENT	0	0	(5)	27	36	(324)	(288)	(284)	(280)	(250)	(208)	(1,576)
FIXED ASSETS 1/	3,797	3,911	4,316	4,608	4,812	4,857	4,854	4,858	4,848	4,803	4,739	
CURRENT ASSETS & OTHER ASSETS	696	822	688	783	824	272	272	272	272	272	272	
TOTAL ASSETS	4,494	4,733	5,004	5,391	5,635	5,129	5,126	5,130	5,120	5,075	5,011	
LONG TERM DEBT	1,258	1,021	1,224	1,244	1,299	1,255	1,162	1,088	999	914	833	
SHORT TERM & OTHER LIABILITIES	231	217	217	217	218	218	219	219	219	220	220	
TOTAL LIABILITIES	1,488	1,238	1,442	1,462	1,517	1,473	1,381	1,307	1,218	1,134	1,054	
EQUITY	2,495	2,752	3,219	3,624	3,941	0	0	0	0	0	0	
TOTAL EQUITY PLUS LIAB.	3,983	3,990	4,661	5,086	5,458	1,473	1,381	1,307	1,218	1,134	1,054	
PERFORMANCE INDICATORS												
TARIFF INCREASE FINAL CONSUMERS	30.03%	33.38%	34.66%	12.92%	0.57%	-100.00%	n/a	n/a	n/a	n/a	n/a	
OPERATING RATIO	62.39%	74.00%	58.63%	48.11%	51.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
RATE OF RETURN ON REV. ASSETS	4.04%	2.98%	8.49%	11.24%	11.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
% INTERN.GEN./CONSTRUCT.	55.87%	-38.71%	-29.49%	48.47%	63.33%	-140.10%	-154.21%	-141.52%	-151.66%	-198.99%	-225.67%	
DEBT SERVICE COVERAGE	1.64	0.73	0.73	1.65	1.69	0.00	0.00	0.00	0.00	0.00	0.00	
DEBT/(DEBT+EQUITY) RATIO	33.1%	26.2%	28.8%	27.1%	26.9%	28.7%	26.9%	25.5%	23.8%	22.3%	21.0%	
DISTRIBUTION MARGIN	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

1/ Includes assets revaluation.

GUATEMALA - EEGSA

(Current Q. Millions)

NDE Alternative

	1990 Actual	1991 Actual	1992	1993	1994	1995	1996	1997	1998	1999	2000	92-2000
AVERAGE EXCHANGE RATE (Quetz.)	4.30	5.0[illegible]	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	
SALES TO EEGSA (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS (Gwh)	1510	1598	1708	1946	2048	2153	2263	2378	2499	2627	2761	20383
AVERAGE RATE TO EEGSA (/Kwh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVER. RATE TO OTHER UTIL. (/Kwh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVER. RATE FINAL CONSUM. (/Kwh)	21.97	27.39	40.46	45.75	45.74	45.74	45.74	45.74	45.74	45.74	45.74	45.30
SALES TO EEGSA	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS	332	437.8	691	890	937	985	1035	1088	1143	1202	1263	9234
OTHER REVENUES	0	2.1	3	3	3.	3	0	0	0	0	0	13
TOTAL REVENUES	332	439.9	694	893	940	988	1035	1088	1,144	1202	1263	9247
FUEL	25	95.7	82	10	0	0	0	0	0	0	0	92
OPERATING EXP. (Exc. Fuel.) 1/	324	353.3	565	836	891	935	984	1035	10,09	1145	1202	8682
TOTAL OPERATING EXPENSES	349	449	647	845	891	935	984	1035	1089	1145	1202	8773
OPERATING INCOME	(17)	(9)	46	48	49	53	52	53	55	57	61	474
OTHER NET INCOME	3	5	3	4	4	4	4	4	4	4	4	33
INTEREST CHARGED TO OPERATIONS	6	10	24	24	28	31	35	39	42	43	46	311
INCOME TAXES	3	5	20	21	21	22	21	21	21	22	22	192
NET INCOME	(24)	(20)	5	6	3	4	0	(3)	(5)	(4)	(5)	3
GROSS INTERNAL CASH GENERATION	33	42	100	103	109	115	116	120	125	130	136	1054
Less: INTEREST CHARGED TO OPERAT.	6	10	24	24	28	31	35	39	42	43	46	311
AMORTIZATION	1	2	0	24	24	24	24	34	39	28	38	234
DEBT SERVICE	8	12	24	48	52	54	58	73	81	71	85	546
NET INTERNAL CASH GENERATION	26	29	76	56	57	61	58	48	44	59	51	508
GOVERNMENT CONTRIBUTION	0	0	0	0	0	0	0	0	0	0	0	0
OTHER CONTRIBUTIONS	11	16	21	22	23	24	25	26	27	28	29	224
TOTAL OWN FUNDS	11	16	21	22	23	24	25	26	27	28	29	224
LOAN DISBURSEMENTS	0	15	147	52	42	48	51	55	48	50	54	547
TOTAL SOURCES	36	60	244	129	121	133	133	120	119	137	134	1279
INVESTMENTS	44	64	91	108	92	105	109	118	107	112	119	961
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0
INC.(DECR) WORKING CAPITAL	(9)	1	99	28	16	18	3	2	(2)	2	7	174
OTHER USES	4	0	37	0	0	0	0	0	0	0	0	37
TOTAL USES	39	65	227	136	109	122	113	120	105	114	126	1172
(FINANCIAL GAP) OR EXCEDENT	(2)	(5)	17	(7)	13	11	20	9	14	23	8	108
FIXED ASSETS 1/	490	484	507	544	561	587	614	646	663	682	705	
CURRENT ASSETS & OTHER ASSETS	153	217	277	305	320	337	346	360	370	384	404	
TOTAL ASSETS	643	701	784	849	881	924	960	1006	1033	1067	1110	
LONG TERM DEBT	1	13	136	164	182	207	224	239	259	271	287	
SHORT TERM & OTHER LIABILITIES	202	244	200	231	242	255	276	308	320	345	378	
TOTAL LIABILITIES	203	257	336	395	424	462	499	548	579	617	664	
EQUITY	440	444	447	454	457	461	461	458	454	449	445	
TOTAL EQUITY PLUS LIAB.	643	701	784	849	881	923	980	1006	1033	1066	1109	
PERFORMANCE INDICATORS												
TARIFF INCREASE FINAL CONSUMERS	35.09%	24.69%	47.74%	13.06%	-0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
OPERATING RATIO	104.97%	102.07%	93.32%	94.64%	94.79%	94.62%	95.01%	95.14%	95.22%	95.23%	95.19%	
RATE OF RETURN ON REV. ASSETS	-3.22%	-0.96%	10.46%	10.11%	9.85%	10.31%	9.47%	9.20%	9.10%	9.25%	9.48%	
% INTERN.GEN./CONSTRUCT.	58.61%	46.01%	83.06%	51.64%	61.56%	57.97%	52.77%	40.64%	41.21%	56.46%	47.61%	
DEBT SERVICE COVERAGE	4.35	3.41	4.20	2.17	2.10	2.11	1.99	1.66	1.54	1.94	1.72	
DEBT/(DEBT+EQUITY) RATIO	31.6%	36.6%	42.9%	46.6%	48.1%	50.0%	52.0%	54.4%	53.3%	53.9%	55.8%	
DISTRIBUTION MARGIN	36.91%	37.00%	32.54%	28.21%	28.20%	28.20%	28.20%	28.20%	28.20%	28.20%	28.20%	

1/ Includes assets revaluation.

GUATEMALA - EEGSA

(Current Q Millions)

	1990 Actual	1991 Actual	1992	1993	1994	1995	1996	1997	INDE ALTERNATIVE 1998	1999	2000	92-2000
AVERAGE EXCHANGE RATE (Quetz.)	4 30	5,06	5,06	5,06	5,06	5,06	5,06	5,06	5,06	5,06	5,06	
SALES TO EEGSA (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS (Gwh)	1510	1598	1708	1946	2048	2153	2263	2378	2499	2627	2761	20.383
AVERAGE RATE TO EEGSA (/Kwh)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
AVER. RATE TO OTHER UTIL. (/Kwh)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
AVER. RATE FINAL CONSUM. (/Kwh)	21,97	27,39	40,46	45,75	45,74	45,74	45,74	45,74	45,74	45,74	45,74	45,30
SALES TO EEGSA	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS	332	438	691	890	937	985	1.035	1.088	1.143	1.202	1.263	9.234
OTHER REVENUES	0	2	3	3	3	3	0	0	0	0	0	13
TOTAL REVENUES	332	440	694	893	940	988	1.035	1.088	1.144	1.202	1.263	9.247
FUEL	25	96	82	10	0	0	0	0	0	0	0	92
OPERATING EXP. (Exc. Fuel.) 1/	324	353	565	836	891	935	984	1.035	1.089	1.145	1.202	8.682
TOTAL OPERATING EXPENSES	349	449	647	845	891	935	984	1.035	1.089	1.145	1.202	8.773
OPERATING INCOME	(17)	(9)	46	48	49	53	52	53	55	57	61	474
OTHER NET INCOME	3	5	3	4	4	4	4	4	4	4	4	33
INTEREST CHARGED TO OPERATIONS	6	10	24	24	28	31	35	39	42	39	41	301
INCOME TAXES	3	5	20	21	21	22	21	21	21	23	24	196
NET INCOME	(24)	(20)	5	6	3	4	(0)	(3)	(5)	(1)	(1)	10
GROSS INTERNAL CASH GENERATIO	33	42	100	103	109	115	116	120	125	130	136	1.054
Less: INTEREST CHARGED TO OPERAT	6	10	24	24	28	31	35	39	42	39	41	301
AMORTIZATION	1	2	0	24	24	24	24	34	39	28	38	234
DEBT SERVICE	8	12	24	48	52	54	58	73	81	67	79	536
NET INTERNAL CASH GENERATION	26	29	76	56	57	61	58	48	44	63	57	518
GOVERNMENT CONTRIBUTION	0	0	0	0	0	0	0	0	0	0	0	0
OTHER CONTRIBUTIONS	11	16	21	22	23	24	25	26	27	28	29	224
TOTAL OWN FUNDS	11	16	21	22	23	24	25	26	27	28	29	224
LOAN DISBURSEMENTS	0	15	147	52	42	48	51	55	48	50	54	547
TOTAL SOURCES	36	60	244	129	121	133	133	129	119	141	140	1.289
INVESTMENTS	44	64	91	108	92	105	109	118	107	112	119	961
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0
INC.(DECR) WORKING CAPITAL	(9)	1	99	28	16	18	3	2	(2)	3	7	175
OTHER USES	4	0	37	0	0	0	0	0	0	0	0	37
TOTAL USES	39	65	227	136	109	122	113	120	105	115	126	1.173
(FINANCIAL GAP) OR EXCEDENT	(2)	(5)	17	(7)	13	11	20	9	14	27	13	116
FIXED ASSETS 1/	490	484	507	544	561	587	614	646	663	682	705	
CURRENT ASSETS & OTHER ASSETS	153	217	277	305	320	337	346	360	370	384	404	
TOTAL ASSETS	643	701	784	849	881	924	960	1.006	1.033	1.067	1.110	
LONG TERM DEBT	1	13	136	164	182	207	224	239	259	271	287	
SHORT TERM & OTHER LIABILITIES	202	244	200	231	242	255	276	308	292	304	332	
TOTAL LIABILITIES	203	257	336	395	424	462	499	548	551	575	619	
EQUITY	440	444	447	454	457	461	461	458	454	452	452	
TOTAL EQUITY PLUS LIAB.	643	701	784	849	881	923	960	1.006	1.005	1.028	1.071	
PERFORMANCE INDICATORS												
TARIFF INCREASE FINAL CONSUMER	35,09%	24,69%	47,74%	13,06%	-0,02%	-0,00%	-0,00%	0,00%	0,00%	0,00%	-0,00%	
OPERATING RATIO	104,97%	102,07%	93,32%	94,64%	94,79%	94,62%	95,01%	95,14%	95,22%	95,23%	95,19%	
RATE OF RETURN ON REV. ASSETS	-3,22%	-0,96%	10,46%	10,11%	9,85%	10,31%	9,47%	9,20%	9,10%	9,25%	9,48%	
% INTERN.GEN./CONSTRUCT.	58,61%	46,01%	83,06%	51,64%	61,56%	57,97%	52,77%	40,64%	41,21%	56,46%	47,61%	
DEBT SERVICE COVERAGE	4,35	3,41	4,20	2,17	2,10	2,11	1,99	1,66	1,54	1,94	1,72	
DEBT/(DEBT+EQUITY) RATIO	31,6%	36,6%	42,9%	46,6%	48,1%	50,0%	52,0%	54,4%	53,3%	53,9%	55,8%	
DISTRIBUTION MARGIN	36,91%	37,00%	32,54%	28,21%	28,20%	28,20%	28,20%	28,20%	28,20%	28,20%	28,20%	

GUATEMALA - CONSOLIDATED SECTOR

(Current Q Million)

	1990 Real	1991 Actual	1992	1993	1994	1995	1996	1997	1998	1999	2000	92-2000
							PRIVATE SECTOR ALTERNATIVE					
AVERAGE EXCHANGE RATE (Quetz.)	4,30	5,06	5,06	5,06	5,06	5,06	5,06	5,06	5,06	5,06	5,06	
SALES TO EEGSA (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES (Gwh)	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS (Gwh)	1990	2104	2303	2619	2753	0	0	0	0	0	0	7.674
AVERAGE RATE TO EEGSA (/Kwh)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
AVER. RATE TO OTHER UTIL. (/Kwh)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
AVER. RATE FINAL CONSUM. (/Kwh)	21,65	27,32	39,70	45,01	45,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES TO EEGSA	0	0	0	0	0	0	0	0	0	0	0	0
SALES TO OTHER UTILITIES	0	0	0	0	0	0	0	0	0	0	0	0
SALES FINAL CONSUMERS	431	575	914	1.179	1.240	0	0	0	0	0	0	3.333
OTHER REVENUES	1	2	67	3	3	4	1	1	1	1	1	81
TOTAL REVENUES	431	577	982	1.182	1.243	4	1	1	1	1	1	3.413
FUEL	39	190	282	152	185	0	0	0	0	0	0	619
OPERATING EXP. (Exc. Fuel.) 1/	289	294	363	597	629	0	0	0	0	0	0	1.590
TOTAL OPERATING EXPENSES	328	484	645	749	814	0	0	0	0	0	0	2.209
OPERATING INCOME	103	94	337	432	429	4	1	1	1	1	1	1.205
OTHER NET INCOME	(361)	(13)	4	4	4	5	4	4	4	4	4	37
INTEREST CHARGED TO OPERATIONS	127	135	107	104	91	112	107	109	102	89	102	922
INCOME TAXES	3	5	20	21	21	22	21	21	21	23	24	196
NET INCOME	(387)	(59)	213	312	320	(126)	(123)	(125)	(118)	(107)	(122)	124
GROSS INTERNAL CASH GENERATION	284	248	511	608	609	0	0	0	0	0	0	1.728
Less: INTEREST CHARGED TO OPERAT.	127	135	107	104	91	112	107	109	102	89	102	922
AMORTIZATION	34	159	482	249	256	178	146	160	166	146	125	1.908
DEBT SERVICE	161	294	589	353	348	289	253	269	267	235	227	2.830
NET INTERNAL CASH GENERATION	123	(46)	(78)	256	261	(289)	(253)	(269)	(267)	(235)	(227)	(1.102)
GOVERNMENT CONTRIBUTION	29	255	259	100	0	0	0	0	0	0	0	359
OTHER CONTRIBUTIONS	7	12	4	7	8	8	10	11	12	11	12	84
TOTAL OWN FUNDS	36	268	263	107	8	8	10	11	12	11	12	443
LOAN DISBURSEMENTS	66	83	576	304	250	127	84	107	77	52	59	1.636
TOTAL SOURCES	226	304	760	666	520	(154)	(159)	(151)	(178)	(171)	(156)	978
INVESTMENTS	219	250	605	506	381	257	217	243	212	176	184	2.781
INTEREST DURING CONSTRUCTION	0	9	10	14	34	15	18	14	18	20	0	144
INC.(DECR) WORKING CAPITAL	4	45	114	141	71	0	0	0	0	0	0	326
OTHER USES	4	0	37	0	0	0	0	0	0	0	0	37
TOTAL USES	226	304	766	661	486	272	236	257	230	196	184	3.288
(FINANCIAL GAP) OR EXCEDENT	(0)	(0)	(5)	5	33	(426)	(394)	(408)	(408)	(367)	(340)	(2.311)
FIXED ASSETS 1/	4.287	4.395	4.823	5.152	5.372	5.444	5.469	5.504	5.512	5.485	5.445	
CURRENT ASSETS & OTHER ASSETS	719	883	896	1.013	1.064	309	309	309	309	309	309	
TOTAL ASSETS	5.006	5.279	5.719	6.165	6.436	5.753	5.778	5.813	5.820	5.794	5.754	
LONG TERM DEBT	1.259	1.034	1.361	1.408	1.481	1.462	1.386	1.327	1.258	1.186	1.120	
SHORT TERM & OTHER LIABILITIES	263	230	239	249	258	269	279	289	300	312	324	
TOTAL LIABILITIES	1.522	1.264	1.599	1.657	1.739	1.730	1.665	1.616	1.558	1.497	1.444	
EQUITY	2.934	3.197	3.666	4.078	4.398	0	0	0	0	0	0	
TOTAL EQUITY PLUS LIAB.	4.457	4.461	5.266	5.735	6.137	1.730	1.665	1.616	1.558	1.497	1.444	
PERFORMANCE INDICATORS												
TARIFF INCREASE FINAL CONSUMERS	34,88%	26,20%	45,30%	13,36%	0,07%	-100,00%	n/a	n/a	n/a	n/a	n/a	
OPERATING RATIO	76,02%	83,78%	65,69%	63,41%	65,52%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	
RATE OF RETURN ON REV. ASSETS	-7,58%	2,05%	8,74%	11,11%	10,85%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	
% INTERN.GEN./CONSTRUCT.	56,44%	-17,79%	-12,76%	49,12%	62,93%	-106,32%	-107,35%	-104,80%	-116,30%	-119,70%	-123,05%	
DEBT SERVICE COVERAGE	1,77	0,84	0,87	1,72	1,75	0,00	0,00	0,00	0,00	0,00	0,00	
DEBT/(DEBT+EQUITY) RATIO	30,4%	24,0%	28,0%	26,9%	27,0%	30,1%	28,8%	27,8%	26,8%	25,8%	25,1%	
DISTRIBUTION MARGIN	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

1/ Includes assets revaluation.

GUATEMALA - INDE

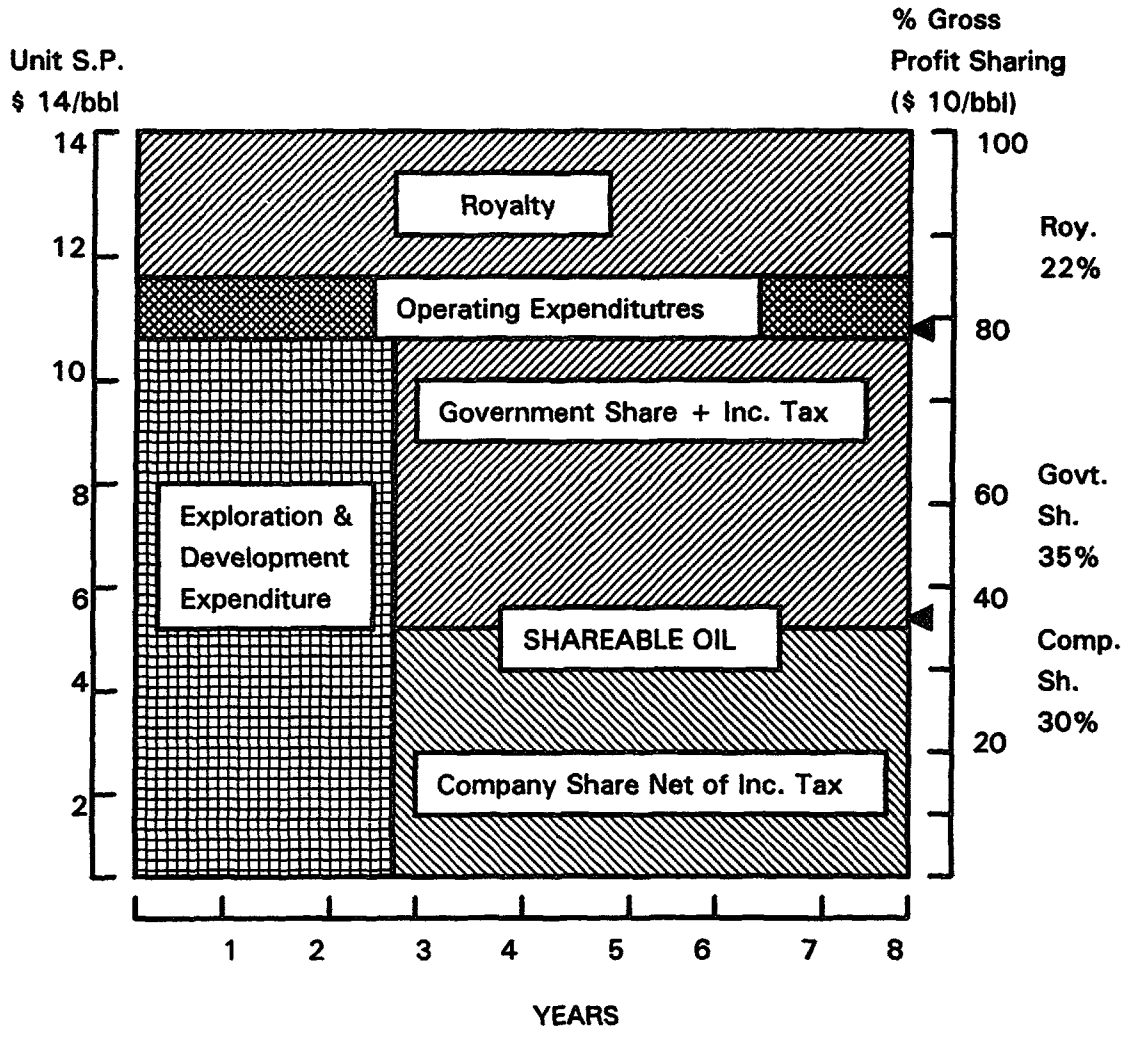
(Current Q. Millions)

PRIVATE SECTOR ALTERNATIVE

	1990 Actual	1991 Actual	1992	1993	1994	1995	1996	1997	1998	1999	2000	92-2000
AVERAGE EXCHANGE RATE (Quetz.)	4,30	5,06	5,06	5,06	5,06	5,06	5,06	5,06	5,06	5,06	5,06	
SALES TO EEGSA (Gwh)	1585	1493	1517	1378	1462	1517	1642	1774	1912	2057	2210	15.470
SALES TO OTHER UTILITIES (Gwh)	90	100	114	123	133	144	155	168	181	195	211	1.424
SALES FINAL CONSUMERS (Gwh)	389	406	481	549	572	0	0	0	0	0	0	1.601
AVERAGE RATE TO EEGSA (/Kwh)	13,86	17,26	27,30	32,84	32,84	32,84	32,84	32,84	32,84	32,84	32,84	32,30
AVER. RATE TO OTHER UTIL. (/Kwh)	13,86	16,86	27,30	32,84	32,84	32,84	32,84	32,84	32,84	32,84	32,84	32,40
AVER. RATE FINAL CONSUM. (/Kwh)	22,24	29,66	39,94	45,10	45,36	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SALES TO EEGSA	220	258	414	453	480	498	539	583	628	676	726	4.996
SALES TO OTHER UTILITIES	12	17	31	40	44	47	51	55	59	64	69	461
SALES FINAL CONSUMERS	87	120	192	248	259	0	0	0	0	0	0	699
OTHER REVENUES	0	0	65	0	0	0	0	0	0	0	0	67
TOTAL REVENUES	319	395	702	741	783	546	591	638	688	740	795	6.224
FUEL	15	94	200	143	185	0	0	0	0	0	0	527
OPERATING EXP. (Exc. Fuel.) 1/	184	198	212	214	218	0	0	0	0	0	0	645
TOTAL OPERATING EXPENSES	199	292	412	357	404	0	0	0	0	0	0	1.172
OPERATING INCOME	120	103	290	385	380	546	591	638	688	740	795	5.052
OTHER NET INCOME	(364)	(18)	0	0	0	0	0	0	0	0	0	4
OTHER NET INCOME FROM SECTOR	6	16	0	0	0	0	0	0	0	0	0	0
INTEREST CHARGED TO OPERATIONS	120	124	83	80	63	81	72	70	60	50	61	621
NET INCOME	(358)	(23)	208	305	317	465	519	568	628	691	734	4.435
GROSS INTERNAL CASH GENERATION	251	206	411	505	500	0	0	0	0	0	0	1.416
Less: INTEREST CHARGED TO OPERAT.	120	124	83	80	63	81	72	70	60	50	61	621
AMORTIZATION	33	157	482	226	232	154	123	126	126	118	86	1.673
DEBT SERVICE	153	281	565	305	296	235	195	197	186	168	148	2.294
NET INTERNAL CASH GENERATION	98	(75)	(154)	200	204	(235)	(195)	(197)	(186)	(168)	(148)	(878)
GOVERNMENT CONTRIBUTION	29	255	259	100	0	0	0	0	0	0	0	359
OTHER CONTRIBUTIONS	2	0	0	0	0	0	0	0	0	0	0	0
TOTAL OWN FUNDS	32	255	259	100	0	0	0	0	0	0	0	359
LOAN DISBURSEMENTS	66	68	429	252	209	79	34	51	29	2	5	1.089
TOTAL SOURCES	195	247	533	552	413	(156)	(161)	(145)	(157)	(166)	(143)	571
INVESTMENTS	175	186	513	398	289	152	108	125	105	65	65	1.820
INTEREST DURING CONSTRUCTION	0	9	10	14	34	15	18	14	18	20	0	144
INC.(DECR) WORKING CAPITAL	21	52	15	113	55	0	0	0	0	0	0	183
OTHER USES	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL USES	195	247	539	525	377	168	126	139	123	84	65	2.146
(FINANCIAL GAP) OR EXCEDENT	(0)	0	(5)	27	36	(324)	(288)	(284)	(280)	(250)	(208)	(1.576)
FIXED ASSETS 1/	3.797	3.911	4.316	4.608	4.812	4.857	4.854	4.858	4.848	4.803	4.739	
CURRENT ASSETS & OTHER ASSETS	696	822	688	783	824	272	272	272	272	272	272	
TOTAL ASSETS	4.494	4.733	5.004	5.391	5.635	5.129	5.126	5.130	5.120	5.075	5.011	
LONG TERM DEBT	1.258	1.021	1.224	1.244	1.299	1.255	1.162	1.088	999	914	833	
SHORT TERM & OTHER LIABILITIES	231	217	217	217	218	218	219	219	219	220	220	
TOTAL LIABILITIES	1.488	1.238	1.442	1.462	1.517	1.473	1.381	1.307	1.218	1.134	1.054	
EQUITY	2.495	2.752	3.219	3.624	3.941	0	0	0	0	0	0	
TOTAL EQUITY PLUS LIAB.	3.983	3.990	4.661	5.086	5.458	1.473	1.381	1.307	1.218	1.134	1.054	
PERFORMANCE INDICATORS												
TARIFF INCREASE FINAL CONSUMERS	30,03%	33,38%	34,66%	12,92%	0,57%	-100,00%	n/a	n/a	n/a	n/a	n/a	
OPERATING RATIO	62,39%	74,00%	58,63%	48,11%	51,52%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	
RATE OF RETURN ON REV. ASSETS	4,04%	2,98%	8,49%	11,24%	11,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	
% INTERN.GEN./CONSTRUCT.	55,87%	-38,71%	-29,49%	48,47%	63,33%	-140,10%	-154,21%	-141,52%	-151,66%	-198,99%	-225,67%	
DEBT SERVICE COVERAGE	1,64	0,73	0,73	1,65	1,69	0,00	0,00	0,00	0,00	0,00	0,00	
DEBT/(DEBT+EQUITY) RATIO	33,1%	26,2%	28,8%	27,1%	26,9%	28,7%	26,9%	25,5%	23,8%	22,3%	21,0%	
DISTRIBUTION MARGIN	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

1/ Includes assets revaluation.

Annex 9: New Fiscal Framework for Petroleum Sector



Assumptions	
Recoverable reserves	30 MM BBL
Operating Expenditure	$9.9/B
Exploration	1.1
Development	2.0
Technical Cost	$4.0/B
Selling Price	$14.0/B
Gross Profit	$10.0/B

Cost Recovery

Government Take

Company Take

Total Govt. Take 65%

Company Take 35%

Annex 10: Recoverable Reserves and Production Policies of Petroleum Sector

Proven Recoverable Reserves: 21,185
('000 bbls)

Oil Field	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Rubelsanto	150	100	75	50						375
Chinaja	100	75	50							225
Caribe	300	250	200	150	100	50				1050
Tierra Blanca	400	350	300	250	200	150	100	50		1800
Subtotal	950	775	625	450	300	200	100	50	0	3450
XAN	2000	2000	2000	2000	1800	1600	1400	1300	1100	15200
Yalpemech	50	250	150	100	50					600
Chocop	360	350	300	250	215	180	130	100	50	1935
Total	3360	3375	3075	2800	2365	1980	1630	1450	1150	21185

Probable Recoverable Reserves 18,587
('000 bbl)

Oil Field	1993	1994	1995	1996	1997	1998	1999	2000	Total
Rubelsanto	1617	1380	1096	848	492	237	200	150	6020
Chinaja	100	50							150
Caribe	300	250	200	150	50	50			1000
Tierra Blanca	400	350	300	250	150	150	100	50	1750
Subtotal	2417	2030	1596	1248	692	437	300	200	8920
XAN	1100	770	540	380	260	180	130	100	3460
Yalpemech	200	100	50						350
Las Casas	961	1329	961	479	205	137			4072
Chocop	360	350	300	250	215	180	130		1785
Total	5038	4579	3447	2357	1372	934	560	300	18587

Possible Recoverable Reserves: 17,570
('000 bbls)

Oil Field	1993	1994	1995	1996	1997	1998	1999	2000		Total
Rubelsanto		780	1442	1224	1045	888	593	265		6970
Caribe	240	190	150	120						700
Tierra Blanca		200	150	100						450
Subtotal	240	1170	1742	1444						8120
XAN										
Yalpemech	0	540	520	400	320	270	250	200	150	2650
Las Casas	300	450	540	500	400	320	270	250	200	3230
Chocop			720	700	600	500	430	360	260	3570
Total	540	2160	3522	3044	2365	1978	1683	1403	875	17570

Annex 11: Financial Impact of Actual and Revised Contract

This case has aggregated the Rubelsanto, Chinaja Oeste, Caribe and Tierra Blanca fields. The aggregation of the fields allows for the characterization of the fields as a single production unit for operational, cost, and economy of scale purposes. The overall input is reasonably reliable for the purpose of this analysis. For the sake of simplicity, it is assumed that past production and the prospective future production (issuing from proven and probable reserves) are aggregated and put on stream as of the beginning of 1990. The analysis disregards the economic impact of the 1975 Petroleum Law (changed in 1983 to provide for softer terms), so as to reflect the economic viability of the project in question for a newcomer under the present law.

a) Technical assumptions

- proven recoverable reserves (16 MMB produced + 6 MMB producible): 22 MMB
- probable recoverable reserves: 8 MMB
- Total reserves 30 MMB

- production period (starting 1990): 8 years
- assumed production profile:

Year	90	3.0	MMB	8,220	BOPD
	91	4.5	MMB	12,330	BOPD
	92	6.8	MMB	18,630	BOPD
	93	6.8	MMB	18,630	BOPD
	94	4.4	MMB	12,050	BOPD
	95	2.6	MMB	7,120	BOPD
	96	1.3	MMB	3,560	BOPD
	97	0.6	MMB	1,640	BOPD
		30.0	MMB		

b) Economic assumptions

			Unit cost MM$	Expend. MM$
-	seismic	500 km	0.015	7.5
-	exploration wells (3,300 m)	4	6.0	24.0
-	development wells	13	3.5	45.5
-	flowlines, treatm., gathering			15.0
-	opex		3.5/yx8	28.0

- total expenditures 120.0

- unit cost of production: $\frac{120}{30}$ = $ 4.0/B

- Coban blend selling price (constant 1990) netted back to well head: (26°API, 3%S): $ 13.8/B

c) Expenditure schedule

	MM$
Year 84-86 seismic and exploration drilling	31.5
Year 87-89 development drilling and infrastructure	60.5
Year 90 (start up of production) - 97 opex	28.0
	120.0

d) Fiscal terms

- royalty (26° API) 16%
- income tax 34%
- sharing of shareable oil (from Repsol):

Oil production (1000 BOPD)	Company share (%)	Government share (%)
> 15	70	30
15 - 30	65	35
30 - 40	60	40
40 - 50	55	45
50 - 60	50	50
60 - 70	45	55
70 - 85	40	60
85 - 100	35	65
< 100	30	70

e) Results

- Company's NCF (real terms) 100.7 MM$
- Company's DCF (at 10%) 18.2 MM$
- Company's DCF (at 15%) 0.8 MM$
- Company's IRR 14.8%
- Government's take (real terms) 193.2 MM$
- Government to Company profit ratio (%): 65.7/34.3

Remarks:

(i) the Government take, percentage wise, is sufficiently high and in line with common practice elsewhere;

(ii) Government participation in shareable oil starts in the latter part of the third year from start up of production;

(iii) the company's rate of return can be considered fair, given the limited size of the assumed oil reserves.

2.4 Sensitivity on economics by changing some parameters in the base case

2.4.1 The base case under paragraph II - 2.3 above is re-analyzed after reducing by 20% the expenditures and increasing the Coban Blend S.P. to $ 15/B. Such changes may be considered optimistic but not impossible to attain.

Subcase 1

(a) Revised assumptions

	MM$
Seismic	6.0
Exploration wells	19.2
Development wells	36.4
Infrastructure	12.0
Opex	22.4
Total expenditure (constant 1990)	96.0

Unit cost of production $ 3.2/B
Coban blend S.P. $ 15.0/B (constant 1990)

(b) Results

- Company's NCF 125.0 MM$
  DCF (10%) 32.2 MM$
  DCF (20%) 1.4 MM$
  IRR 21.0 %
  POT 7.7 years (1.7 years from start up of production)
- Government take 229.0 MM$
- Government to company profit ratio (%) 64.9/35.1

Remarks: (i) the percent reduction in the Government's take is negligible, while its take in absolute terms is substantially higher;

(ii) the Government participation starts in the latter part of the second year from start up of production;

(iii) the company's IRR increases substantially.

The reduction of expenditures and the increase of the S.P. is obviously beneficial to both sides.

Subcase 2: The base case is reexamined with the following parameters changed:

- reduce by 10% the expenditures;
- set the S.P. at $ 14.0/B;
- allocate 10% of production to shareable oil, from start up of production;
- allocate 90% of production minus royalty payment to cost recovery;
- set a flat royalty rate at 15% level.

Results

- Company's NCF	109.7 MM$
DCF (10%)	23.9 MM$
DCF (15%)	5.4 MM$
IRR (%)	17.7%
POT 8.3 years (2.3 years from start up of production)	
- Government take	201.5 MM$
- Government to Company profit ratio (%)	65.3/34.7

Remarks: (i) the Government has the advantage of participating in the sharing of production from the very beginning, even though such advantage relates to a modest 10% of the production, initially; this represents, however, an assured and earlier income;

(ii) under the assumed cost and price scenario, and the slight changes in the fiscal terms, the company would still achieve an acceptable return on its investments; the impact on its return, which is attributable to the slight delay in recovering its costs (less than one year) is in the order of a fraction of 1%.

Subcase 3 Refer to the base case, allocate 10% of production to shareable oil from start up of production and allow recovery of interest on development investments.

Results

- Company's NCF	110.4 MM$
DCF (10%)	22.0 MM$
DCF (15%)	3.0 MM$
IRR %	15.8
- Government take	183.5 MM$
- Government to Company profit ratio (%)	62.4/37.6

Remarks: Allocation of 10% production to shareable oil from start up of production - allowing earlier government access to oil sharing - is compensated by recoupment of interest on development investment.

Conclusion

2.5 To conclude, it is recommended that a slight change to the fiscal frame be enacted by:

(a) converting the sliding scale royalty rate into a flat 15% rate;

(b) allocating 10% of the production of shareable oil from the beginning of the production phase; and

(c) allowing the company to recoup, out of the cost, of oil interest on development investments.

This would accommodate both the companies (flat royalty rate) and the Government (earlier participation in sharing).

Annex 12: The Petroleum Law and the Production Sharing Model Contract (P.S.C.)

The main features of the P.S.C. are summarized as follows:

Duration:	Exploration six years, with an initial three year compulsory drilling phase and a subsequent three year optional drilling phase; withdrawal allowed at the end of the initial three year term.
Area:	Not to exceed 3000 Km^2 onshore and 4800 km^2 offshore.
Relinquishments:	50% overall at the end of the fifth year; all the contract area, less exploitation areas, by the end of the sixth year.
Work commitments:	Drilling of one exploratory well within initial three years; drilling of two exploratory wells each year, over the following three years; drilling of at least one development well per year, over four years, during development phase.
Operating costs:	Totally incurred by Contractor.
Royalty:	At a rate ranging between a minimum 5% for a 15^0 API crude (or lower gravity) to 20% for a 30^0 API crude, such latter rate increasing or decreasing by 1% for each 1^0 API increase or decrease; royalty to be paid in cash or in kind, at State's option.
Recovery of costs:	Out of total production, after deduction of royalty.
State participation:	"Shareable oil" remaining after royalty payment and recovery of costs, accrues to the State in percentages ranging between a minimum 30% and 70%, according to increasing levels of production. The complement to 100% accrues to Contractor.

Income tax:Due on Contractor's taxable income at the rate of 34%; interest on Contractor's capital costs not allowed as a deductible item.

Contractor's proceeds:	May be retained abroad to the extent not needed to meet payments accruing to the State (royalty, State participation, income tax).
Training contributions:	Different amounts (to be agreed), according to whether operations relate to exploration phase or to production phase.
Welfare contributions:	Amount to be agreed.
Internal market supply:	Contractor's crude oil entitlement to the extent needed or at 55% level, whichever is greater (this sounds odd; it should be the other way around!); however, the State is committed to assign initially to internal consumption the share of crude accruing to it.
Surface rentals:	Amounts to be agreed.

Additional Comments to Production Sharing Contract

1. Term of Contract. A 25 year overall term (including production) is overly restrictive in the event of the discovery of a sizeable field in the 6th year, developed over the following 4 years, and exploited during the ensuring 15 years. Provision for a 5 year extension is recommended, subject to the existence of economically recoverable residual reserves.

2. Assignment. Assignment of a company's interest to an affiliate should be allowed without prior approval of the Ministry, subject to the parent company's guarantee of its affiliate's compliance with the transferred commitments.

3. Termination. Specify that contractor's decision to terminate the contract at any time during the "compulsory drilling" 3 year exploration phase is subject to compliance with its work obligation, or corresponding penalty payment thereof. Specify whether the "optional drilling" second three year exploration phase is a one year at a time phase, whereby contractor can withdraw at each year end, from the fourth to the sixth.

4. Approval of a commercial discovery and relevant development plan. While the Regulations of the Hydrocarbon Law provide for the Ministry to approve (or disapprove a notification of commercial discovery and the relevant development plan within 70 days from the date of its submission, no provision governs the event that no response comes from the Ministry within said time limit. It is suggested that lack of response within the prescribed time limit be deemed as a tacit approval, in as much as production from the discovery (appraisal) well(s) prior to such approval is subject to a higher royalty rate of 35%.

Annex 13: Guatemala Petroleum Market: Consumption and Prices

Consumption of Petroleum Products (bbls)

Product	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
G.Super	967	944	971	798	813	690	692	806	912	1043	1008	890	916.7
G. Regular	1263	1064	917	1152	1247	1319	1283	1414	107	1621	1700	1509	1554.27
Kerosine	484	562	534	456	471	451	373	275	271	288	275	195	
Diesel	3662	3409	3048	2812	3048	2820	2815	3294	375	3635	4335	4387	4650.22
Fuel Oil	3314	2315	1817	1517	1673	821	900	1046	1118	1078	1264	1850	
LPG	509	544	572	665	738	858	951	1023	1094	1118	1003	1224	
Others	1223	1339	1329	908	1075	1049	503	776	786	798	854	345	-7121.19
Total	11422	10177	9198	8308	905	8008	7516	8634	9263	9581	10439	10400	
Change %		-10.90	-9.62	-9.68	9.11	-11.66	-6.14	14.87	7.29	3.43	8.96	-0.37	-100.00

% ot Total												
G.Super	8.47	9.28	10.01	9.61	8.97	8.62	9.21	9.34	9.85	10.89	9.66	8.56
G. Regular	11.06	10.45	10.62	13.87	13.76	16.47	17.07	15.38	16.27	16.92	16.29	14.51
Kerosine	4.24	5.52	5.81	5.49	5.20	5.63	4.96	3.19	2.93	3.01	2.63	1.88
Diesel	32.06	33.50	33.14	33.85	33.62	35.21	37.44	38.15	38.59	37.94	41.53	42.18
Fuel Oil	29.01	22.75	19.75	18.26	18.46	10.25	11.97	12.11	12.07	11.25	12.11	17.79
LPG	4.46	5.35	6.22	8.00	8.14	10.71	12.65	11.85	11.81	11.67	9.61	11.77
Others	10.71	13.16	14.45	10.93	11.86	13.10	6.69	8.99	8.49	8.33	8.18	3.32
Total	100	100	100	100	100	100	100	100	100	100	100	100
Sup+Reg	19.52	19.73	20.63	23.47	22.72	25.09	26.28	25.71	26.11	27.81	245.94	23.07

Retail Prices (Q/Gal)

Q/1000 lbs/Q/Gal

Date	Premium	Regular	Kerosene	Diesel	Fuel Oil	LPG	
Feb 80	1.92	1.88	0.87	0.98	064	20.4	0.744
Aug 80	2	1.96	0.9	1.03	0.62	20.4	0.744
Jul 81	2.09	2.04	1.12	1.24	0.899	20.4	0.744
Seot 82	1.95	1.9	1.12	1.2	0.848	20.3	0.740
Nov 83	2.07	1.9	1.09	1.17	0.7203	20.3	0.740
Jul 85	3.1	2.9	1.09	1.17	0.7287	20.3	0.740
Jan 86	3.1	2.9	22.05	1.7	1.56	23	0.839
Aug 88	3.25	3.05	2.42	2.25	1.45	27	0.985
Aug 89	3.31	3.11	2.48	2.31	1.48	23.95	0.874
Nov 89	3.9	3.7	3	2.7	1.75	28	1.021
Sept 90	6.95	6.75	6.55	2.7	1.75	56.95	2.077
Dec 80	9.6	9.4	9.1	5.95	2.4	82.25	3.000
Feb 91	9.6	8.95	8.4	5.95	3.4	82.25	3.000

Annex 14: Price Structure

Region	Integration	Formula
A	FOB	
B	Freight	FM = Worldscale*(AFRA +/-premium)*factor utilization/1c
C	Insurance	C = 0.06% * (A + B)
D	Transit losses	D = 0.5% * A (Gasol.): 0.35% * A (keros. Y Diesel)
E	CIF	E = A +B + C + D
F	Port Charges	
G	Bank's Commission	
H	Import cost	H = E+F+G
I	Terminal cost	
J	Terminal's utilities	
K	Ex-terminal cost	K = H+I+J
L	Compensation Refinery/Imports	L = M - K
M	Ex-refinery price	
N	Distribution costs	
O	Freight	
P	Wholesales costs	P = M + N + O
Q	Municipal tax	
R	National tax	
S	Sub-total	S = P + Q + R
T	Compensation	T = U - S
U	Price of wholesale to retailer	U = X - W - V
V	Temperature correction	V = 1% * U (gasoline/Kerosene); 0.96% * U (diesel)
W	Cost for retail storage	
X	Retail price	
Y	Net compensation	Y = L + T

Annex 15:

Descripion of Petroleum Pricing System for Guatemala

A) OLD SYSTEM: SALES TAX, AJUSTE COMPENSATORIO
B) NEW SYSTEM: 10% IMPORT TAX, 7% VAT, SPECIFIC PETROLEUM TAX
C) AS B), BUT AD VALOREM TAX
SIMBASE: FOB PRICES=1991 WEIGHTED AVERAGE OF SITCO FOB PRICES
EXCHANGE RATE 5.0289 Q/US$ (1991 AVERAGE)

	PREMIUM	REGULAR	KEROSENE	DIESEL	FUEL OIL	LPG CYL.	LPG G+A	TURBO JET
SYSTEM A								
PRICE FOB USC/G	74.00	69.84	67.56	63.20	28.58	36.36	36.36	71.00
FREIGHT ETC	2.15	2.14	2.16	2.50	2.50	18.38	18.38	2.16
PRICE CIF	76.15	71.98	69.72	65.69	31.08	54.74	54.74	73.16
VALUE IN QUETZ	382.94	361.99	350.59	330.35	156.30	275.26	275.26	367.92
COST TERMINAL	3.30	3.30	3.30	3.30	3.30	20.05	20.05	3.30
PRICE EX TERM.	386.24	365.29	353.89	333.65	159.60	295.30	295.30	371.22
AJUSTE I	9.76	7.71	66.11	77.35	9.76	0.00	0.00	48.78
PRICE EX REF	396.00	373.00	420.00	411.00	170.98	295.30	295.30	420.00
MUNI TAX	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
SALES TAX	56.91	54.38	42.70	63.88	0.00	0.00	0.00	40.70
OTHER COSTS	121.36	121.36	113.76	121.36	121.36	61.44	61.44	88.70
PRICE NET AJII	576.27	550.74	576.46	596.24	292.34	356.74	356.74	549.40
AJUSTE II	383.73	344.26	268.54	-1.24	47.66	-56.74	43.26	550.60
RETAIL PRICE	960	895	845	595	340	300	400	1100
AJUSTE I	9.76	7.71	66.11	77.35	9.76	0.00	0.00	48.78
MUNI TAX	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
SALES TAX	56.91	54.38	42.70	63.88	0.00	0.00	0.00	40.70
AJUSTE II	383.73	344.26	268.54	-1.24	47.66	-56.74	43.26	550.60
TOTAL REV A	452.40	408.35	377.35	139.99	57.42	-56.74	43.26	640.08
SYSTEM B								
PRICE FOB USC/G	74.00	69.84	67.56	63.20	28.58	36.36	36.36	71.00
FREIGHT ETC	2.15	2.14	2.16	2.50	2.50	18.38	18.38	2.16
PRICE CIF	76.15	71.98	69.72	65.69	31.08	54.74	54.74	73.16
IMPORT TAX 10%	7.61	7.20	6.97	6.57	3.11	5.47	5.47	7.32
PRICE INCL TAX	83.76	79.18	76.69	72.26	34.19	60.21	60.21	80.48
VALUE IN QUETZ	421.23	398.18	385.65	363.39	171.93	302.78	302.78	404.72
COST TERMINAL	3.30	3.30	3.30	3.30	3.30	20.05	20.05	3.30
PRICE EX TERM.	424.53	401.48	388.95	366.69	175.23	322.83	322.83	408.02
SPECIFIC TAX	300.00	300.00	50.00	50.00	50.00	50.00	50.00	400.00
OTHER COSTS	121.36	121.36	113.76	121.36	121.36	61.44	61.44	88.70
PRICE EXCL VAT	845.89	822.84	552.71	538.05	346.59	434.27	434.27	896.72
VAT 7%	50.49	48.87	30.50	28.94	15.53	24.69	24.69	56.33
RETAIL PRICE	896.38	871.72	583.21	566.99	362.12	458.96	458.96	953.05
AJUSTE I	9.76	7.71	66.11	77.35	9.76	0.00	0.00	48.78
RET.P + AJI	906.14	879.43	649.31	644.33	371.89	458.96	458.96	1001.82
IMPORT TAX	38.29	36.20	35.06	33.04	15.63	27.53	27.53	36.79
VAT	50.49	48.87	30.50	28.94	15.53	24.69	24.69	56.33
SPECIFIC TAX	300	300	50	50	50	50	50	400
TOTAL REV B2	388.78	385.07	115.56	111.97	81.16	102.22	102.22	493.12
AJUSTE I	9.76	7.71	66.11	77.35	9.76	0.00	0.00	48.78
TOT REV B1	398.54	392.79	181.66	189.32	90.93	102.22	102.22	541.90

LEVEL AND STRUCTURE OF PETROLEUM PRODUCT PRICES UNDER DIFFERENT PRICING SYSTEMS

	PREMIUM	REGULAR	KEROSENE	DIESEL	FUEL OIL	LPG CYL	LPG G+A	AVJET
ABSOLUTE PRICES IN CENTAVOS/GAL								
CIF PRICE	382.94	361.99	350.59	330.35	156.30	275.26	275.26	367.92
A	960.00	895.00	845.00	595.00	340.00	300.00	400.00	1100.00
B1	906.14	879.43	649.31	644.33	371.89	458.96	458.96	1001.82
B2	896.38	871.72	583.21	566.99	362.12	458.96	458.96	953.05
B3	778.68	743.32	593.91	625.84	372.82	469.66	469.66	792.55
C1	729.03	695.96	670.38	646.04	371.34	515.91	515.91	672.68
C2	739.27	705.65	634.75	647.81	358.79	493.82	517.38	753.38
PRICE A = 1								
CIF PRICE	0.399	0.404	0.415	0.555	0.460	0.918	0.688	0.334
B1	0.944	0.983	0.768	1.083	1.094	1.530	1.147	0.911
B2	0.934	0.974	0.690	0.953	1.065	1.530	1.147	0.866
B3	0.811	0.831	0.703	1.052	1.097	1.566	1.174	0.720
C1	0.759	0.778	0.793	1.086	1.092	1.720	1.290	0.612
C2	0.770	0.788	0.751	1.089	1.055	1.646	1.293	0.685
CIF PRICE = 1								
A	2.507	2.472	2.410	1.801	2.175	1.090	1.453	2.990
B1	2.366	2.429	1.852	1.950	2.379	1.667	1.667	2.723
B2	2.341	2.408	1.663	1.716	2.317	1.667	1.667	2.590
B3	2.033	2.053	1.694	1.894	2.385	1.706	1.706	2.154
C1	1.904	1.923	1.912	1.956	2.376	1.874	1.874	1.828
C2	1.931	1.949	1.810	1.961	2.296	1.794	1.880	2.048
PRICE DIESEL = 1								
CIF PRICE	1.159	1.096	1.061	1.000	0.473	0.833	0.833	1.114
A	1.613	1.504	1.420	1.000	0.571	0.504	0.672	1.849
B1	1.406	1.365	1.008	1.000	0.577	0.712	0.712	1.555
B2	1.581	1.537	1.029	1.000	0.639	0.809	0.809	1.681
B3	1.244	1.188	0.949	1.000	0.596	0.750	0.750	1.266
C1	1.128	1.077	1.038	1.000	0.575	0.799	0.799	1.041
C2	1.141	1.089	0.980	1.000	0.554	0.762	0.799	1.163

LEVEL AND STRUCTURE OF PETROLEUM PRODUCT PRICES UNDER DIFFERENT PRICING SYSTEMS

	PREMIUM	REGULAR	KEROSENE	DIESEL	FUEL OIL	LPG CYL	LPG G+A	AVJET
ABSOLUTE PRICES IN CENTAVOS/GAL								
CIF PRICE	382.94	361.99	350.59	330.35	156.30	275.26	275.26	367.92
A	960.00	895.00	845.00	595.00	340.00	300.00	400.00	1100.00
B1	906.14	879.43	649.31	644.33	371.89	458.96	458.96	1001.82
B2	896.38	871.72	583.21	566.99	362.12	458.96	458.96	953.05
B3	778.68	743.32	593.91	625.84	372.82	469.66	469.66	792.55
C1	729.03	695.96	670.38	646.04	371.34	515.91	515.91	672.68
C2	739.27	705.65	634.75	647.81	358.79	493.82	517.38	753.38
PRICE A = 1								
CIF PRICE	0.399	0.404	0.415	0.555	0.460	0.918	0.688	0.334
B1	0.944	0.983	0.768	1.083	1.094	1.530	1.147	0.911
B2	0.934	0.974	0.690	0.953	1.065	1.530	1.147	0.866
B3	0.811	0.831	0.703	1.052	1.097	1.566	1.174	0.720
C1	0.759	0.778	0.793	1.086	1.092	1.720	1.290	0.612
C2	0.770	0.788	0.751	1.089	1.055	1.646	1.293	0.685
CIF PRICE = 1								
A	2.507	2.472	2.410	1.801	2.175	1.090	1.453	2.990
B1	2.366	2.429	1.852	1.950	2.379	1.667	1.667	2.723
B2	2.341	2.408	1.663	1.716	2.317	1.667	1.667	2.590
B3	2.033	2.053	1.694	1.894	2.385	1.706	1.706	2.154
C1	1.904	1.923	1.912	1.956	2.376	1.874	1.874	1.828
C2	1.931	1.949	1.810	1.961	2.296	1.794	1.880	2.048
PRICE DIESEL = 1								
CIF PRICE	1.159	1.096	1.061	1.000	0.473	0.833	0.833	1.114
A	1.613	1.504	1.420	1.000	0.571	0.504	0.672	1.849
B1	1.406	1.365	1.008	1.000	0.577	0.712	0.712	1.555
B2	1.581	1.537	1.029	1.000	0.639	0.809	0.809	1.681
B3	1.244	1.188	0.949	1.000	0.596	0.750	0.750	1.266
C1	1.128	1.077	1.038	1.000	0.575	0.799	0.799	1.041
C2	1.141	1.089	0.980	1.000	0.554	0.762	0.799	1.163

Annex 16: Direct Loss and Returns From a Multipurpose Tree Plantation - Las Chapernas

(Quetzales/hectare)

Year	Operation		Total	
Inputs & Costs				
First	Rent to land Q. 3000/ha @ 5%/yr		Q. 150.000	
	Depreciation on fixed investment of Q.200/ha for tools, etc. at 10%		20.00	
	Cost of seedlings, 2,500 at Q0.20		500.00	
	Opening of planting holes		52.50	
	Distribution of seedlings in field		49.00	
	Planting of seedlings		60.20	
	Weeding around seedlings		89.60	
		Total		Q. 921.30
Second	Rent to land		150.00	
	Weeding around seedlings		89.60	
	Weeding between tree rows		175.00	
		Total		Q. 414.60
Third	Rent to land		150.00	
	Weeding around seedlings		89.60	
	Weeding between tree rows		175.00	
		Total		Q. 414.60
Fourth	Rent to land		150.00	
	Weeding between tree rows		84.00	
		Total		Q. 234.00
Fifth	Rent to land			Q. 150.00
Sixth	Rent to land			Q. 150.00
Seventh	Rent to land		150.00	
	Tree felling		56.00	
	Cutting to post dimensions		126.00	
	Cutting into fuelwood		196.00	
	Piling posts		17.50	
	Piling fuelwood		38.50	
		Total		Q. 584.00
		Total Costs		Q. 2,868,50
Outputs & Returns				
Seventh	Rent to land		4,200.00	
	Sale of fuelwood at roadside, 46.8 steres @ Q.9.93		465.00	
		Total Revenue		Q. 4,665.00

Note: Daily cost of labour - Q.7/-.

Source: Adapted from "Analisis Financiero de una plantacion de Caesalpinia velutina en la Costa Sur de Guatemala."

Direct Cost and Returns From a Fuelwood Plantation - Las Chapernas "A"
(Quetzales/hectare)

Year	Operation		Total
Inputs % Costs			
First to fourth	Rent to land - 4 years at Q. 150		600.00	
	Raising and maintaining plantation		1,384.50	Q. 1,984.50
Fifth	Rent to land		150.00	
	Tree felling		186.62	
	Cutting into fuelwood		662.13	
	Moving fuelwood to loading point		124.15	
		Total		Q. 1,122.90
				Q. 3,107.40
Outputs and Returns				
Fifth	Sale of fuelwood at roadside, 148.07 steres @Q.15.63			Q. 2,314.33

Source: Adapted from "Estudio de Rendimientos y Costos de Faenas para la Producción de Arboles de Uso Múltiple en Guatemala".

Annex 17: Fuelwood Market Distribution Channels

Some contractors buy from producers at the roadside and sell directly to woodyards in the cities. Some woodyard owners buy directly at the roadside, transport to their yard, split the wood and sell to the public. The following five cases illustrate the foregoing:

- A farmer whose land includes an area of natural forest sells the right to cut a small volume of fuelwood for domestic use to a neighboring farmer. In this case the costs involved are those o the farmer's labor cost and cutting rights charged by the land's owner of land.

- A laborer who cuts one carga of wood in a matorral about 50 km from the Capital, carries it to the roadside where he sells it to a woodyard operator who transports it to the Capital for sale in his woodyard.

- A farmer who has raised an agroforestry plantation on his own or rented land and sells the best quality trees for poles and small timbers and the remainder for fuelwood.

- A farmer in the same region who sells all the trees from his plantation for fuelwood to a woodyard operator who sells it in a nearby city.

- The operator of a small woodyard within 20 km of the capital who buys pick-up loads o fuelwood delivered at his yard where he retails it to the public.

Fuelwood Financial Costs and Market Prices
Quetzales/Carga

Source of Fuelwood	Case 1 Adjoining farmer's land	Case 2 Area of matorral	Case 3 Agroforestry planation	Case 4 Fuelwood plantation	Case 5 Rural Woodyard
Species	Mixed broad-leaves	Oak	Caesalpinia velutina	Leucaena Leucocephala	Mixed broadleaves
Cutting rights harge by owner	4.00				
Growing and logging cost	3.20 (logging only)		1.52	6.36	
Roadside cost	7.20	6.00	1.52	6.36	
Purchase price by woodyard operator		6.00	3.00	4.70	10.00(at wood-yard gate)
Transport at Q.0.0-25/carga/km		2.00 (80 km)	1.13 (45 km)	0.25 (10 km)	
Loading/ unloading (assumed)		0.25	0.25	0.25	
Splitting into lenos (assumed)		0.50	0.50	0.50	0.50
Woodyard Operating Costs (Assumed)		0.50	0.40	0.40	0.40
Cost to woodyard operator		9.25	5.28	6.10	10.90
Sales price to consumer/leno		0.25	0.08	0.09	0.15
Equivalent sales price/ carga		20.00	6.40	7.20	12.00

Annex 18: Environment: Institutional and Legal Aspects of Environmental Policy

1. Objectives and Institutions. Guatemala's environmental law, Decree 68-86, entitled "Protection and Improvement of the Environment" created the legal foundation for the regulation of the environmental sector as well as the environmental agency CONAMA (Comisión Nacional del Medio Ambiente), the executive organ charged with implementing this law.

2. The Environmental Law is based on two principles:

- The protection and the improvement of the environment and of natural and cultural resources are the basic prerequisites for the country's social and economic development;

- Guatemala recognizes the U.N. resolution regarding the environment (Stockholm, 1972).

3. CONAMA. The environmental agency CONAMA, whose head reports directly to the President of the Republic, is charged taking these principles into account. CONAMA has a legal mandate to impose sanctions, including fines and the suspension of licenses, and it can set deadlines for the implementation of corrective measures which it requires offenders to carry out. Fines are paid into the common fund of the Treasury and the money is used for CONAMA's programs. According to its statutes, the coordinator of CONAMA, who is appointed by the President of the Republic, has at his disposal a technical advisory council, a team of specialists and a team of administrators. The technical advisory council (Consejo Técnico Asesor) is composed of 10 members: one appointed delegate and one representative each from 9 different institutions.

4. CONAP. In addition, the "Protected Areas Law," Decree 4-89, established the specialized agency CONAP (Consejo Nacional de Areas Protegidas) and the procedures to be followed to officially designate an area as protected. CONAP is a council consisting of 14 members who represent various institutions and organizations. Although CONAP is subject directly to the authority of the President of the Republic, it is presided over the coordinator of CONAMA and thus is also subject to the authority of CONAMA.

5. Protected Areas. On the basis of an inventory of all characteristics (physical, social, economic, cultural, biotic), a given area, which may be further subdivided into sub-areas falling into specific protection categories, is provided with an appropriate classification under the Guatemalan System of Protected Areas (SIGAP). In accordance with the provisions which apply

to each category, a master plan must be prepared, on the basis of which an annual plan of operations is prepared. For the year in question, the plan of operations specified all permissible activities and types of resource utilization within the area as well as any conditions or environmental standards which must be met.

6. Also, a total of six biotype and 44 areas have been placed under special protection. They have not yet been officially designated as protected areas and inventories have not yet been carried out in them.

7. CONAP has the task of supervising and coordinating SIGAP and of evaluating the master plans and plans of operation that are required under the Protected Areas Law. All enterprises which are currently operating in protected areas or wish to set up operations in such areas have to conclude a contract with CONAP setting forth the conditions and standards for the continuation or initiation of their activities. These terms are established on the basis of an EIA that is prepared by the interested enterprise and subsequently evaluated by CONAP.

Joint UNDP/World Bank

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

LIST OF REPORTS ON COMPLETED ACTIVITIES

Region/Country	*Activity/Report Title*	*Date*	*Number*
	SUB-SAHARAN AFRICA (AFR)		
Africa Regional	Anglophone Africa Household Energy Workshop (English)	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa (English)	08/88	087/88
	Institutional Evaluation of EGL (English)	02/89	098/89
	Biomass Mapping Regional Workshops (English - Out of Print)	05/89	--
	Francophone Household Energy Workshop (French)	08/89	103/89
	Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development (English)	03/90	112/90
	Biomass Assessment and Mapping (English - Out of Print)	03/90	--
Angola	Energy Assessment (English and Portuguese)	05/89	4708-ANG
	Power Rehabilitation and Technical Assistance (English)	10/91	142/91
Benin	Energy Assessment (English and French)	06/85	5222-BEN
Botswana	Energy Assessment (English)	09/84	4998-BT
	Pump Electrification Prefeasibility Study (English)	01/86	047/86
	Review of Electricity Service Connection Policy (English)	07/87	071/87
	Tuli Block Farms Electrification Study (English)	07/87	072/87
	Household Energy Issues Study (English - Out of Print)	02/88	--
	Urban Household Energy Strategy Study (English)	05/91	132/91
Burkina Faso	Energy Assessment (English and French)	01/86	5730-BUR
	Technical Assistance Program (English)	03/86	052/86
	Urban Household Energy Strategy Study (English and French)	06/91	134/91
Burundi	Energy Assessment (English)	06/82	3778-BU
	Petroleum Supply Management (English)	01/84	012/84
	Status Report (English and French)	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983-1987) (English and French)	05/85	036/85
	Improved Charcoal Cookstove Strategy (English and French)	09/85	042/85
	Peat Utilization Project (English)	11/85	046/85
	Energy Assessment (English and French)	01/92	9215-BU
Cape Verde	Energy Assessment (English and Portuguese)	08/84	5073-CV
	Household Energy Strategy Study (English)	02/90	110/90
Central African Republic	Energy Assessement (French)	08/92	9898-CAR
Comoros	Energy Assessment (English and French)	01/88	7104-COM
Congo	Energy Assessment (English)	01/88	6420-COB
	Power Development Plan (English and French)	03/90	106/90
Côte d'Ivoire	Energy Assessment (English and French)	04/85	5250-IVC
	Improved Biomass Utilization (English and French)	04/87	069/87
	Power System Efficiency Study (Out of Print)	12/87	--
	Power Sector Efficiency Study (French)	02/92	140/91
Ethiopia	Energy Assessment (English)	07/84	4741-ET
	Power System Efficiency Study (English)	10/85	045/85

Region/Country	*Activity/Report Title*	*Date*	*Number*
Ethiopia	Agricultural Residue Briquetting Pilot Project (English)	12/86	062/86
	Bagasse Study (English)	12/86	063/86
	Cooking Efficiency Project (English)	12/87	--
Gabon	Energy Assessment (English)	07/88	6915-GA
The Gambia	Energy Assessment (English)	11/83	4743-GM
	Solar Water Heating Retrofit Project (English)	02/85	030/85
	Solar Photovoltaic Applications (English)	03/85	032/85
	Petroleum Supply Management Assistance (English)	04/85	035/85
Ghana	Energy Assessment (English)	11/86	6234-GH
	Energy Rationalization in the Industrial Sector (English)	06/88	084/88
	Sawmill Residues Utilization Study (English)	11/88	074/87
Guinea	Energy Assessment (Out of Print)	11/86	6137-GUI
Guinea-Bissau	Energy Assessment (English and Portuguese)	08/84	5083-GUB
	Recommended Technical Assistance Projects (English & Portuguese)	04/85	033/85
	Management Options for the Electric Power and Water Supply Subsectors (English)	02/90	100/90
	Power and Water Institutional Restructuring (French)	04/91	118/91
Kenya	Energy Assessment (English)	05/82	3800-KE
	Power System Efficiency Study (English)	03/84	014/84
	Status Report (English)	05/84	016/84
	Coal Conversion Action Plan (English - Out of Print)	02/87	--
	Solar Water Heating Study (English)	02/87	066/87
	Peri-Urban Woodfuel Development (English)	10/87	076/87
	Power Master Plan (English - Out of Print)	11/87	--
Lesotho	Energy Assessment (English)	01/84	4676-LSO
Liberia	Energy Assessment (English)	12/84	5279-LBR
	Recommended Technical Assistance Projects (English)	06/85	038/85
	Power System Efficiency Study (English)	12/87	081/87
Madagascar	Energy Assessment (English)	01/87	5700-MAG
	Power System Efficiency Study (English and French)	12/87	075/87
Malawi	Energy Assessment (English)	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry (English)	11/83	009/83
	Status Report (English)	01/84	013/84
Mali	Energy Assessment (English and French)	11/91	8423-MLI
	Household Energy Strategy (English and French)	03/92	147/92
Islamic Republic of Mauritania	Energy Assessment (English and French)	04/85	5224-MAU
	Household Energy Strategy Study (English and French)	07/90	123/90
Mauritius	Energy Assessment (English)	12/81	3510-MAS
	Status Report (English)	10/83	008/83
	Power System Efficiency Audit (English)	05/87	070/87
	Bagasse Power Potential (English)	10/87	077/87
Mozambique	Energy Assessment (English)	01/87	6128-MOZ
	Household Electricity Utilization Study (English)	03/90	113/90
Namibia	Energy Assessment (English)	03/93	11320-NAM

Region/Country	*Activity/Report Title*	*Date*	*Number*
Niger	Energy Assessment (French)	05/84	4642-NIR
	Status Report (English and French)	02/86	051/86
	Improved Stoves Project (English and French)	12/87	080/87
	Household Energy Conservation and Substitution (English and French)	01/88	082/88
Nigeria	Energy Assessment (English)	08/83	4440-UNI
	Energy Assessment (English)	07/93	11672-UNI
Rwanda	Energy Assessment (English)	06/82	3779-RW
	Energy Assessment (English and French)	07/91	8017-RW
	Status Report (English and French)	05/84	017/84
	Improved Charcoal Cookstove Strategy (English and French)	08/86	059/86
	Improved Charcoal Production Techniques (English and French)	02/87	065/87
	Commercialization of Improved Charcoal Stoves and Carbonization Techniques Mid-Term Progress Report (English and French)	12/91	141/91
SADCC	SADCC Regional Sector: Regional Capacity-Building Program for Energy Surveys and Policy Analysis (English)	11/91	--
Sao Tome and Principe	Energy Assessment (English)	10/85	5803-STP
Senegal	Energy Assessment (English)	07/83	4182-SE
	Status Report (English and French)	10/84	025/84
	Industrial Energy Conservation Study (English)	05/85	037/85
	Preparatory Assistance for Donor Meeting (English and French)	04/86	056/86
	Urban Household Energy Strategy (English)	02/89	096/89
Seychelles	Energy Assessment (English)	01/84	4693-SEY
	Electric Power System Efficiency Study (English)	08/84	021/84
Sierra Leone	Energy Assessment (English)	10/87	6597-SL
Somalia	Energy Assessment (English)	12/85	5796-SO
Sudan	Management Assistance to the Ministry of Energy and Mining	05/83	003/83
	Energy Assessment (English)	07/83	4511-SU
	Power System Efficiency Study (English)	06/84	018/84
	Status Report (English)	11/84	026/84
	Wood Energy/Forestry Feasibility (English - Out of Print)	07/87	073/87
Swaziland	Energy Assessment (English)	02/87	6262-SW
Tanzania	Energy Assessment (English)	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study (English)	08/88	086/88
	Tobacco Curing Efficiency Study (English)	05/89	102/89
	Remote Sensing and Mapping of Woodlands (English)	06/90	--
	Industrial Energy Efficiency Technical Assistance (English - Out of Print)	08/90	122/90
Togo	Energy Assessment (English)	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake (English and French)	04/86	055/86
	Power Efficiency Improvement (English and French)	12/87	078/87
Uganda	Energy Assessment (English)	07/83	4453-UG
	Status Report (English)	08/84	020/84
	Institutional Review of the Energy Sector (English)	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry (English)	02/86	049/86
	Fuelwood/Forestry Feasibility Study (English)	03/86	053/86

Region/Country	*Activity/Report Title*	*Date*	*Number*
Uganda	Power System Efficiency Study (English)	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry (English)	02/89	097/89
	Tobacco Curing Pilot Project (English - Out of Print)	03/89	UNDP Terminal Report
Zaire	Energy Assessment (English)	05/86	5837-ZR
Zambia	Energy Assessment (English)	01/83	4110-ZA
	Status Report (English)	08/85	039/85
	Energy Sector Institutional Review (English)	11/86	060/86
	Power Subsector Efficiency Study (English)	02/89	093/88
	Energy Strategy Study (English)	02/89	094/88
	Urban Household Energy Strategy Study (English)	08/90	121/90
Zimbabwe	Energy Assessment (English)	06/82	3765-ZIM
	Power System Efficiency Study (English)	06/83	005/83
	Status Report (English)	08/84	019/84
	Power Sector Management Assistance Project (English)	04/85	034/85
	Petroleum Management Assistance (English)	12/89	109/89
	Power Sector Management Institution Building (English - Out of Print)	09/89	--
	Charcoal Utilization Prefeasibility Study (English)	06/90	119/90
	Integrated Energy Strategy Evaluation (English)	01/92	8768-ZIM

EAST ASIA AND PACIFIC (EAP)

Asia Regional	Pacific Household and Rural Energy Seminar (English)	11/90	--
China	County-Level Rural Energy Assessments (English)	05/89	101/89
	Fuelwood Forestry Preinvestment Study (English)	12/89	105/89
Fiji	Energy Assessment (English)	06/83	4462-FIJ
Indonesia	Energy Assessment (English)	11/81	3543-IND
	Status Report (English)	09/84	022/84
	Power Generation Efficiency Study (English)	02/86	050/86
	Energy Efficiency in the Brick, Tile and Lime Industries (English)	04/87	067/87
	Diesel Generating Plant Efficiency Study (English)	12/88	095/88
	Urban Household Energy Strategy Study (English)	02/90	107/90
	Biomass Gasifier Preinvestment Study Vols. I & II (English)	12/90	124/90
Lao PDR	Urban Electricity Demand Assessment Study (English)	03/93	154/93
Malaysia	Sabah Power System Efficiency Study (English)	03/87	068/87
	Gas Utilization Study (English)	09/91	9645-MA
Myanmar	Energy Assessment (English)	06/85	5416-BA
Papua New Guinea	Energy Assessment (English)	06/82	3882-PNG
	Status Report (English)	07/83	006/83
	Energy Strategy Paper (English - Out of Print)	--	--
	Institutional Review in the Energy Sector (English)	10/84	023/84
	Power Tariff Study (English)	10/84	024/84

Region/Country	*Activity/Report Title*	*Date*	*Number*
Philippines	Commercial Potential for Power Production from Agricultural Residues (English)	12/93	157/93
Solomon Islands	Energy Assessment (English)	06/83	4404-SOL
	Energy Assessment (English)	01/92	979/SOL
South Pacific	Petroleum Transport in the South Pacific (English-Out of Print)	05/86	--
Thailand	Energy Assessment (English)	09/85	5793-TH
	Rural Energy Issues and Options (English - Out of Print)	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns (English - Out of Print)	09/87	079/87
	Northeast Region Village Forestry and Woodfuels Preinvestment Study (English)	02/88	083/88
	Impact of Lower Oil Prices (English)	08/88	--
	Coal Development and Utilization Study (English)	10/89	--
Tonga	Energy Assessment (English)	06/85	5498-TON
Vanuatu	Energy Assessment (English)	06/85	5577-VA
Western Samoa	Energy Assessment (English)	06/85	5497-WSO

SOUTH ASIA (SAS)

Bangladesh	Energy Assessment (English)	10/82	3873-BD
	Priority Investment Program	05/83	002/83
	Status Report (English)	04/84	015/84
	Power System Efficiency Study (English)	02/85	031/85
	Small Scale Uses of Gas Prefeasibility Study (English - (Out of Print)	12/88	--
India	Opportunities for Commercialization of Nonconventional Energy Systems (English)	11/88	091/88
	Maharashtra Bagasse Energy Efficiency Project (English)	05/91	120/91
	Mini-Hydro Development on Irrigation Dams and Canal Drops Vols. I, II and III (English)	07/91	139/91
	WindFarm Pre-Investment Study (English)	12/92	150/92
Nepal	Energy Assessment (English)	08/83	4474-NEP
	Status Report (English)	01/85	028/84
	Energy Efficiency & Fuel Substitution in Industries (English)	06/93	158/93
Pakistan	Household Energy Assessment (English - Out of Print)	05/88	--
	Assessment of Photovoltaic Programs, Applications, and Markets (English)	10/89	103/89
Sri Lanka	Energy Assessment (English)	05/82	3792-CE
	Power System Loss Reduction Study (English)	07/83	007/83
	Status Report (English)	01/84	010/84
	Industrial Energy Conservation Study (English)	03/86	054/86

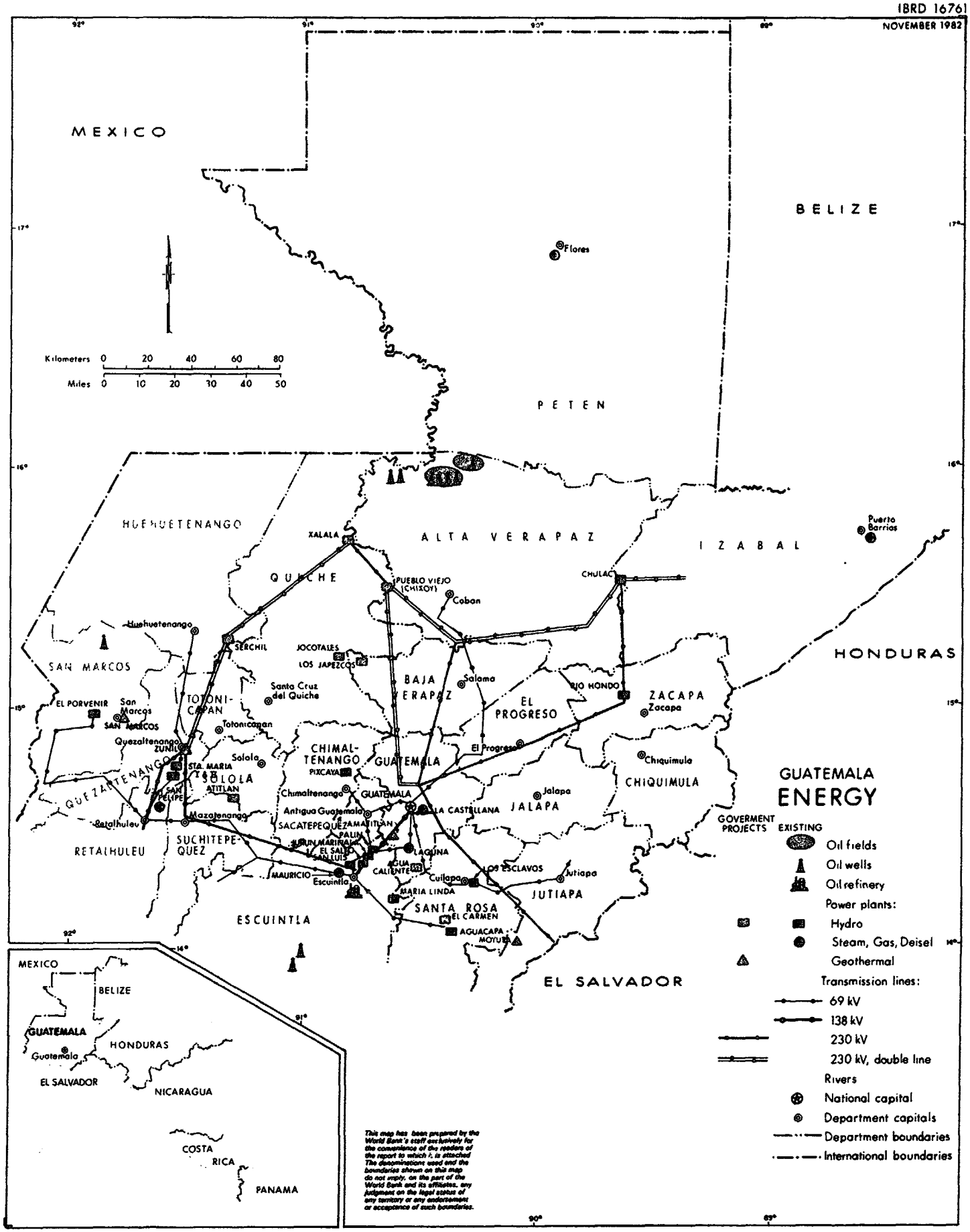
Region/Country	*Activity/Report Title*	*Date*	*Number*
	EUROPE AND CENTRAL ASIA (ECA)		
Eastern Europe	The Future of Natural Gas in Eastern Europe (English)	08/92	149/92
Poland	Energy Sector Restructuring Program Vols. I-V (English)	01/93	153/93
Portugal	Energy Assessment (English)	04/84	4824-PO
Turkey	Energy Assessment (English)	03/83	3877-TU
	MIDDLE EAST AND NORTH AFRICA (MNA)		
Morocco	Energy Assessment (English and French)	03/84	4157-MOR
	Status Report (English and French)	01/86	048/86
Syria	Energy Assessment (English)	05/86	5822-SYR
	Electric Power Efficiency Study (English)	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector (English)	04/89	099/89
	Energy Efficiency Improvement in the Fertilizer Sector(English)	06/90	115/90
Tunisia	Fuel Substitution (English and French)	03/90	--
	Power Efficiency Study (English and French)	02/92	136/91
	Energy Management Strategy in the Residential and Tertiary Sectors (English)	04/92	146/92
Yemen	Energy Assessment (English)	12/84	4892-YAR
	Energy Investment Priorities (English - Out of Print)	02/87	6376-YAR
	Household Energy Strategy Study Phase I (English)	03/91	126/91
	LATIN AMERICA AND THE CARIBBEAN (LAC)		
LAC Regional	Regional Seminar on Electric Power System Loss Reduction in the Caribbean (English)	07/89	--
Bolivia	Energy Assessment (English)	04/83	4213-BO
	National Energy Plan (English)	12/87	--
	National Energy Plan (Spanish)	08/91	131/91
	La Paz Private Power Technical Assistance (English)	11/90	111/90
	Natural Gas Distribution: Economics and Regulation (English)	03/92	125/92
	Prefeasibility Evaluation Rural Electrification and Demand Assessment (English and Spanish)	04/91	129/91
	Private Power Generation and Transmission (English)	01/92	137/91
Chile	Energy Sector Review (English - Out of Print)	08/88	7129-CH
Colombia	Energy Strategy Paper (English)	12/86	--
Costa Rica	Energy Assessment (English and Spanish)	01/84	4655-CR
	Recommended Technical Assistance Projects (English)	11/84	027/84
	Forest Residues Utilization Study (English and Spanish)	02/90	108/90
Dominican Republic	Energy Assessment (English)	05/91	8234-DO
Ecuador	Energy Assessment (Spanish)	12/85	5865-EC
	Energy Strategy Phase I (Spanish)	07/88	--
	Energy Strategy (English)	04/91	--
	Private Minihydropower Development Study (English)	11/92	--

Region/Country	*Activity/Report Title*	*Date*	*Number*
Guatemala	Issues and Options in the Energy Sector (English)	09/93	12160-GU
Haiti	Energy Assessment (English and French)	06/82	3672-HA
	Status Report (English and French)	08/85	041/85
	Household Energy Strategy (English and French)	12/91	143/91
Honduras	Energy Assessment (English)	08/87	6476-HO
	Petroleum Supply Management (English)	03/91	128/91
Jamaica	Energy Assessment (English)	04/85	5466-JM
	Petroleum Procurement, Refining, and Distribution Study (English)	11/86	061/86
	Energy Efficiency Building Code Phase I (English-Out of Print)	03/88	--
	Energy Efficiency Standards and Labels Phase I (English - Out of Print)	03/88	--
	Management Information System Phase I (English - Out of Print)	03/88	--
	Charcoal Production Project (English)	09/88	090/88
	FIDCO Sawmill Residues Utilization Study (English)	09/88	088/88
	Energy Sector Strategy and Investment Planning Study (English)	07/92	135/92
Mexico	Improved Charcoal Production Within Forest Management for the State of Veracruz (English and Spanish)	08/91	138/91
Panama	Power System Efficiency Study (English - Out of Print)	06/83	004/83
Paraguay	Energy Assessment (English)	10/84	5145-PA
	Recommended Technical Assistance Projects (English-(Out of Print)	09/85	--
	Status Report (English and Spanish)	09/85	043/85
Peru	Energy Assessment (English)	01/84	4677-PE
	Status Report (English - Out of Print)	08/85	040/85
	Proposal for a Stove Dissemination Program in the Sierra (English and Spanish)	02/87	064/87
	Energy Strategy (English and Spanish)	12/90	--
Saint Lucia	Energy Assessment (English)	09/84	5111-SLU
St. Vincent and the Grenadines	Energy Assessment (English)	09/84	5103-STV
Trinidad and Tobago	Energy Assessment (English - Out of Print)	12/85	5930-TR

GLOBAL

Energy End Use Efficiency: Research and Strategy (English - Out of Print)	11/89	--
Guidelines for Utility Customer Management and Metering (English and Spanish)	07/91	--
Women and Energy--A Resource Guide The International Network: Policies and Experience (English)	04/90	--
Assessment of Personal Computer Models for Energy Planning in Developing Countries (English)	10/91	--
Long-Term Gas Contracts Principles and Applications (English)	02/93	152/93
Comparative Behavior of Firms Under Public and Private Ownership (English)	05/93	155/93

12/13/93



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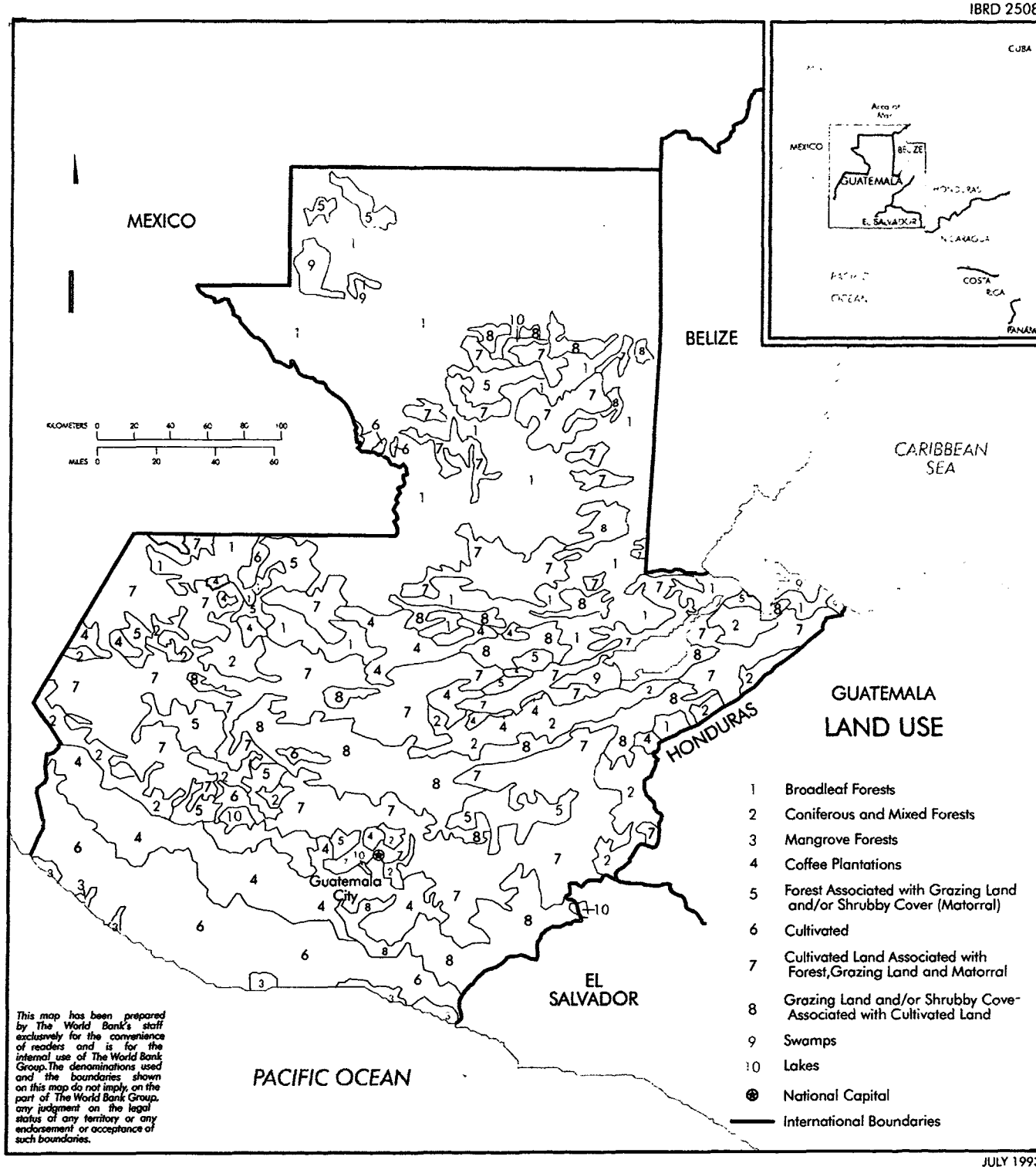

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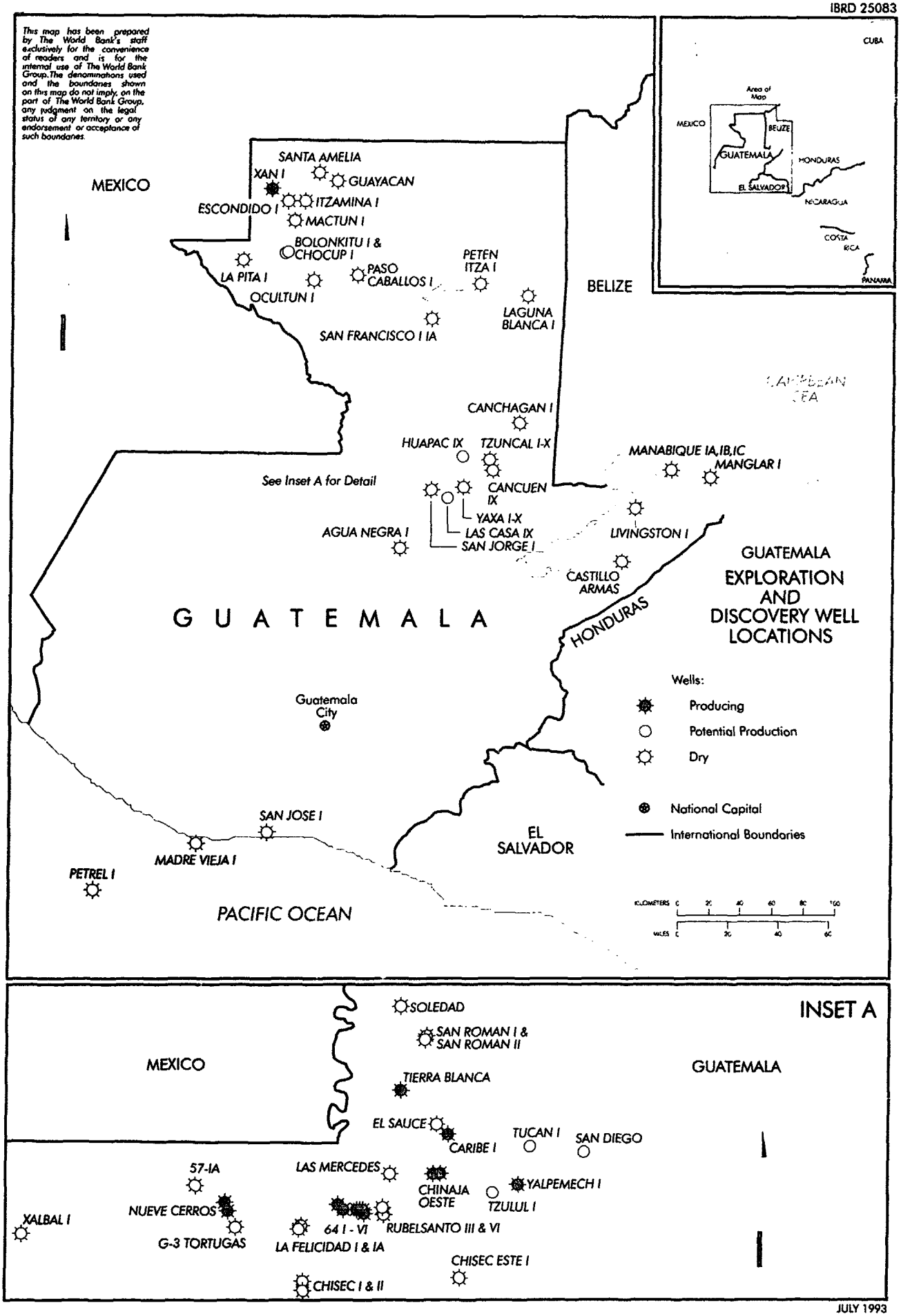

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GUATEMALA
BASIN SETTING

Pre-Jurassic Sediments / Metamorphics

Volcanic Belt

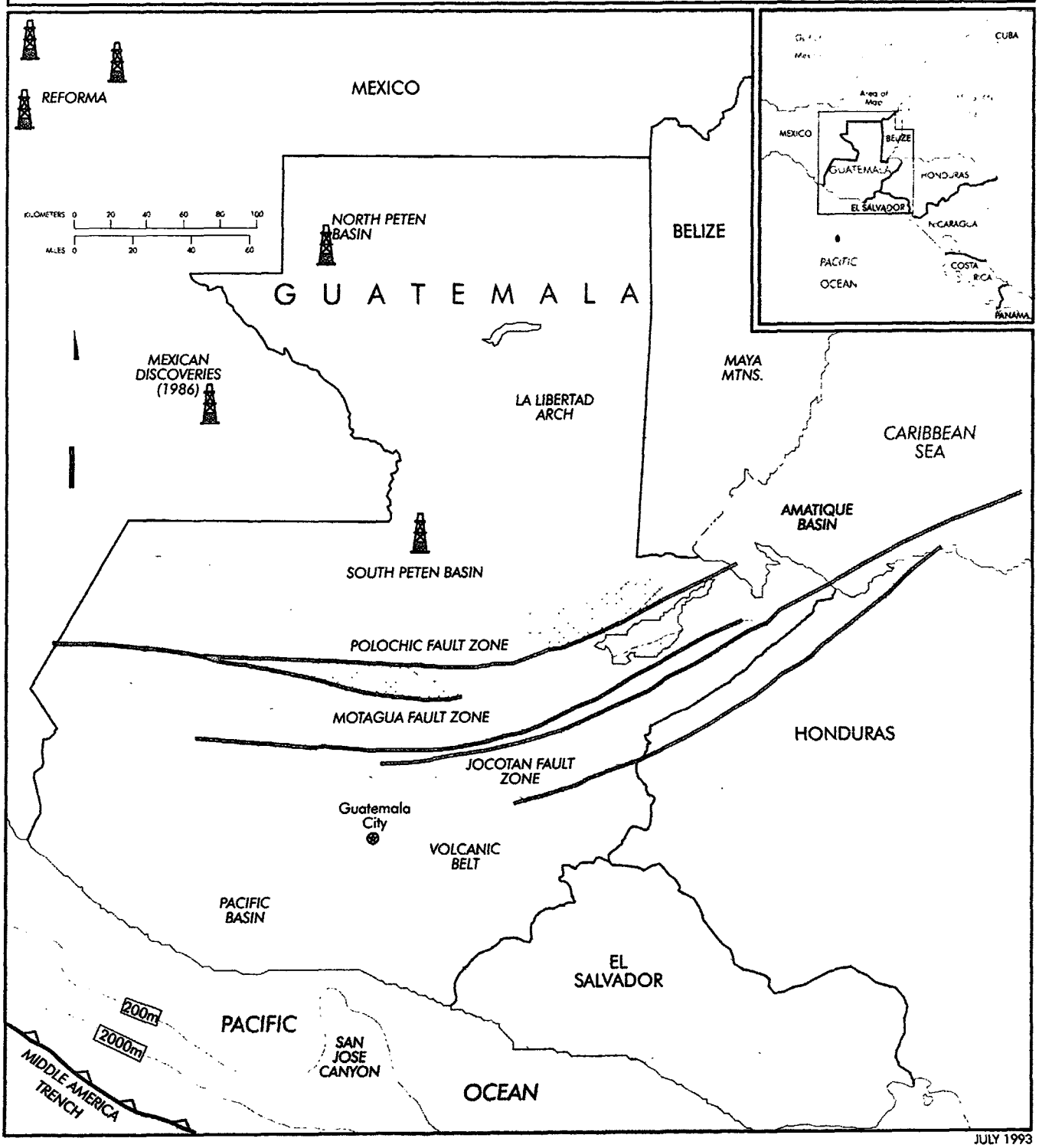
Serpentinites

Fault Lines

Present Oil Producing Areas

National Capital

International Boundaries



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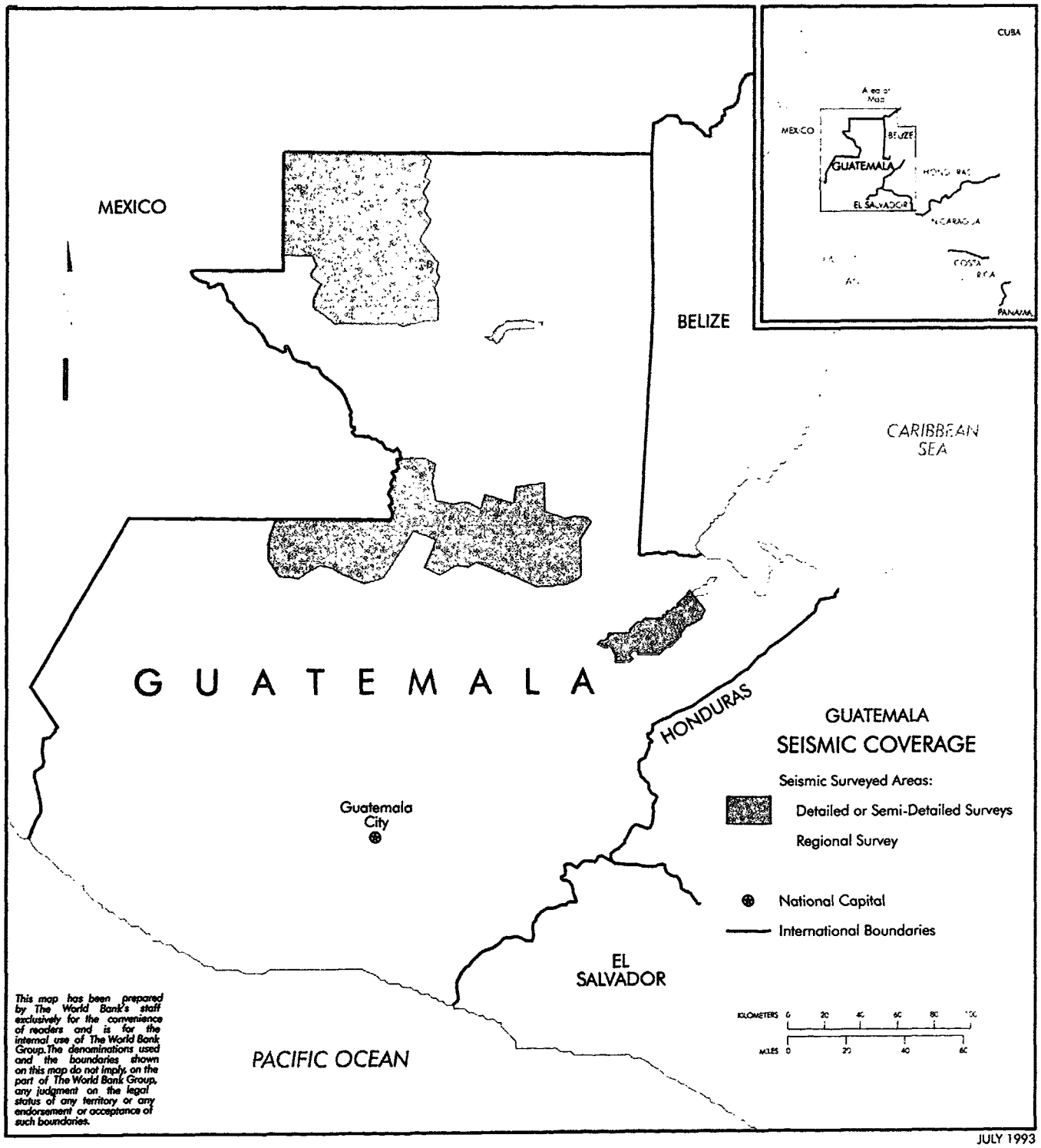

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