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PRIVATE POWER OPPORTUNITIES IN MEXICO

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ACRONYMS

BANOBRAS	Banco Nacional de Obras y Servicios Publicos (National Development Bank for Public Works and Services)
CETES	Certificados de la Tesoreria de la Nacion (28-day Mexican treasury Notes)
CFE	Comision Federal de Electricidad (Federal Electric Commission)
CNA	Comision Nacional de Agua (National Water Commission)
CONAE	Comision Nacional para el Ahorro de Energia (National Energy Conservation Commission)
CONAGUA	Comision Nacional del Agua (National Water Commission)
CRE	Comision Reguladora de Energia (Energy Regulatory Commission)
DDF	Departamento del Distrito Federal (Department of the Federal District)
DOC	U.S. Department of Commerce
EXIM	U.S. Export-Import Bank
GATT	General Agreement on Trade and Tariffs
GDP	Gross Domestic Product
IDB	Interamerican Development Bank
IFC	International Finance Corporation
IIC	Interamerican Investment Corporation
IMSS	Instituto Mexicano del Seguro Social (Mexico Social Security Institute)

ACRONYMS

INFONAVIT	Instituto Nacional de Fondo de Vivienda para el Trabajador (National Institute of Workers' Housing Funds)
LFC	Luz y Fuerza del Centro (Central Light and Power)
NAFTA	North American Free Trade Agreement
NCFI	National Commission on Foreign Investment
NRIT	National Registry of Transfers of Technology
PEMEX	Petroleos Mexicanos (National Petroleum Company)
PROFEPA	Procuraduria Federal de Proteccion al Ambiente (Federal Solicitor for Environmental Protection)
SARH	Secretaria de Agricultura y Recursos Hidraulicos (Ministry of Agriculture and Hydraulic Resources)
SE	Secretaria de Energia (Ministry of Energy)
SECOFI	Secretaria de Comercio y Fomento Industrial (Ministry of Commerce and Industrial Development)
SEDESOL	Secretaria de Desarrollo Social (Ministry of Social Development)
SEDUE	Secretaria de Desarrollo Urbano y Ecologia (Ministry of Urban Development and Ecology)
SEMIP	Secretaria de Energia, Minas, y Industria Paraestatal (Ministry of Energy, Mines and Parastatal Industry)
SHCP	Secretaria de Hacienda y Credito Publico (Ministry of Treasury and Public Finance)
SMARNP	Secretaria del Medio Ambiente, Recursos Naturales y Pesca Ministry of the Environment, Natural Resources and Fisheries

ACRONYMS

SPP	Secretaria de Programacion y Persupuesto (Ministry of Planning and Budget)
SRMC	Short-run marginal cost
SRE	Secretaria de Relaciones Exteriores (Ministry of Exterior Relations)
STPS	Secretaria de Trabajo y Prevision Social (Ministry of Labor and Social Security)
SSA	Secretaria de Salud (Ministry of Health)
VAT	Value added tax

EXECUTIVE SUMMARY

Overview of the Power Sector and Regulatory Framework

Mexico's power sector is currently undergoing a process of dramatic reform. The Government has stated its intention to open the sector to private participation, and has backed that pledge with a series of laws and regulations designed to attract domestic and foreign investors. These changes have their roots in two related causes: the general program of economic reform and liberalization begun under President de la Madrid and expanded under President Salinas; and rapid economic growth that has increased the demand for power at the same time that the Government's fiscal conservatism has reduced the funds available for investment in new capacity.

Power sector reforms have eliminated the legal generation monopoly of the Comision Federal de Electricidad (CFE), the state-owned integrated utility that has supplied Mexico's power needs since 1934. The end of this monopoly was the key first step in opening the sector to private participation. It has been followed by a series of clarifying regulations and decrees designed to reduce bureaucratic impediments and make the rights and responsibilities of CFE and potential developers transparent. These actions have been greeted with enthusiasm by the project development community, but challenges still remain, the most important of which is to bring CFE "on-board" with the reform program. Although the utility is mandated to accept power from various categories of producers -- providing several reasonable conditions are met -- no project has yet reached financial closure due to unacceptable prices and contract terms. Most of the specific areas in which problems remain are being addressed by regulatory changes that have been recently published or are currently under consideration, however, so the prospects are good that the first project under the new program will be implemented in the near future.

The Mexican power sector is dominated by five key Government agencies: the Secretaria de Energia (SE), which has ministerial jurisdiction over the entire energy sector; the Comision Reguladora de Energia (CRE), a newly created regulatory body within SE; the Comision Federal de Electricidad (CFE), the state-owned generation, transmission and distribution utility; Luz Y Fuerza del Centro (LFC), the utility serving Mexico City; and Petroleos Mexicanos (PEMEX), the state-owned, integrated oil and gas enterprise that both supplies fuel to most power facilities and has a significant quantity of its own generating capacity. Other important agencies include the Secretaria del Medio Ambiente, Recursos Naturales y Pesca (SMARNP), which directs environmental policy, determines allowable emission levels for generating stations and grants all environmental permits; and the Comision Nacional de Energia (CONAE), an interdepartmental institution with a mandate to promote energy conservation and efficiency in Mexico. CONAE has taken the lead in promoting cogeneration in Mexico, and has produced a study on cogeneration potential that provides the best available information on that topic.

In keeping with the broad goals of the economic reforms begun during the de la Madrid Administration, a series of significant changes in the legislation governing the electric sector have been introduced in recent years. The basic thrust of these changes has been to reduce the Government's role in subsidizing the construction and operation of the electric power system

while encouraging private-sector participation in the generation of power. Prior to 1992, CFE had constitutionally protected monopoly rights to conduct all power sector activities. A law passed in that year introduced the concepts of independent producer and small producer and re-defined the concepts of self supply and cogeneration. These changes introduce an important degree of competition in the electric sector, while avoiding the necessity to amend the Constitution. The private sector is now allowed to participate in the following areas, with the approval of SE: independent production (IPPs); cogeneration; self-supply; low-level production; and generation for export. Subsequent decrees clarified issues such as back-up tariffs, bidding procedures, pricing methodologies for small amounts of excess capacity and transmission tariffs and access policies.

Independent production facilities must have a capacity of 30 MW or higher and all power produced must be supplied to CFE or exported. The decision whether to allow CFE to construct a plant or to solicit bids from private producers will be made by SE, based on the objectives of least-cost production, system stability, power quality and safety. All capacity acquisitions must be consistent with the long-term expansion plan of CFE, expressed in the *Documento de Prospectiva (DDP)*, CFE's annual planning document.

Cogeneration is defined as 1) joint production of electric power by steam or another type of thermal energy or both; 2) direct or indirect production of electric power starting with unused thermal energy in a certain process; or 3) direct or indirect production of electric power using fuels produced by certain processes. In addition, the power generated must be used, or be available to, the "establishments associated with the cogeneration", which can be the owners of the process upon which the cogeneration is based, the owners of the cogeneration facility itself or members of a cogeneration "association". All excess power must be placed at the disposal of CFE.

Power produced for self-supply must be used 1) only to satisfy the needs of the owners or partners of the company owning the generating facility; and 2) exclusively inside the perimeter authorized by SE. Ownership is defined as equity participation, but there is no minimum share requirement. If excess power is available for sale to CFE, it is subject to the same transmission, pricing and dispatch rules that govern excess cogeneration capacity and power.

Low-level production is defined as one of the following:

- production of less than 30 MW that is sold in its entirety to CFE;
- self-supply of less than 1 MW for small rural communities or isolated areas; and
- exports of less than 30 MW.

Permits for low-level production are limited to persons of Mexican nationality or entities established according to Mexican law and residing within the country. In addition, for the first and third types of generation listed above, the permit holder may not be the owner of projects whose total capacity exceeds 30 MW and that are located in the same area as the low-level production. When processing applications for permits, SE will set an overall capacity limit for low-level production within a given area, taking into account existing generation and transmission

capacity, the specifics of the proposal and "any other attending circumstances". For facilities of less than 20 MW that supply all output to CFE, pricing and dispatch will be governed by the same rules that apply to sale of excess cogeneration of less than 20 MW. The regulations do not specifically address facilities of between 20 and 30 MW.

Producers of electric power to be exported as a result of a process of independent production, cogeneration or low-level production are subject to the regulations governing that type of production, with the additional requirement that a purchase contract or letter of intent must be presented to CFE prior to the issuance of a permit.

Permitting requirements are laid out in a comprehensive fashion in an extremely useful two-volume guide published by CONAE, the *Manual para Tramitar Permisos, Licencias y Autorizaciones en Dependencias Oficiales para la Construcción y Operación de una Planta de Cogeneración* (Manual for Expediting Permits, Licenses and Authorizations in Official Offices for the Construction and Operation of a Cogeneration Plant). Despite the specific reference to cogeneration, this document is an invaluable tool for developers of any type of power generation facility, since the requirements described are applicable to all types of projects.

Requirements for environmental assessments have been published in the Environmental Gazette (*Gaceta Ecológica*, V. 1, 1989, pp. 286-358). In addition, SMARNP has established ambient standards for ozone, SO_x, NO_x and Total Suspended Particulates (TSP). Source standards have been established for certain categories of point sources, such as fired boilers. No standards have yet been published for combustion turbines, but CONAE reports that SMARNP will accept a representation that the control technology for a plant meets the latest U.S. and European standards. There is no current requirement that continuous emissions monitoring equipment be installed.

Power Market Structure

All generation and transmission projects, whether private or CFE, solicited or unsolicited, must be in accordance with the regional and national objectives of the DDP, a comprehensive ten-year planning document produced annually by CFE and submitted to SE. The DDP contains data on current and projected demand, planned additions to generation and transmission capacity and energy conservation efforts. It is similar to the integrated resource or least-cost plans submitted by many U.S. utilities to their respective regulatory commissions.

Power sales by CFE in 1993 totalled 101.3 terawatt hours (TWH), a 3.8 percent increase over the previous year. Total demand grew at an annual rate of 4.3 percent during the five years from 1988 to 1993, and by 5.2 percent during the ten-year period ending in 1993. It should be noted that these figures do not include the consumption of power generated by the private sector and PEMEX, which is estimated to be approximately 10 percent of Mexico's total power usage. Base-load and peak demand are both forecast to increase by 65 percent between 1994 and 2003, the former from 13,035 MW to 21,603 MW, and the latter from 7,175 MW to 11,890 MW.

Industry accounts for 54 percent of CFE's total power sales, compared with an average of 35 percent for the U.S. electric utility industry. Moreover, this figure excludes self-supply and cogeneration. The forecasted growth rates for among customer classes vary considerably. Light and heavy industry dominate, increasing their combined share of total consumption to 59 percent. Mexico is divided into nine regions that comprise the Sistema Electrico Nacional (SEN). In addition, there are 12 small isolated systems, 6 of which utilize imported energy; the combined demand in these systems is negligible. The four regions with the largest demand are: the Northeast, which includes Monterrey, Nuevo Leon and the Maquiladora region on the Texas border; the West, which includes Guadalajara and Puerto Vallarta; the Central region with Mexico City and environs; and the East, which includes Vera Cruz and Puebla. Two regions have particularly high forecasted growth rates: the Northeast, which is experiencing a rapid industrial and trade-based expansion; and the Peninsula region, which will continue to be developed for tourism.

At the end of 1993, Mexico had 29,205 MW of capacity, which had increased to 31,860 MW by the end of 1994. Conventional steam facilities dominate the generation portfolio of CFE, and high-sulfur fuel oil (HSFO) is by far the predominant fuel in those facilities, accounting for 72 percent of all non-nuclear fuel used by CFE in 1992. Gas was next with 17.3 percent, followed by coal with 8.9 percent and diesel with 1.3 percent.

At the end of 1992, CFE had 346,183 km. of transmission and distribution lines, of which 9,162 were 499 kV, 17,673 were 230 kV, and 39,149 were from 69 to 161 kV. Seven of the nine regions that comprise the SEN form the Sistema Interconectado Nacional (SIN, or National Interconnected System), which covers almost all of continental Mexico and the Yucatan peninsula, which was recently joined to the system. The only regions not connected are those on the Baja California peninsula, although they have two 230 kV interconnections to the U.S. and the 12 small isolated systems noted above. Transmission losses have increased from 12.7 percent in 1986 to 15 percent in 1993 due to inadequate investment in refurbishment and maintenance.

Mexico has historically used electricity tariffs to achieve various public policy goals, but has recently eliminated most of those subsidies. Fiscal transfers to the power sector have declined from a high of 2.3 percent of GDP in 1983 to zero in 1991. Real electricity prices have increased about 35 percent over the last five years, and in 1993 reached an average of \$0.07 per kWh. The most recent phase of this trend was initiated by the *Pacto para la Estabilidad y Crecimiento Economico* (Economic Stability and Growth Pact, or PECE), which was passed in October of 1992. Under this agreement most tariffs were increased by 0.79 percent monthly until March 1993, at which time the agricultural tariff began to increase at 0.5 percent monthly until October 1993. In that month all tariffs except those for heavy industry and agriculture were escalated by 0.44 percent monthly. The agreement was renewed in September 1994 as the *Pacto para el Bienestar, la Estabilidad y el Empleo* (Pact for Well-Being, Stability and Employment), with a provision limiting power-sector price increases to four percent over the subsequent year. Substantial cross-subsidies remain even after these increases, most notably for the residential and agricultural sectors, but the Government plans to slowly phase these out, as well. Despite the

VSP

increases of recent years, CFE industrial tariffs are still somewhat lower than those in border areas of the U.S, in particular in California and Arizona.

The most likely fuel choices for prospective developers in Mexico are coal and natural gas. CFE's expansion plans for the coming decade indicate a substantial increase in the use of gas for power generation, which is part of a larger SE strategy to reduce the country's use of HSFO and increase its use of natural gas in all relevant sectors of the economy. This will be accomplished in the power sector through the construction of new combined-cycle and peaking facilities, as well as the repowering of existing HSFO units. This shift toward gas is being driven both by the environmental benefits of gas vis-a-vis HSFO, and by the economic attractiveness of gas as a generation fuel. Several important uncertainties still exist, however, regarding the contractual terms under which gas can be purchased from PEMEX, as well as its availability.

Business and Investment Climate

The Salinas Administration came into office in 1988 and the following May released its *Plan Nacional de Desarrollo* (National Development Plan) for 1989-94, which had the twin goals of six percent GDP growth and a reduction in inflation to the levels of Mexico's trading partners. Part of the strategy for achieving these objectives was to increase investment, which was accomplished by privatization of state enterprises, deregulation of strategic sectors such as banking and transport and policies to encourage foreign investment and the return of flight capital. This plan marked the beginning of the dramatic reforms of which the current private power program is a component. An important aspect of the Government's strategy has been its efforts to develop a closer trading relationship with the U.S. in particular, and to open its economy to foreign investment and import competition in general. The benefits of this strategy have already been realized, with overall trade expanding rapidly during the first half of 1994 as the North American Free Trade Agreement (NAFTA) came into effect.

Over the course of the past decade the Mexican Government has taken broad strides to encourage and augment both direct and indirect foreign investments flowing into Mexico. As a result of these policies, direct foreign investment increased more than five-fold between 1983 and 1992. As would be expected, the U.S. has been the largest investor, followed by Great Britain, Germany, Switzerland, Japan, France and Spain. Although investment has been concentrated in the industrial and service industries, significant quantities of funds have also been committed to sectors such as agriculture, commerce and extractive industries. Foreign firms now account for 10 of the largest 50 firms Mexico.

The defining legislative works regulating foreign investment in Mexico are the *1973 Law to Promote Mexican Investment and Regulate Foreign Investment* (the 1973 Law), the *1989 Amendment to Foreign Investment Regulations* (the 1989 Amendment) and the *1993 Amendments to the Foreign Investment Regulations* (the 1993 Amendments). These laws are aimed at regulating investments in Mexican corporations and establishing a framework to promote certainty, competitiveness and clarity with regards to investments. Mexico repealed its foreign exchange controls in November 1991. The New Peso is now freely convertible with all other currencies,



and there are no restrictions on the remittance of profits abroad, the repatriation of capital or the repayment of intercompany loans and/or interest.

Federal tax liabilities for companies operating in Mexico consist of federal corporate taxes, value added taxes and payroll taxes. Taxes levied at the state and local level include state payroll taxes and local real estate taxes. There are no state corporate income taxes. The corporate tax rate is currently at 35 percent, which for Mexican branches of foreign corporations is only levied on income derived from operations in Mexico. A value added tax (VAT) is levied on the consumption of all goods and services produced in Mexico. The tax is levied at a flat rate and is determined with respect to the service or good to which it is being applied. VAT is also payable on imported goods and services rendered by non-residents for use in Mexico.

Recent Regional Developments

The most important recent international event with repercussions for private power development is of course NAFTA. Its overall impact on the power sector is perceived to be relatively minor, however, due to the Mexican Government's insistence on retaining Constitutional protection for CFE. As a result, the effect of NAFTA is likely to be indirect, in the form of increased demand for power caused by whatever boost the Agreement gives to Mexico's economy. A more specific benefit may come from increased cogeneration opportunities in industries favorably affected by the opening of Canadian and U.S. markets.

Potential Private Power Opportunities

CFE expansion plans call for the addition of 14,639 MW of additional capacity in the period from 1994 to 2003. This is to be supplied by 6,479 MW that are either in construction or contracted for (which CFE designates as "promised capacity") and 8,169 MW of "additional capacity". The vast majority of the latter is potentially open to development by U.S. private parties. The largest share of this capacity will be in the Northeast, West and Central Regions, which together account for 65 percent of the total. Baja California will require 800 MW, with the first additions needed in 1996 to handle summer peaking needs, which will be met by imports until through 1995.

CFE's expansion plan anticipates that combined-cycle facilities will provide a large share of the total capacity to be added during the coming decade. Of the 14,639 MW to be added to the system -- which includes both "promised" and "additional" capacity -- 6,426 MW is to be combined-cycle gas, or 44 percent of the total. Next is hydro, which accounts for 3,467 MW, or 24 percent of the total, followed by HSFO, with 2,458 MW (17 percent). The remaining capacity is to be 700 MW of dual-fuel coal/HSFO (5 percent), 700 MW of conventional coal (5 percent), 675 MW of nuclear (5 percent), and 213 MW of geothermal (2 percent).

Taking into account the above parameters for its long-term goals, CFE has developed expansion options for each region, using combinations of new capacity, re-powering of existing facilities, transmission links to other regions and imports. These options will be updated and refined in

subsequent DDPs, but at the present time they provide the most authoritative guide to the long-term expansion of the Mexican power sector, and to the most likely opportunities for private developers.

Substantial opportunities exist for the development of cogeneration facilities. As part of its mandate to provide encouragement and technical assistance to potential cogeneration developers, CONAE has commissioned several studies attempting to estimate the potential capacity that could be economically developed, given Mexico's current and future industrial base. As would be expected, the largest share of potential capacity is found in PEMEX facilities, but opportunities exist in the industries that already have their own generating capacity, such as pulp and paper, food, minerals and sugar refining. In terms of total megawattage, most of this potential exists in large industries -- i.e., those with cogeneration potential of 20 MW or more. A large share of the total potential capacity, however, is found in the large number of smaller companies with appropriate thermal operations.

Although a large number of financial techniques are being used or considered for project finance -- including Eurobonds, Rule 144a funds, industrial credit companies and corporate capital allocations -- the first projects to reach completion in Mexico will likely have relatively straightforward debt-equity structures and funding sources. This is due to the novelty of project finance in Mexico, as well as in the rest of Latin America, where to date only one limited-recourse power project has reached financial closure -- the Mamonal power plant in Columbia. This novelty, combined with CFE's reticence to date to provide contractual terms acceptable to lenders, suggests that the transaction costs of the first projects will be relatively high, making a simple financial structure more appealing and affordable.

1. OVERVIEW OF THE POWER SECTOR AND REGULATORY FRAMEWORK

1.1. Overview

Mexico's power sector is currently undergoing a process of dramatic reform. The Government has stated its intention to open the sector to private participation, and has backed that pledge with a series of laws and regulations designed to attract domestic and foreign investors. These changes have their roots in two related causes. The first is the general program of economic reform and liberalization begun under President de la Madrid and expanded under President Salinas, the principles of which have guided the conception and implementation of the private power program now underway. The second is an outgrowth of the success of the economic reform program: rapid economic growth has increased the demand for power at the same time that the Government's fiscal conservatism has reduced the funds available for investment in new capacity.

Power sector reforms have eliminated the legal generation monopoly of the Comision Federal de Electricidad (CFE), the state-owned integrated utility that has supplied Mexico's power needs since 1934. The end of this monopoly was the key first step in opening the sector to private participation. It has been followed by a series of clarifying regulations and decrees designed to reduce bureaucratic impediments and make the rights and responsibilities of CFE and potential developers transparent. These actions have been greeted with enthusiasm by the project development community, but challenges still remain.

The most important of these challenges is to bring CFE "on-board" with the reform program. Although the utility is mandated to accept power from various categories of producers -- providing several reasonable conditions are met -- no project has yet reached financial closure due to unacceptable prices and contract terms. Most of the specific areas in which problems remain are being addressed by regulatory changes that have been recently published or are currently under consideration, however, so the prospects are good that the first project under the new program will be implemented in the near future. This likelihood is enhanced by President Ernesto Zedillo's recent appointment of three top energy sector officials: Ignacio Pichardo Pagaza will head the Secretaria de Energia; Carlos Ruiz Sacristan is to be chief of Petroleos Mexicanos; and Rogelio Gasca of the Comision Federal de Electricidad. All three men are reform-minded, effective administrators, and their tenure should have a positive influence on private power development.

Since the need for additional capacity is unlikely to go away, the issues that have prevented projects from being successfully implemented must be resolved if Mexico is to attract the capital necessary to avert power shortages and/or unacceptable price increases for electricity. The remainder of this section describes the structure of the sector, the reforms made to date and those that are pending, with the goal of providing a comprehensive picture of the regulatory structure that is shaping this process. It also outlines the permitting requirements necessary for private power development and details the steps necessary to implement a project.

SE - Secretaria de Energia

SE (Ministry of Energy) has overall responsibility for the entire energy sector, and oversight responsibility for CRE, CFE, PEMEX and three research institutes: the Instituto de Investigaciones Electricas (IIE); the Instituto Mexicano del Petroleo (IMP); and the Instituto Nacional de Investigaciones Nucleares (ININ). It is the successor to SEMIP, the Ministry of Energy, Mines and Parastatal Industry, which was replaced by SE on December 19, 1994 when revisions were passed to the Basic Public Administration Law. SEMIP's overview of mining was given to a new environmental ministry, which is described below, and responsibility for parastatal industries was transferred to SECOFI, the Ministry of Commerce and Industrial Development.

SE directs and coordinates planning and regulatory efforts for all energy-related areas, including the electric sector, and provides guidance for public/private investment policy. It also provides guidelines for the Comision Nacional para el Ahorro de Energia (CONAE), the interdepartmental agency that promotes cogeneration. This broad mandate has led to an equally broad perspective at the policy-making levels of the Ministry, with the result that it is the energy-sector government agency most closely attuned to the economic reform objectives of the previous and current administrations. SE has played a leadership role in the effort to open the power sector to private participation, and can be expected to continue to do so as the private power program develops.

SE's specific responsibilities that are relevant to private power development include the following:

- approving CFE's planning documents, which define expected capacity requirements and the most likely alternatives for satisfying them;
- monitoring CFE's solicitation process for new capacity;
- determining which plants are approved and whether they are built by CFE or the private sector; and
- approving new regulations that define the rights and responsibilities of CFE and private developers.

CRE - Comision Reguladora de Energia

CRE (Regulatory Energy Commission) is a decentralized administrative unit of SE established by decree in November 1993 (*Decreto Legal*, Diario Oficial 25, Noviembre 1993). Its responsibilities are similar to those of a public utility regulatory body in the U.S., with the crucial exception of its lack of direct responsibility for tariff development. CRE's specific mandate is to provide technical advice to SE on issues related to the regulation of the electric sector in Mexico. Among other functions, its responsibilities include the following:

- performing tariff and other studies;

- training personnel for other agencies;
- providing advice to SE on regulatory policy;
- supervising the issue of permits for independent production, self-supply, cogeneration, low-level production and the export of electric power;
- facilitating the establishment of contracts between private parties and CFE; and
- arbitrating conflicts between private parties and CFE.

In the area of tariffs, CRE's role is limited to performing analyses of the tariff proposals presented by CFE, although there is a possibility that this role will be expanded in the future, with CRE assuming some of the authority now vested in the Secretaria de Hacienda y Credito Publico (SHCP).

CFE - Comision Federal de Electricidad

Created by Law in 1934, CFE is a state-owned entity that supplies electricity generation, transmission and distribution for the entire country except for Mexico City, which is the responsibility of Luz Y Fuerza del Centro, or LFC (the two are commonly considered to be the same for policy purposes, and will be subject to the same regulations vis-a-vis developers; LFC is therefore not discussed separately in this report).

Under the Salinas administration, CFE pursued a comprehensive policy program aimed at increasing the productivity of the sector. This program targeted the following four areas:

- *Power Availability.* To increase available capacity, CFE undertook two measures: incorporating excess power from self-generation by state-owned enterprises into the grid; and creating a private power program.
- *CFE's Financial Position.* To achieve a sound financial condition, CFE allowed private sector participation in a new power plant construction program. The private sector would provide the funds to develop generation facilities, relieving CFE of the financial burden.
- *Labor Productivity.* CFE has established agreements with the Electric Power Workers Union (Sindicato Unico de Trabajadores Electricistas de la Republica Mexicana) addressing issues of organization, regionalization, simplification, training and personnel incentives.
- *Electricity Demand.* CFE has implemented energy efficiency programs, mainly through Demand-Side Management activities, to reduce the high growth rate of electricity demand.

As described in detail in Section 1.3, CFE's generation monopoly has been circumscribed by recent legislative and regulatory developments. Because these changes have not yet resulted in the construction of actual projects, however, CFE maintains a dominant role in the sector, and its cooperation will be essential for the successful development of most private projects.

CFE's key responsibilities include the following:

- supplying electric energy in the form of "public service";
- proposing power sector programs and projects to SE;
- exporting electric energy and, with an exclusive mandate, importing it for purposes of public service; and
- formulating and proposing to SE operational, investment and financial plans for the short, medium and long term that will be required for the supply of public service.

SHCP -Secretaria de Hacienda y Credito Publico

SHCP, the treasury ministry, is important to prospective developers because it provides final approval of CFE tariffs. In making its decision regarding the acceptability of CFE's proposal, SHCP considers the financial health of CFE as well as the impact of tariff changes on different customer classes and Mexico's international competitiveness. Although SHCP will retain some authority over tariffs for the foreseeable future, some observers believe that it will gradually cede authority to CRE as the latter completes its staffing and develops its analytical capabilities. SHCP is also a key player in the development of the Government's overall economic reform goals, which are much of the impetus behind the recent opening to private sector participation and foreign investment in the power sector.

PEMEX - Petroleos Mexicanos

PEMEX, one of the largest companies in the country, is a state-owned enterprise with an exclusive mandate for the exploration, production, refining and distribution of petroleum, natural gas and petrochemicals in Mexico. Like CFE, PEMEX has Constitutional protection as a national company. Its activities are regulated by the Comision Nacional de Petroleo, Gas y Petroquimica (CNPQP), an administrative unit of SE that has an important role in strategy formulation for PEMEX, as well as in the tariff-setting process for gas, oil and other hydrocarbons. PEMEX is currently going through a restructuring process that has cut approximately 100,000 jobs, and the possibility of foreign investment in some activities is being explored, but it will remain the sole supplier of fuel for power projects for the foreseeable future.

SMARNP - Secretaria del Medio Ambiente, Recursos Naturales y Pesca

SMARNP (Ministry of the Environment, Natural Resources and Fisheries) absorbed all responsibility for environmental affairs from other ministries during the December 1994 reorganization that created SE. These responsibilities had been partially consolidated under SEDESOL (Ministry of Social Development) in 1992, but significant areas of oversight still remained with other ministries. This lack of a central coordinating body for legislation and enforcement has meant that areas of environmental jurisdiction have not always been clear. The new Ministry will assume this function as well as leading efforts to increase enforcement of existing and future legislation.

Sub-ministries and other entities that SMARNP will supervise include the following:

- *National Institute of Ecology (Instituto Nacional de Ecologia)*. Currently a decentralized entity within SEDESOL, the Institute will be converted into an Environmental Policy Sub-Ministry, although its activities will remain unchanged.
- *Federal Solicitor for Environmental Protection (Procuraduria Federal de Proteccion al Ambiente, or PROFEPA)*. PROFEPA will be a decentralized entity, as it was under SEDESOL, but with stronger enforcement authority.
- *Sub-Ministry for Natural Resources (Subsecretaria de Recursos Naturales)*. This division will have responsibility for all non-hydrocarbon natural resources.
- *National Water Commission (Comision Nacional del Agua, or CONAGUA)*. CONAGUA will be transferred from SARH (Ministry of Agriculture and Hydraulic Resources), and will remain a decentralized agency.

SMARNP will direct all environmental policy, determine allowable emission levels for generating stations and grant all environmental permits. The Ministry is responsible for all environmental protection matters in Mexico, and coordinates its actions with several other Ministries, including SECOFI, SE and SHCP. It has the jurisdiction to publish ambient and source emissions standards, and to enforce them in Federal zones or where two or more jurisdictional entities are affected, which would include all large emissions sources. States may enact their own standards, but they must be at least as strict as those promulgated by SMARNP.

CONAE - Comision Nacional de Energia

CONAE was created in 1989 as an interdepartmental institution with a mandate to promote energy conservation and efficiency in Mexico. It is chaired by and receives direction from SE, and includes representatives from SHCP, SMARNP and the Secretaria de Comercio y Fomento Industrial (SECOFI, which is roughly equivalent to the U.S. Department of Commerce). CONAE has taken the lead in promoting cogeneration in Mexico, and has produced a study on cogeneration potential that provides the best available information on that topic. The information

gathered for that report was also compiled into a database of potential cogeneration sites. CONAE has published a two-volume guide to the permitting and other regulatory steps required for private-sector energy projects, which is discussed in Section 1.5.

Table 1 provides a summary of the policy issues that affect the development of the electric sector, the institutions involved and the specific functions they perform.

Table 1 Policy Framework of the Mexican Power Sector		
Issue	Agency	Function
Economic Policy	SHCP	Determines the scope of private sector participation in different industries according to the goals of the government.
Energy Policy	SE	Coordinates and plans the use of different types of energy. Includes CRE and CNPCP as administrative units. Oversees PEMEX and CFE. Driving force behind private power policy.
Electric Sector Planning	CFE	Determines future needs and develops guidelines for generation, transmission and distribution.
	SE	Determines who builds and operates new capacity based on least-cost production, system stability, power quality and safety. Issues permits for private investors. Approves and modifies CFE plans.
Tariff Setting	CFE	Performs studies to determine prices for transmission and distribution. Proposes tariffs based on studies done by CFE and SECOFI.
	CRE	Performs studies related to tariff setting.
	SHCP	Approves tariffs.
Environmental Policy	SMARNP	Sets environmental policy in coordination with other ministries. Sets emissions and ambient pollution standards.
Information / Technology Transfer	CONAE	Promotes cogeneration, provides databases of industries with cogeneration potential, assists in feasibility studies.

1.3. Relevant Legislation and Pending Changes

Legislative and Regulatory History

In keeping with the broad goals of the economic reforms begun during the de la Madrid Administration, a series of significant changes in the legislation governing the electric sector have been introduced in recent years. The basic thrust of these changes has been to reduce the Government's role in subsidizing the construction and operation of the electric power system while encouraging private-sector participation in the generation of power. Section 1.3 outlines this evolution as it affects private power developers, highlighting the most important events.

Regulation prior to 1992. The institutional development of the electric sector started with the creation of CFE in 1934 and continued with a more precise definition of its role in 1949, the acquisition of two foreign-owned utilities in 1960 and the modification of the Mexican Constitution in the same year to guarantee state control of the power sector through CFE. This exclusive mandate to provide electric energy in the form of "public service" remains intact in the Constitution, although as explained below, it has been effectively circumvented by various administrative decrees. In 1975, a new law was passed (*Ley del Servicio Publico de Energia Electrica*, Diario Oficial, 22 Septiembre 1975), in which these concepts were reinforced and the role of the State in the electric sector was expanded to cover all activities related to planning, constructing and maintaining the power sector infrastructure. Other modifications between 1975 and 1992 opened the sector slightly to private cogeneration, but under very limited circumstances.

The Reforms of 1992. In 1992, during the administration of President Salinas de Gortari, important changes to the 1975 law were passed (*Decreto que Reforma, Adiciona y Deroga Diversas Disposiciones de la Ley del Servicio Publico de Energia Electrica*, Diario Oficial, 23 Diciembre 1992), in which the concepts of independent producer and small producer were introduced and the concepts of self supply and cogeneration were re-defined. The 1992 decree deems these activities to be "other than public service", and thus suitable for private participation. The rationale behind this distinction, as understood by Mexican jurists, is that these activities do not satisfy collective needs, but rather specific needs, which are not considered to be "general, uniform, permanent, or obligatory." In practical terms, these changes introduce an important degree of competition in the electric sector, while avoiding the necessity to amend the Constitution. The implementing regulations for these reforms (*Reglamento de la Ley del Servicio Publico de Energia Electrica*, Diario Oficial, 23 Mayo 1993, hereinafter "the by-laws") define the following as areas in which the private sector is allowed to participate, with the approval of SE:

- independent production (IPPs);
- cogeneration;
- self-supply;
- low-level production; and
- generation for export.

The above activities all require a permit from SE, which is valid indefinitely, except in the case of independent producers, whose initial permit is valid for 30 years. The basic principle upon which this participation will be based is least-cost planning: CFE will make both capacity addition and dispatch decisions based on the complete array of CFE and private options available. Regulatory specifics for each of these generation categories and for private participation in general are discussed in Section 1.1.

Subsequent Regulatory Changes. The 1992 legislation and the 1993 by-laws left many important issues unresolved from the perspective of private developers. Subsequent regulatory decrees have addressed some of these, but others are still awaiting action. The following is a list of those that have been passed as of the publication of this study; a detailed description of the provisions contained in these decrees is provided in Section 1.1.

- *Power Sector Manual.* In accordance with the by-laws, a manual for potential investors in the power sector was published in June of 1993 (*Manual de Servicios al Público en Materia de Energía Eléctrica*, Diario Oficial, 29 Julio 1993). The manual establishes the procedures and forms that are necessary to implement a contract between CFE and a private party involved in generation or cogeneration. It covers areas such as billing, payments, complaints, complementary activities to the provision of electric power and information requirements.
- *Back-up Tariffs.* Tariffs for back-up service to be provided by CFE were published in May of 1994 (*Acuerdo que Establece el Servicio de Respaldo para los Particulares que se Acojan a las Modalidades de Generación de Energía Eléctrica que Permite la Ley del Servicio Público de Energía Eléctrica*, Diario Oficial, 13 Mayo 1994).
- *Bidding Procedure.* Also in May of 1994, the by-laws were modified to make the bidding process more transparent and the evaluation of different proposals more objective (*Decreto por el que se Reforman, Adicionan y Derogan Diversas Disposiciones del Reglamento de la Ley del Servicio Público de Energía Eléctrica*, Diario Oficial 19 Mayo 1994).
- *Pricing Methodology for Excess Power of Less than 20 MW.* A methodology for determining payments for small producers was published in late 1994 (*Acuerdo por el que se Aprueba la Metodología para el Cálculo de las Remuneraciones por la Capacidad Puesta a Disposición de la Comisión Federal de Electricidad or Luz y Fuerza del Centro por los Permisarios con Excedentes de 20 MW o Menos*, Diario Oficial 24 Noviembre 1994).
- *Transmission Tariffs and Access Policies.* A methodology was published on the same date for determining transmission and connection charges (*Acuerdo por el que se Aprueba la Metodología para Determinar los Cargos Correspondientes a los Servicios de Transmisión y Servicios Conexos que Prestan la Comisión Federal de Electricidad or Luz y Fuerza del Centro*, Diario Oficial 24 Noviembre 1994).

Forthcoming Decrees and Rules. As noted above, several key issues remain to be resolved. Regulations to address these issues are currently being developed, and are expected to be published in late 1994 or early 1995. The most important of these pending rules is the following:

- *Pricing Methodology for IPPs.* Although capacity and energy charges are determined by a developer's proposal and the contract that will be based on it, there is currently no guidance for CFE on how to evaluate different pricing proposals, either against competing proposals or against CFE's costs. Clarification is needed in areas such as the comparison of different discount rates and fuel-price assumptions. The forthcoming rules will also define how CFE is to calculate its own generation costs.

1.4. Detail of Policies affecting Private Power Development

As described above, private developers are now allowed to generate electricity in any of the following arrangements:

- independent production (IPPs);
- cogeneration;
- self-supply;
- low-level production; and
- generation for export.

This Section will detail the most important elements of the various laws and regulations described above as they relate to these five arrangements.

Independent Production

General. Independent production facilities must have a capacity of 30 MW or higher and all power produced must be supplied to CFE or exported. The decision whether to allow CFE to construct a plant or to solicit bids from private producers will be made by SE, based on the objectives of least-cost production, system stability, power quality and safety. All capacity acquisitions must be consistent with the long-term expansion plan of CFE, expressed in the Documento de Prospectiva, CFE's annual planning document (which is also mandated by the by-laws and is discussed in detail in Section 2.1). The least-cost criterion is meant to ensure that CFE will construct future capacity itself only when it has a clear cost advantage.

The solicitation for proposals, if approved, will typically specify a region and capacity, leaving the specifics discussed below to the developers. In some circumstances, however, CFE will specify a fuel, location or other requirement, if such specificity is necessary to preserve the integrity of the long-term plan. This is the case, for example, with the solicitation for Merida III, which specified location, fuel type and technology.

Technology and Fuel Choice. As noted above, bidders will generally be required to propose the technology, fuel type, design, engineering, construction and location of the prospective facility. This flexibility will in reality be limited by two constraints. First, fuel choice will be driven by both availability and SE plans to shift significant capacity from fuel-oil to gas. Second, the location of a site within the region specified in the solicitation will be determined in large part by the location of fuel supplies and interconnections with the CFE grid.

Interconnection with Transmission Grid. CFE will indicate a preferred interconnection point or a set of alternatives, along with their respective costs and maximum capacity, in order to enable a fair evaluation of different proposals.

Pricing. The bidder will propose a capacity and energy charge, which will then be incorporated -- after modification, if necessary -- into the Power Purchase Agreement (PPA) if the bid is accepted. Capacity charges should reflect fixed costs, including a fair return on capital, while energy charges should correspond to the variable costs of generation, including in both cases the costs of transmission. The length of the contract will be established by mutual agreement, but is not to exceed 30 years in its initial term.

Bidding Procedures and Schedule. Once an initial solicitation has been issued, interested private parties will have 60 days to make comments and suggestions. The invitation for bidding will then be published in the "Diario Oficial", and proposals will be due not less than 40 days after the publication date. CFE will release its decision on the date specified in the solicitation, which will be not more than 180 days from the opening of the proposals. If more than one proposal satisfies the technical criteria established in the Terms of Reference (TOR), then the project will be awarded to the bidder with lowest long-run cost. If CFE for any reason decides not to sign an agreement with any of the bidding companies, and declares the bidding void in spite of the fact that one or more participants fulfilled the requirements of the TOR, CFE must reimburse those firms for the costs incurred in the preparation of the proposals. If needed, participants can present a written complaint to the Secretaria de la Contraloria General de la Republica, an independent agency that oversees government contracting, which must respond in 45 days or less.

Dispatch Rules. Electric power produced by different plants, including those of CFE, will be dispatched in order of increasing total short-run cost. Those costs will be based on the methodology in the forthcoming regulations discussed above for CFE facilities, and on the charges contained in the PPA for independent producers (different rules apply for cogenerators and those selling excess self-supply, which are discussed in those sections below). At the beginning of each period -- the length of which will be determined by CFE -- the independent producer will furnish its total short-run cost of power for the period, determined according to the formulae contained in the PPA. CFE will then provide to the producer at the beginning of each month a (non-binding) forecast of the power that will be dispatched from that facility over the following three-month period.

Transmission Charges. Wheeling charges have different components depending on whether the required capacity is greater or less than 69 kV. For services at or greater than this level, charges will be billed monthly and will contain four parts:

- fixed charge for grid use
- variable charge for grid use
- fixed charge for administration of the agreement
- charge for related services (i.e., frequency control, etc.)

The procedure to calculate these four cost components will be user-specific. First, the burden on the grid caused by the requested transmission service will be modeled using a methodology proposed by CFE and approved by SE through the CRE. The model will be run with and without the requested services in order to determine the impact on the entire grid. This usage will then be multiplied by cost parameters to obtain the fixed and variable cost for grid use. Cost parameters for these charges, as well as for the administration and "related services" charges, will be proposed by CFE and approved by SE through CFE. The specific components of each charge are as follows:

Fixed Charge for Grid Use. The fixed cost for grid use has two components: (i) a charge for the use of the transmission infrastructure, and (ii) a charge for transmission and generation capacity due to power losses.

Variable Charge for Grid Use. CFE's model will measure the transmission losses caused by the requested service during the base and peak periods for that tariff region and voltage level. These power losses will then be multiplied by the corresponding energy charges for that tariff region and voltage level.

Fixed Cost for Administration of the Agreement. The fixed charge for administration is based on CFE's administrative costs. This cost concept recognizes differences among users but is not proportional to demand or energy consumption.

Charge for Related Services. The charge for related services includes costs incurred by the CFE in providing frequency and voltage control services.

For transmission below 69 kV, there will only be three charges:

- charge for grid use
- fixed charge for administration of the agreement
- charges for related services

These cost concepts are very similar to those for services at or greater than 69 kV.

Cogeneration

General. Cogeneration is defined in the by-laws as 1) joint production of electric power by steam or another type of thermal energy or both; 2) direct or indirect production of electric power starting with unused thermal energy in a certain process; or 3) direct or indirect production of electric power using fuels produced by certain processes. In addition, the power generated must be used, or be available to, the "establishments associated with the cogeneration", which can be the owners of the process upon which the cogeneration is based, the owners of the cogeneration facility itself or members of a cogeneration "association". Ownership, in the above definitions, can refer to co-ownership, and does not require a particular level of involvement or share of ownership. All excess power must be placed at the disposal of CFE according to the provisions described below.

Technology and Fuel Choice. Because cogeneration facilities are not required to conform to CFE's planning process, they may use any technology or fuel. In order to qualify, however, they must increase both the energy efficiency and economic efficiency of the process served and must exceed the efficiency of "conventional" CFE plants, which CONAE advises is unofficially deemed to be 33% thermal efficiency.

Transmission Access. Transmission services that are required to provide power to "owners" other than those in control of the thermal host, or to supply excess power to CFE, may be requested from CFE, and will be provided on a first-come, first-serve basis, according to the provisions of the regulations described above. If facilities must be built, they can be constructed by CFE with the cost shared by the developer and CFE according to agreements reached between the parties. Developers may also construct their own transmission facilities, but these may not interconnect with the Sistema Electrico Nacional (SEN, or National Electric System).

Pricing and Dispatch Rules. Any capacity provided to CFE that is greater than 20 MW must go through the bidding process described for independent producers, and will be subject to the same pricing provisions (i.e., contractually established capacity and energy charges) and dispatch rules. Excess capacity of less than 20 MW may be purchased by CFE if such a purchase lowers overall costs, with prices and contract terms determined by the methodology described below. Energy will be sold based on a bid provided by the producer at the beginning of each period, which will establish both the price paid for energy provided and the amount of energy dispatched from the facility during the period. This energy rate will be capped, however, by a maximum submitted as part of the capacity bid, subject to adjustment for fuel prices, inflation, etc. based on a formula proposed as part of the capacity bid. These rules apply to all facilities supplying CFE with less than 20 MW of capacity, including self-suppliers and low-level producers.

The decision by CFE to purchase capacity will be based on a comparison of the producer's offer for base, intermediate and peak capacity with CFE's short-run marginal (SRMC) cost at the "node" closest to the producer's interconnection point to the power grid. During the last week of May of each year, CFE will provide SE, through the CRE, the necessary information to calculate SRMC by node for the following twelve months. This comparison procedure is laid out in great

detail in the published regulation, including initial values for the formulas used to calculate CFE's costs. When CFE's cost is greater than that in the proposal, CFE will accept the excess capacity and sign a long-term power purchase agreement. If no agreement is reached, the producer can request SE's intervention through the CRE.

Back-Up Tariffs. Back-up tariffs consist of three components: a fixed monthly charge; a capacity payment, which is divided into "reserved", "measured" and "chargeable" demand, depending on whether the desired service is for scheduled maintenance, emergency back-up or both; and an energy charge that differentiates between peak and non-peak periods and between regions.

The reserved demand and measured demand concepts are applicable only if emergency back-up service is involved. Reserved demand is determined by the user and corresponds to the maximum level the user could require for maintenance purposes or emergency. If the actual maximum demand utilized on a particular day is larger than reserved demand it becomes the new reserved demand for the next 12 months. Measured demand is determined daily, but charged on a monthly basis. Each day in which measured demand exceeds the level specified in the user's contract is deemed to be a day of backup service utilization. Each different type of service allows a certain number of days of such usage in the contract year to be deemed "non-cumulative", for which there will be no charge. All days of backup service usage after that threshold are deemed to be "cumulative", and the measured demand charge for a given month is the sum of the maximum demand utilized on all cumulative days during the month. Chargeable demand is applicable when the service desired is for scheduled maintenance only. In this case the reserved demand is the same as the demand actually utilized, and a single charge is levied.

To date, back-up tariffs have been published only for high-tension service. A summary of these tariffs is provided in Table 2, averaged across regions. The fixed charge for all six classes of service is \$96 per month.

Table 2
CFE Back-up Tariffs

Type and Level of Service	Rates (\$/KW/month or ¢/KWH)*				
	Reserved Demand \$/KW	Measured Demand \$/KW	Chargeable Demand \$/KW	Peak Energy ¢/KWH	Off-Peak Energy ¢/KWH
<i>High-Tension, Sub-Transmission Level</i>					
Emergency and Scheduled Maintenance	1.97	0.41	NA	3.55	2.06
Emergency Only	0.91	0.41	NA	3.55	2.06
Scheduled Maintenance Only	NA	NA	0.41	3.55	2.06
<i>High-Tension, Transmission Level</i>					
Emergency and Scheduled Maintenance	1.58	0.33	NA	3.24	2.03
Emergency Only	0.74	0.33	NA	3.24	2.03
Scheduled Maintenance Only	NA	NA	0.33	3.24	2.03

SOURCE: SHCP, 1994.

* All charges referred to in this report are based on the exchange rate of 3.35 New Pesos per dollar that was in effect during August of 1994.

Self-Supply

To satisfy the criteria for this category of generation, the power produced must be used 1) only to satisfy the needs of the owners or partners of the company owning the generating facility; and 2) exclusively inside the perimeter authorized by SE. Ownership is defined as equity participation, but there is no minimum share requirement. If excess power is available for sale to CFE, it is subject to the same transmission, pricing and dispatch rules that govern excess cogeneration capacity and power. Back-up power is also available under the conditions described above.

Low-Level Production

Low-level production is defined as one of the following:

- production of less than 30 MW that is sold in its entirety to CFE;
- self-supply of less than 1 MW for small rural communities or isolated areas; and
- exports of less than 30 MW.

Permits for low-level production are limited to persons of Mexican nationality or entities established according to Mexican law and residing within the country. In addition, for the first and third types of generation listed above, the permit holder may not be the owner of projects whose total capacity exceeds 30 MW and that are located in the same area as the low-level production. When processing applications for permits, SE will set an overall capacity limit for low-level production within a given area, taking into account existing generation and transmission capacity, the specifics of the proposal and "any other attending circumstances". For facilities of less than 20 MW that supply all output to CFE, pricing and dispatch will be governed by the same rules that apply to sale of excess cogeneration of less than 20 MW. The regulations do not specifically address facilities of between 20 and 30 MW.

Generation for Export

Producers of electric power to be exported as a result of a process of independent production, cogeneration or low-level production are subject to the provisions described above, with the additional requirement that a purchase contract or letter of intent must be presented to CFE prior to the issuance of a permit.

1.5. Permitting Requirements

The steps that must be followed in order to develop a private generation facility vary for each of the five types of private generation described in the previous section, although the permitting requirements -- with the important exception of the actual generation permit granted by SE -- are substantially similar. This section will provide an overview of the most important permitting requirements that are common to all projects.

These requirements are laid out in a comprehensive fashion in an extremely useful two-volume guide published by CONAE, the *Manual para Tramitar Permisos, Licencias y Autorizaciones en Dependencias Oficiales para la Construcción y Operación de una Planta de Cogeneración* (Manual for Expediting Permits, Licenses and Authorizations in Official Offices for the Construction and Operation of a Cogeneration Plant). Despite the specific reference to cogeneration, this document is an invaluable tool for developers of any type of power generation facility, since the requirements described are applicable to all types of projects. These requirements and the agencies involved are represented schematically in Figure 2. Agencies for which the acronym is not provided in this or previous sections are listed in the "Acronyms" section in the front of this report.

The most important of these permits from the perspective of a developer are the "Initiation Permits" in the first box of Figure 2, which will largely determine the feasibility of a project. The agencies involved and the specific permits -- with the important exception of the generation permit granted by SE, the requirements for which were described in detail in Section 1.4 -- are described in the following paragraphs. The requirements contained in the other two boxes represent a large amount of documentation and application work, but are usually met without difficulty. They are therefore not described in this document, with the exception of the

environmental requirements administered by SMARNP, which are described below because of their particular importance to power generation projects.

Initiation Permits. These permits all relate to the basics that apply to starting a business in Mexico, and must therefore be completed before a developer can apply to SE for a generation permit.

Secretaria de Comercio y Fomento Industrial (SECOFI). SECOFI is the Ministry of Commerce and Industrial Development, and also heads the Comision Nacional de Inversiones Extranjeras (National Foreign Investment Commission). This Commission grants the Permiso para Establecer una Empresa con Capital Extranjero (Permit to Establish a Company with Foreign Capital) which must be obtained before incorporating a business entity in Mexico.

Secretaria de Relaciones Exteriores (SRE). The Ministry of Foreign Relations provides two types of permits or documents necessary for foreign companies. The first is the Permiso para Uso de Denominacion o Razon Social (Permit for Use of Company Name), which applies only to companies newly established in Mexico. The second is the Aviso Notarial sobre la Inversion o No Extranjera (Notarial Announcement on Foreign Investment) that states whether a foreign company is using foreign capital or not.

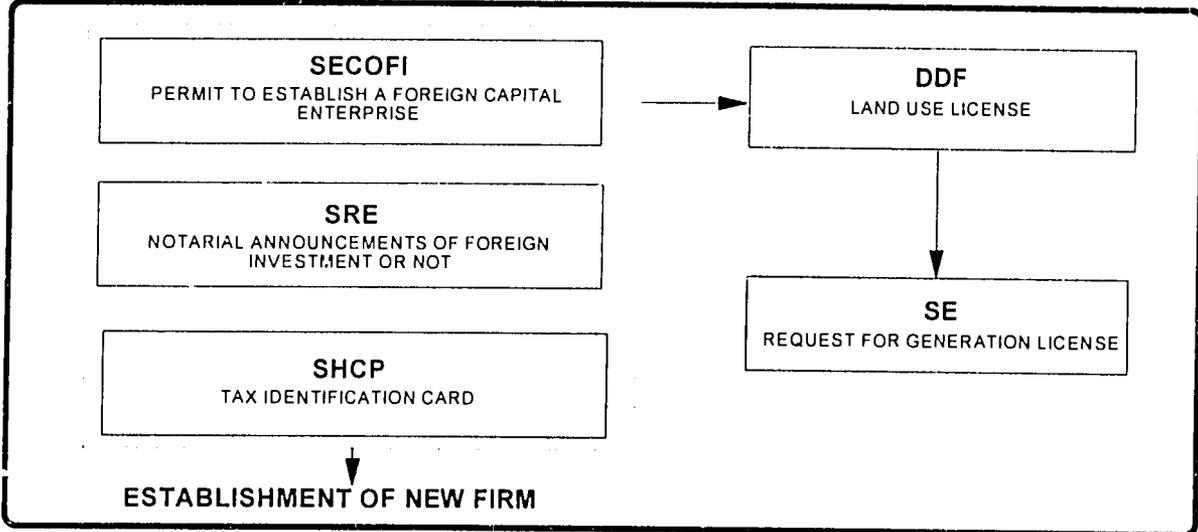
Secretaria de Hacienda y Credito Publico (SHCP). SHCP provides a Cedula de Identificacion Fiscal (Taxpayer Identification Card) necessary for all entities doing business in Mexico.

Departamento del Distrito Federal (DDF). Not all projects will be in Mexico City, but the land-use and other permits granted by the Department of the Federal District provide an illustrative example of those are required by most state and local governments. The documents that may be required from this and similar agencies include the following:

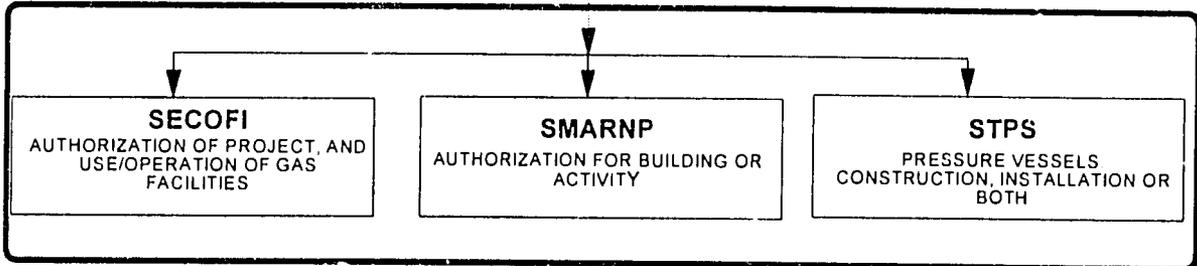
- Constancia y/o Certificado de Zonificacion (Proof and/or Certificate of Zoning)
- Licencia de Uso del Suelo (Land Use License)
- Constancia de Uso de Suelo (Proof of Land Use)
- Licencia de Demolicion Total o Parcial (License for Total or Partial Demolition)
- Licencia de Construccion (Construction License)
- Aviso de Terminacion de Obra (Notice of Work Termination)
- Autorizacion de Uso y Ocupacion (Use and Occupation Authorization)
- Visto Bueno de Prevencion de Incendios (Fire Prevention Approval)
- Registro de Descarga de Aguas Residuales (Wastewater Discharge Registration)

Figure 2
 Permitting Requirements for Power Generation Development

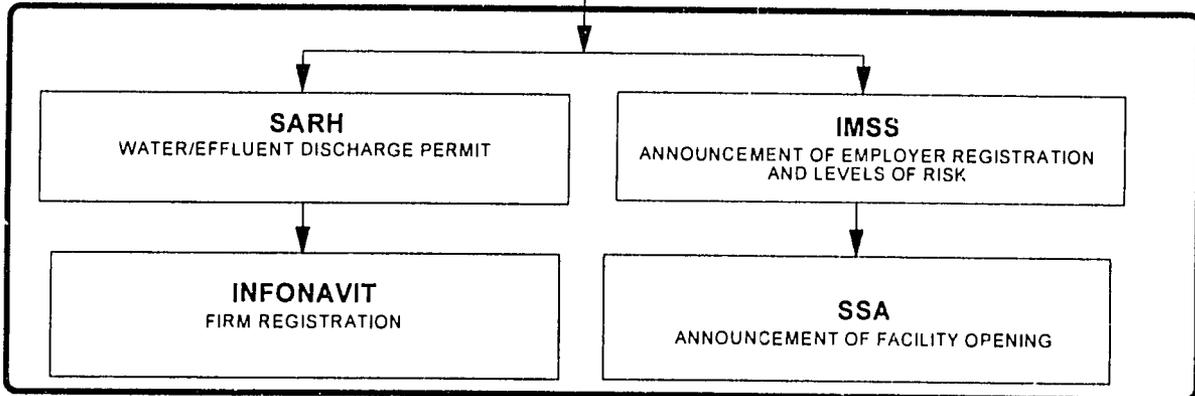
Initiation Permits



Construction Permits



Operation Permits



SOURCE: CONAE, 1993

Emissions and Other Environmental Requirements. Requirements for environmental assessments have been published in the Environmental Gazette (Gaceta Ecologica, V. 1, 1989, pp. 286-358). In addition, SMARNP has established ambient standards for ozone, SO_x, NO_x and Total Suspended Particulates (TSP). Source standards have been established for certain categories of point sources, such as fired boilers. No standards have yet been published for combustion turbines, but CONAE reports that SMARNP will accept a representation that the control technology for a plant meets the latest U.S. *and* European standards. There is no current requirement that continuous emissions monitoring equipment be installed.

1.6. Implementation Procedures

This section will detail the steps necessary in order to obtain a generation permit and the necessary contracts with CFE, PEMEX and, if appropriate, industrial customers. There are of course many distinct activities in some of these steps -- e.g., negotiating the large number of agreements that comprise the security package -- but many of these are not particular to the situation in Mexico, and will therefore not be detailed in the following lists.

Independent Production

- Step 1: Establish legal entity by obtaining permits specified in Section 1.5 from SECOFI, SRE and SHCP.
- Step 2: Monitor Diario Oficial (equivalent to U.S. Federal Register) for solicitations by CFE for new capacity.
- Step 3: Purchase bidding documents and respond to solicitation with proposal.
- Step 4: If selected, receive generation permit from SE.
- Step 5: Negotiate power purchase and grid connection agreements with CFE and other necessary agreements with PEMEX, landowners, etc.

Cogeneration

- Step 1: Locate thermal host(s) that would allow the efficiency gains outlined by CONAE.
- Step 2: Establish legal entity by obtaining permits specified in Section 1.5 from SECOFI, SRE and SHCP.
- Step 3: Obtain generation permit from SE after satisfying efficiency requirements.
- Step 4: Submit proposal for sale of excess capacity, if any, to CFE. Excess capacity of greater than 20 MW will then be submitted to the bidding process.

- Step 5: If accepted, negotiate power purchase, backup power and grid connection agreements with CFE and other necessary agreements with PEMEX, landowners, etc.

Self-Supply

- Step 1: Establish legal entity or association that would consume power by obtaining permits specified in Section 1.5 from SECOFI, SRE and SHCP.
- Step 2: Obtain generation permit from SE.
- Step 3: Negotiate backup power and wheeling agreements (if necessary) with CFE and other necessary agreements with PEMEX, landowners, etc.

Low-Level Production

- Step 1: Establish legal entity by obtaining permits specified in Section 1.5 from SECOFI, SRE and SHCP.
- Step 2: Obtain generation permit from SE if project falls within regional capacity limits.
- Step 3: If granted, negotiate power purchase, grid connection agreements and/or wheeling agreements (as required) with CFE and other necessary agreements with PEMEX, landowners, etc.

Generation for Export

As noted above, electric power can be exported from three types of independent generation: independent production, cogeneration or low-level production. The steps necessary to export are identical to those outlined above for these three types of production, with the additional requirement that a generation permit will not be granted by SE until an export purchase contract or letter of intent is provided to CFE.

2. POWER MARKET STRUCTURE

2.1. Supply and Demand

Documento de Prospectiva (DDP)

The most important source of information on the current and future state of Mexico's power system is the *Documento de Prospectiva del Sector Electrico (DDP)*. Mandated by Articles 66-70 of the by-laws, the DDP is a comprehensive ten-year planning document produced annually by CFE and submitted to SE. All generation and transmission projects, whether private or CFE, solicited or unsolicited, must be in accordance with its regional and national objectives. The DDP contains data on current and projected demand, planned additions to generation and transmission capacity and energy conservation efforts. It is similar to the integrated resource or least-cost plans submitted by many U.S. utilities to their respective regulatory commissions, and the course it follows after submission to SE parallels in some respects the public hearings to which U.S. plans are subjected. After receiving the draft DDP from CFE, SE first clarifies and/or modifies it, and then publishes an excerpt, on which interested parties have five months to comment. The final document, which incorporates the comments and suggestions that SE deems to be relevant, forms the basis of the power sector expansion plan for the coming year.

The remainder of Section 2.1 contains data excerpted from the DDP, with the goal of highlighting the regions and customer classes of the Mexican power sector that will experience the most growth over the coming decade.

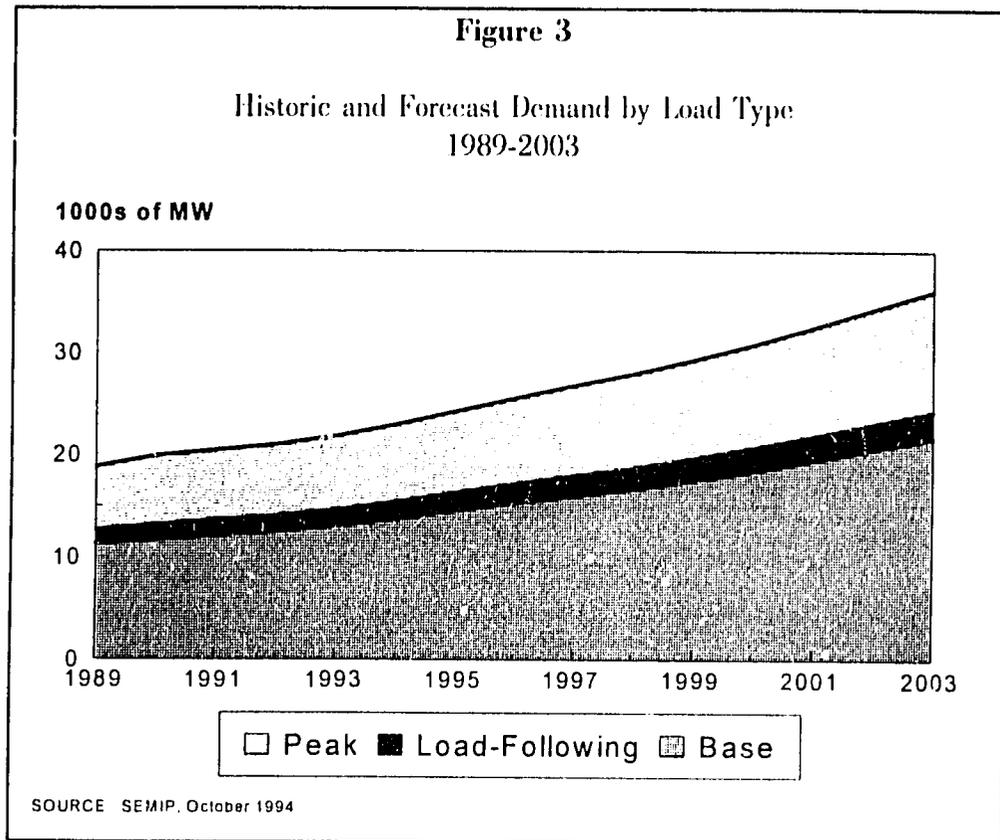
Current and Projected Demand

Overall Demand. Power sales by CFE in 1993 totalled 101.3 terawatt hours (TWH), a 3.8 percent increase over the previous year. Total demand grew at an annual rate of 4.3 percent during the five years from 1988 to 1993, and by 5.2 percent during the ten-year period ending in 1993. The distribution of this demand by customer class and region is provided on an historical and projected basis in subsequent paragraphs. It should be noted that these figures do not include the consumption of power generated by the private sector and PEMEX, which is estimated to be approximately 10 percent of Mexico's total power usage. The omission of this important element of the power sector in the figures presented below is due to lack of data. Wherever reliable information is available it will be presented, but the figures below should be understood to be for CFE only unless private generation and/or that of PEMEX is explicitly mentioned.

For the years 1994-2003, the period covered by the first DDP, CFE has estimated a high and low case for future demand, based on annual growth rates for Mexico's Gross Domestic Product (GDP) of 4.5 and 2.5 percent, respectively. Both cases assume annual growth rates of 1.5 percent for population and 2.8 percent for the number of households. The annual growth in electricity demand derived from these economic and demographic assumptions is 5.4 percent for the high case and 3.8 percent for the low case. Based on the supposition that the costs of underestimating

are greater than those from overestimating, the high case alone is presented in the DDP, from which the following figures are derived. Under this high growth scenario, annual consumption is forecast to reach 176 TWH in 2003.

As illustrated in Figure 3, the bulk of this demand is forecast to be either base-load or peak, with a small amount of load-following. Base-load and peak demand are both forecast to increase by 65 percent during this period, the former from 13,035 MW in 1993 to 21,603 MW in 2003, and the latter from 7,175 MW to 11,890 MW.



It should be noted, however, that little is known outside CFE about its forecasting assumptions and methodology. Comments on CFE's forecasts are specifically requested in the DDP, and it is likely that other parties will provide alternative forecasts, which might be incorporated into the final DDP.

Demand by Customer Class. CFE divides its customers into the following sectors or customer classes, grouped by tariff:

Residential: Tariffs 1, 1A, 1B, 1C and 1D for domestic service.

- Commercial:** Tariffs 2 and 3 for low-tension service -- primarily commercial and service businesses, but includes micro-industry.
- Services:** Tariffs 5, 6 and 7 -- public lighting, non-agricultural pumping and temporary service.
- Light Industry:** Tariffs O-M and H-M for medium-tension service -- primarily small and medium industry, and large commercial and service companies.
- Heavy Industry:** Tariffs H-S, HSL, H-T and HTL for high-tension service -- large industrial companies and large potable water pumping systems.
- Agricultural:** Tariff 9 -- irrigation pumping.

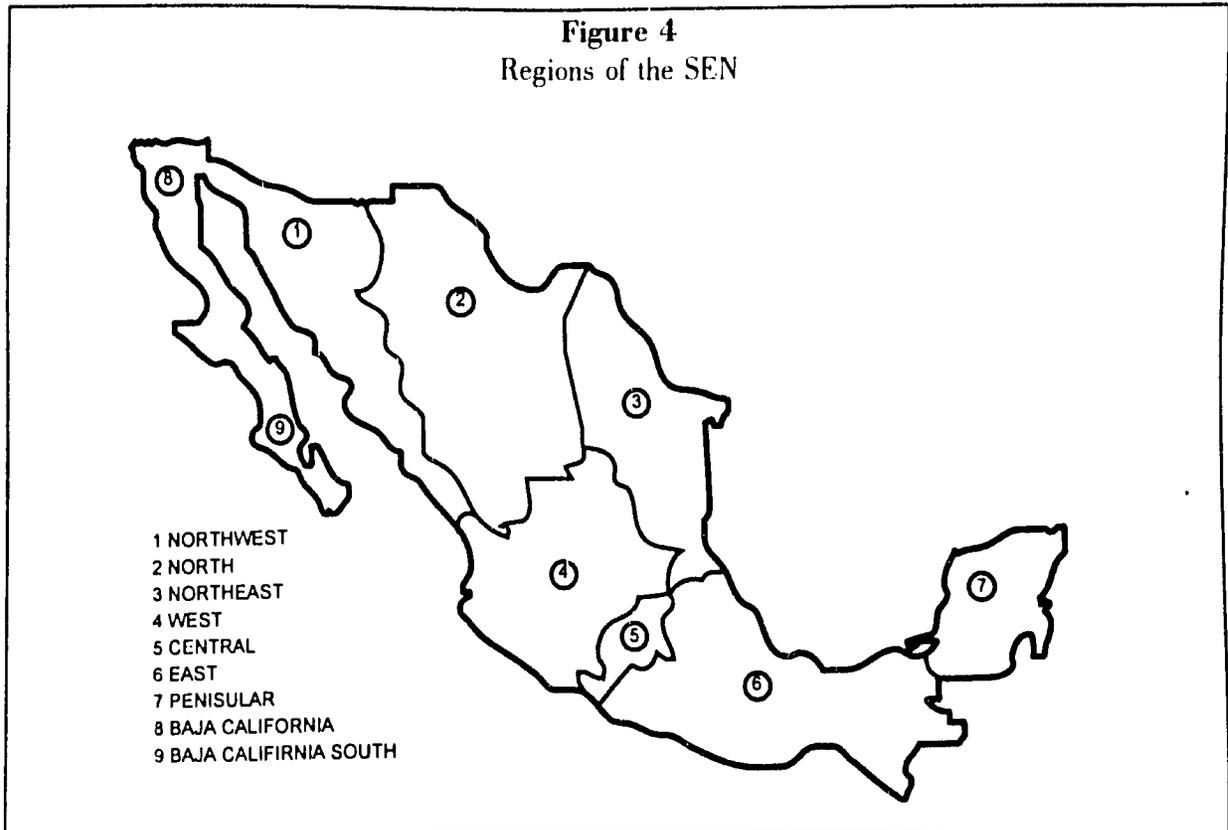
Only two of these classes, light and heavy industry, are likely to provide opportunities for cogeneration development. Table 3 provides a breakdown of current and forecasted demand by customer class. The most striking feature of this data is the predominance of industry, which accounts for 54 percent of CFE's total power sales, compared with an average of 35 percent for the U.S. electric utility industry. Moreover, this figure excludes self-supply and cogeneration. The forecasted growth rates for these customer classes vary considerably. Light and heavy industry continue to dominate, increasing their combined share of total consumption to 59 percent. This increase comes at the expense of small declines in the share of the other customer classes, none of which is significant on its own.

Table 3					
Current and Projected Energy Consumption by Customer Class: 1993-2003					
Customer Class	1993 Demand (GWH)	Projected Annual Growth Rate (%)	Increase from 1993-2003 (GWH)	2003 Share of Total Demand (%)	Gain or Loss (%)
Residential	25,511	5.4	17,632	25	-0.6
Commercial	9,485	5.2	6,246	9	-0.4
Services	5,256	2.4	1,398	4	-1.4
Light Industry	32,348	6.5	28,121	35	2.7
Heavy Industry	22,758	6.2	18,969	24	1.3
Agriculture	5,919	2.5	1,669	1	-1.5
Total	101,277	5.7	71,335	100	NA

SOURCE: SE, October 1994.

* The total GWH figures in this Table and the following Table differ slightly from those presenting data by customer class. They are taken directly from the BDP, which provides no explanation for the discrepancy.

Regional Demand. Mexico is divided into nine regions that comprise the Sistema Electrico Nacional (SEN), the boundaries of which are illustrated in Figure 4. In addition, there are 12 small isolated systems, 6 of which utilize imported energy; the combined demand in these systems is negligible. As would be expected, electricity consumption is largest in regions with large population and/or industrial centers. As is illustrated in Table 4, the four regions with the largest demand are: the Northeast, which includes Monterrey, Nuevo Leon and the Maquiladora region on the Texas border; the West, which includes Guadalajara and Puerto Vallarta; the Central region with Mexico City and environs; and the East, which includes Vera Cruz and Puebla.



SOURCE: SE, October 1994.

Table 4
Current and Projected Electricity Consumption by Region: 1993-2003

Region	1993 Demand (GWH)	Projected Annual Growth Rate (%)	Increase from 1993-2003 (GWH)	2003 Share of Total Demand (%)	Gain or Loss (%)
Northwest	7,641	5.0	5,093	7	-0.1
North	7,790	5.2	5,123	7	-0.2
Northeast	16,274	7.4	17,026	19	3.2
West	19,600	5.8	14,725	20	0.6
Central	26,129	4.4	11,070	23	-2.4
East	16,166	4.8	9,735	15	-0.9
Peninsula	2,889	7.6	3,111	3	0.6
Baja C.	6,124	4.0	2,976	5	-0.7
Baja C. South	626	5.7	460	1	0.0
Total	103,239	5.5	72,319	100	NA

SOURCE: SE, October 1994.

Since they start from a larger base, and the economic rationales for their rapid growth have not abated, these four regions are projected to account for over three quarters of the expected increase in demand during the next ten years. Two regions have particularly high forecasted growth rates: the Northeast, which is experiencing a rapid industrial and trade-based expansion; and the Peninsula region, which will continue to be developed for tourism.

Existing Generation Capacity

At the end of 1993, Mexico had 29,205 MW of capacity, of the fuel and generation technologies displayed in Table 5. This figure had increased to 31,860 MW by the end of 1994. Conventional steam facilities dominate the generation portfolio of CFE, and high-sulfur fuel oil (HSFO) is by far the predominant fuel in those facilities, accounting for 72 percent of all non-nuclear fuel used by CFE in 1992. Gas was next with 17.3 percent, followed by coal with 8.9 percent and diesel with 1.3 percent.

Table 5
Effective 1993 Generation Capacity by Technology/Fuel

Technology/Fuel	MW of Capacity	Share of Total (%)
Hydropower	8,171	28.0
Conventional Steam (HSFO and Gas)	12,575	43.1
Combined-Cycle (Gas)	1,818	6.2
Combustion Turbine (Gas)	1,777	6.1
Internal Combustion (Diesel)	149	0.5
Dual (Coal and HSFO)	1,400	4.8
Coal	1,900	6.5
Geothermal	740	2.5
Nuclear	675	2.3
Total	29,205	100.0

SOURCE: SE, October 1994.

Table 6 provides the regional distribution of this generation capacity. As would be expected, the four regions with the highest current demand also have the bulk of existing capacity.

Table 6
Effective 1993 Generation Capacity by Region

Region	MW of Capacity	Share of Total (%)
Northwest	2,528	8.7
North	1,580	5.4
Northeast	4,280	14.7
West	5,803	19.9
Central	5,232	17.9
East	7,009	24.0
Peninsula	1,007	3.4
Baja C.	1,417	4.9
Baja C. South	270	0.9
Isolated Areas	78	0.3
Total	29,204	100.0

SOURCE: SE, October 1994.

Fuel oil is used principally in base-load facilities, which are usually located in port cities or close to PEMEX refineries. Gas is used in generating stations located in Mexico City and Monterrey and for other combined-cycle facilities, and diesel for peaking units and in isolated areas. There are two large coal units, Rio Escondido and Carbon Dos, both in the northern state of Coahuila. CFE's major generating facilities are displayed in Figure 5 and Table 8.

Approximately 3,000 MW of non-CFE industrial generation capacity -- or ten percent of the country's total capacity -- is already in place. As Table 7 illustrates, over half of this capacity is in PEMEX refineries and petrochemical facilities. Other industries with significant existing generation capacity include steel (12.6 percent of the total), pulp and paper (8.8 percent) and sugar refineries (6.1 percent).

Table 7
Installed non-CFE Industrial Generation Capacity
1990

Industry	Total MW	% of Total	Hydro MW	Steam MW	Internal Combustion MW	Gas MW
PEMEX	1,555	52.4	0	836	30	688
Steel	374	12.6	0	220	0	154
Pulp and Paper	260	8.8	7	214	0	39
Sugar Refineries	181	6.1	2	177	2	0
Industry Groups	152	5.1	0	110	0	42
Chemicals	147	5.0	0	114	0	3
Textiles	111	3.8	31	79	1	0
Minerals	78	2.6	6	26	46	0
Beer	44	1.5	6	35	2	1
Other	67	2.3	24	13	30	0
Total	2,968	100	76	1,855	111	927

SOURCE: SE, October 1994.

Table 8
Principal CFE Generation Stations

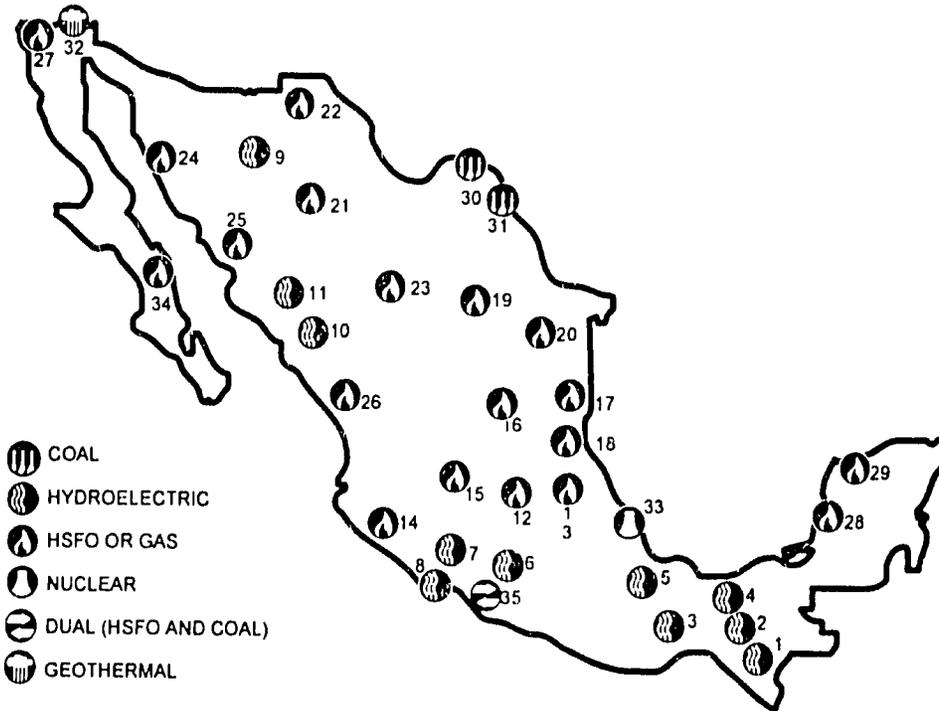
No	Station Name	Type	MW	Region	Fuel
1	Belisario Domínguez	Hydroelectric	900	East	
2	Manuel Moreno Torres	Hydroelectric	1500	East	
3	Malpaso	Hydroelectric	1080	East	
4	Ángel Albino Corzo (Peñitas)	Hydroelectric	420	East	
5	Temascal	Hydroelectric	154	East	
6	C. Ramírez Ulloa (Caracol)	Hydroelectric	600	East	
7	Infiernillo	Hydroelectric	1000	Central	
8	La Villita	Hydroelectric	295	Central	
9	Necaxa	Hydroelectric	109	Central	
10	Plutarco Elías Calles	Hydroelectric	135	Northeast	
11	Raúl J. Marsal (Comedero)	Hydroelectric	110	Northeast	
12	Bacurato	Hydroelectric	92	Northeast	
13	Francisco Pérez Ríos (Tula)	Conventional Steam & CC	1994	Central	HSFO and Gas
14	Valle de México	Conventional Steam & CT	838	Central	HSFO and Gas
15	J. Luque	Conventional Steam	224	Central	Gas
16	Manzanillo	Conventional Steam	1900	West	HSFO
17	Salamanca	Conventional Steam	866	West	HSFO
18	Villa de Reyes (San Luis Potosí)	Conventional Steam	700	West	HSFO
19	Altamira	Conventional Steam	770	Northeast	HSFO
20	Adolfo López Mateos (Tuxpan)	Conventional Steam	700	East	HSFO
21	Monterrey	Conventional Steam	465	Northeast	HSFO and Gas
22	Emilio Portes Gil (Rio Bravo)	Conventional Steam	375	Northeast	HSFO and Gas
23	Francisco Villa	Conventional Steam	399	North	HSFO
24	Samalayuca	Conventional Steam	316	North	HSFO and Gas
25	Guadalupe Victoria (Lerdo)	Conventional Steam	320	North	HSFO
26	Puerto Libertad	Conventional Steam	632	Northeast	HSFO
27	C. Rodríguez Rivero	Conventional Steam	484	Northeast	HSFO
28	José A Pozos (Mazatlán II)	Conventional Steam	616	Northeast	HSFO
29	Presidente Juárez (Rosarito)	Conventional Steam	620	Baja C.	HSFO
30	Lerma (Campeche)	Conventional Steam	150	Peninsular	HSFO

Table 8 (cont'd)
Principal CFE Generation Stations

No	Station Name	Type	MW	Region	Fuel
31	Mérida II	Conventional Steam	168	Peninsula	HSFO
32	Río Escondido	Conventional Steam	1200	Northeast	Coal
33	Carbón II	Conventional Steam	700	Northeast	Coal
34	Cerro Prieto	Geothermal	620	Baja C.	
35	Laguna Verde	Nuclear	675	East	Uranium
36	Agustin Olachea A. (San Carlos)	Internal Combustion	65	Baja C. South	HSFO and Diesel
37	Petalcalco	Dual	1400	West	HSFO and/or Coal

SOURCE: SE, October 1994

Figure 5
Principal CFE Generating Stations
1993



Existing and Planned Transmission Capacity

Existing Transmission Capacity. At the end of 1992, CFE had 346,183 km. of transmission and distribution lines, of which 9,162 were 499 kV, 17,673 were 230 kV, and 39,149 were from 69 to 161 kV. Seven of the nine regions that comprise the SEN form the Sistema Interconectado Nacional (SIN, or National Interconnected System), which covers almost all of continental Mexico and the Yucatan peninsula, which was recently joined to the system. The only regions not connected are those on the Baja California peninsula, although they have two 230 kV interconnections to the U.S, and the 12 small isolated systems noted above.

Planned Capacity Additions. From 1994 to 1998, CFE plans to add substantial additional capacity to the SIN, including the following: 22 km. of 230 kV line in the Northeast Region; 140 km. of 400 kV line, operated initially at 230 kV, from the Northeast to North Regions; 600 km. of 400 kV line from the East to Central Regions; 150 km. of 230 kV and 35 km. of 115 kV line in the Peninsula Region; and 120 km. of 230 kV in Baja California. In addition to building new capacity, CFE also plans to improve the condition of the existing network with a loan from the World Bank. Transmission losses have increased from 12.7 percent in 1986 to 15 percent in 1993 due to inadequate investment in refurbishment and maintenance. The successful completion of this project would increase capacity by up to five percent without laying additional lines.

2.2. Tariff Structure and Levels

Overview

Mexico has historically used electricity tariffs to achieve various public policy goals, but has recently eliminated most of those subsidies. Fiscal transfers to the power sector have declined from a high of 2.3 percent of GDP in 1983 to zero in 1991. Real electricity prices have increased about 35 percent over the last five years, and in 1993 reached an average of \$0.07 per kWh. The most recent phase of this trend was initiated by the *Pacto para la Estabilidad y Crecimiento Economico* (Economic Stability and Growth Pact, or PECE), which was passed in October of 1992. Under this agreement most tariffs were increased by 0.79 percent monthly until March 1993, at which time the agricultural tariff began to increase at 0.5 percent monthly until October 1993. In that month all tariffs except those for heavy industry and agriculture were escalated by 0.41 percent monthly. The agreement was renewed in September 1994 as the *Pacto para el Bienestar, la Estabilidad y el Empleo* (Pact for Well-Being, Stability and Employment), with a provision limiting power-sector price increases to four percent over the subsequent year. Substantial cross-subsidies remain even after these increases, most notably for the residential and agricultural sectors, but the Government plans to slowly phase these out, as well.

Current Tariffs

New tariffs are released in October of each year, and remain in effect until the following September. CFE currently uses 17 tariffs, of which six are relevant for potential cogeneration opportunities. The structures and levels of those six, as of September 1994, are described below:

- Tariff O-M Medium-tension general service below 1000 KW, with rates varying by region and season. There is a maintenance charge of \$3.13 per user (which applies to all six tariffs), a demand charge that ranges from \$6.89 to \$7.23 per KW, and an energy charge of from 4.05 to 4.25 cents per kWh. Seasonal rates are applied for this and all the tariffs below only in the Baja California and Northeast Regions.
- Tariff H-M Medium-tension general service of 1000 KW or more, with rates varying by region, season, and peak vs. non-peak. There is a maintenance charge and a demand charge ranging from \$6.99 to \$7.34 per KW of "billable" demand. Energy charges range from 5.83 to 6.12 per kWh cents for peak-period power, and from 3.64 to 3.82 cents off-peak. Billable demand is defined as the sum of average peak demand plus one fifth of the amount by which off-peak demand exceeds peak demand.
- Tariff H-S High-tension general service at the sub-transmission level. Structured like the H-M tariff, it has a billable demand charge of \$7.05 to \$7.40 per KW. Peak energy is from 4.60 to 4.83 cents per kWh, and off-peak from 2.56 to 2.68 cents per kWh.
- Tariff H-T High-tension general service at the transmission level. Billable demand charges range from \$6.52 to \$6.85 per KW, peak energy charges from 4.32 to 4.53 cents per kWh, and off-peak energy from 2.40 to 2.52 cents per kWh.
- Tariff H-SL High-tension general service at the sub-transmission level. Similar to previous three tariffs, but divides peak-period power into two components: "minimum billable peak energy" is 80 percent of the product of the maximum measured demand during the peak period and the number of hours in the peak period; and "excess billable peak energy" is all remaining peak energy consumed. Billable demand charges range from \$7.05 to \$7.77 per KW, minimum peak energy from 6.39 to 7.81 cents per kWh, excess peak energy from 3.39 to 3.56 cents per kWh, and base energy from 2.00 to 2.10 cents per kWh.
- Tariff H-TL High-tension general service at the transmission level. Same as H-SL but for transmission level service. Billable demand charges range from \$6.42 to \$6.85, minimum peak energy from 4.97 to 5.8 cents per kWh, and base energy from 1.94 to 2.04 cents per kWh.

Table 9 provides a summary of the total average cost per kWh under these tariffs, including all fixed and variable charges. Two different scenarios are examined: a plant operating two shifts per day (8 am until 12 midnight) and five days per week; and a plant operating around the clock, seven days a week. Each tariff is evaluated at the demand levels illustrated in the far right column of the Table, which were derived using the average annual kWh usage for customers of each tariff.

Table 9			
CFE Industrial Tariffs			
September 1994			
(Cents per kWh)			
Tariff Type	Tariff under Different Production Scenarios		Average Demand (KW)
	2 Shifts 5 Days per Week	3 Shifts 7 Days per Week	
O-M	5.16	6.19	60
H-M	5.14	6.38	1,546
H-S	3.99	5.22	9,247
H-T	3.73	4.87	42,260
H-SL	3.83	5.27	11,608
H-TL	3.44	4.67	43,958

SOURCE: CFE, October 1993; INEGI, 1994.

These tariffs can be compared with those offered by neighboring utilities in the southwestern U.S., as presented in Table 10. As the Table makes clear, despite the increases of recent years, CFE industrial tariffs are still somewhat lower than those in border areas of the U.S, in particular in California and Arizona.

Table 10
U.S. Industrial Tariffs
October 1994
(Cents per kWh)

State or Region	Average Revenue per kWh
<i>State Averages</i>	
Texas	4.35
New Mexico	4.81
Arizona	6.53
California	7.19
<i>Regional Averages</i>	
West South Central (TX, AR, LA, OK)	4.45
Mountain (MT, ID, WY, CO, NM, AZ, UT, NV.)	4.35
Pacific (WA, OR, CA)	6.38

SOURCE: Edison Electric Institute, 1994.

2.3. Fuel Availability and Price

Overview

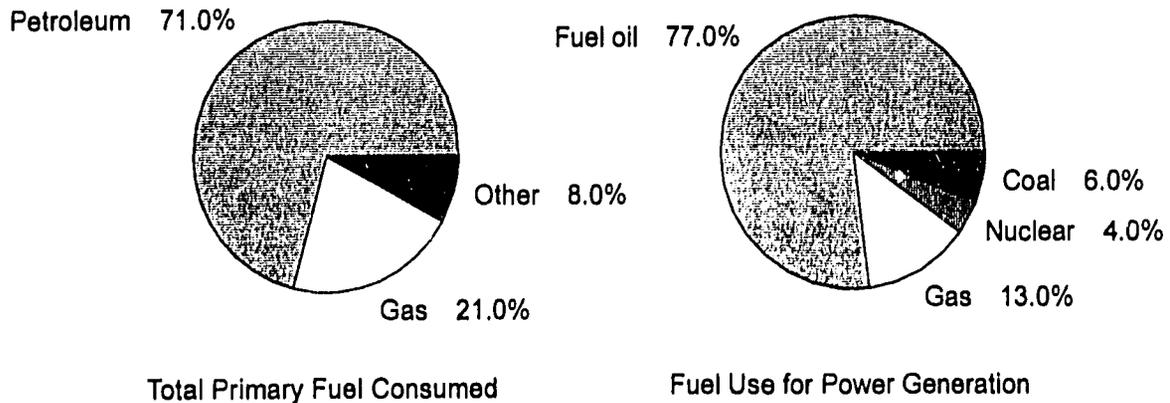
The most likely fuel choices for prospective developers in Mexico are coal and natural gas. Coal is relatively uncomplicated in the sense that it is not under the jurisdiction of PEMEX, and there is very little of it within the country. Any privately owned coal-fired facility would therefore probably rely on imported fuel, as indicated in CFE's regional scenarios presented in Section 5.1. Hydropower is also slated to play a major role in capacity additions over the next decade, but there is no indication that its development will be opened up to private developers in the foreseeable future.

Natural gas, therefore, should play a large role in the private-sector development of generation facilities. As indicated in Section 5.1, CFE's expansion plans for the coming decade indicate a substantial increase in the use of gas for power generation, which is part of a larger SE strategy to reduce the country's use of HSFO and increase its use of natural gas in all relevant sectors of the economy. This will be accomplished in the power sector through the construction of new combined-cycle and peaking facilities, as well as the repowering of existing HSFO units. This shift toward gas is being driven both by the environmental benefits of gas vis-a-vis HSFO, and by the economic attractiveness of gas as a generation fuel. Several important uncertainties still exist, however, regarding the contractual terms under which gas can be purchased from PEMEX, as well as its availability. These themes are discussed in the following paragraphs.

Gas Availability

Gas currently accounts for only 13 percent of total fuel used for power generation in Mexico, but 29 percent of all energy consumed in the economy, as illustrated in Figure 6. This usage will increase dramatically, however, given CFE's plans to add 6,426 MW of combined-cycle capacity over the next ten years (see Section 5.1 below) and SE's efforts to encourage a shift to gas in other industries. The actual extent of this increase is difficult to forecast, because alternative options (such as scrubbers on HSFO-fired plants) are still being considered, but various estimates indicate an increase in national consumption of 50 to 100 percent by 2010, well within the lifetime of a power project. Gas production, in contrast, has remained essentially flat, declining slightly from its 1990 peak 3,652 million cubic feet per day to 3,576 million cubic feet in 1993. Forecasted increases in demand coupled with flat production will create a significant demand-supply gap unless preventative measures are taken in the near future. There are several options for filling this gap, and the strategy ultimately followed will have a significant impact on the

Figure 6
Fuel Usage in Mexico
1992



SOURCE: Rattie & Glaessner, 1994.

reliability and price of natural gas available to prospective developers. These options, as framed by an analysis of the Mexican gas sector conducted by a U.S. integrated oil and gas firm, are discussed in the following paragraphs.

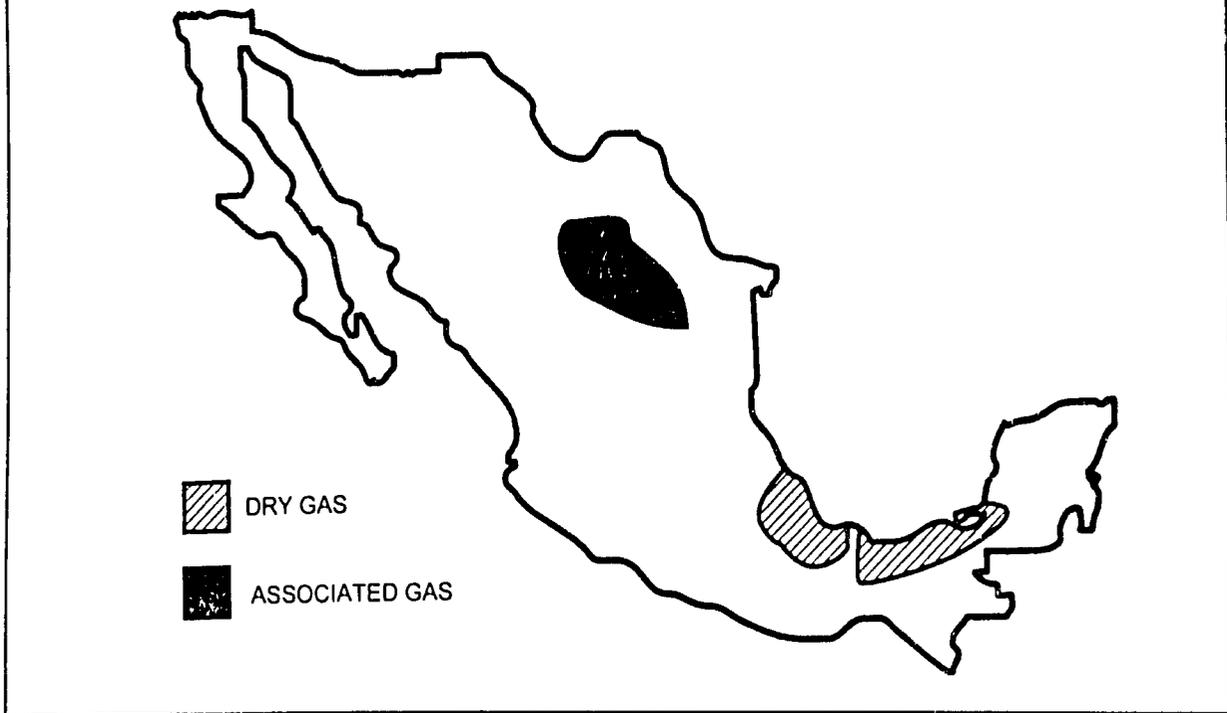
Option 1: Increase Imports. Mexico was a net exporter of gas to the U.S. until 1985. By 1992, as a result of strong economic growth in Mexico and declining gas prices in the U.S., imports from the U.S. were averaging 250 million cubic feet per day (MMCFD) out of a total national consumption of 1,476 MMCFD. This figure declined by more than half by the end of 1993 as demand eased with the slowing of the economy, but has increased again during the first half of 1994, and is expected by PEMEX to grow at a rapid pace in coming years. PEMEX has recently affirmed its commitment to increase imports in order to support the shift from HSF0 to gas in the power sector, but the cost of doing so over the long term would be substantial. The analysis cited above forecasts an increase in national demand from 2.9 to 5.4 billion cubic feet per day (BCFD) by 2010, and essentially flat domestic production (assuming that "dry" gas reserves are not exploited). Using an average gas price of \$2.25 per thousand cubic feet (MCF) in constant 1993 dollars, this would represent an additional \$2 billion per year of gas imports by 2010. In addition, there would need to be significant increases in cross-border pipeline capacity. The import links now operating have a combined capacity of 450 MMCFD, or just 18 percent of the additional 2.5 BCFD that would be needed in 2010.

Option 2: Increase "Associated" Gas Production. Approximately 85 percent of PEMEX gas production is in the form of "associated" or "wet" gas, which is essentially the gas that is dissolved in petroleum and extracted before refining. The remaining 15 percent is "dry" gas, which is extracted from fields developed exclusively for that purpose. This poses several problems for potential purchasers of any increased supply.

The first is PEMEX's emphasis on export earnings from petroleum. Similar opportunities have not been available from natural gas, since it is transported by pipeline and the only viable large-scale customer already has abundant -- and economic -- supplies of its own. To achieve large-scale increases in associated gas production would therefore require corresponding increases in petroleum extraction and refining, which is generally considered not to be feasible in the current resource-constrained environment.

The second is the low quality of much Mexican crude. PEMEX extracts large volumes of a crude variety known as Maya, which is both "heavy" (i.e., contains relatively small amounts of high-value "light" products such as gasoline) and high in sulfur. Because this crude is difficult to process, PEMEX blends it with lighter Isthmus crude before refining. Because of the low quality of the Maya, however, the refineries still produce large volumes of high-sulfur "residual" fuel oil -- the HSF0 discussed elsewhere in this study. Although PEMEX burns significant quantities of this HSF0 (known as *cumbustoleo* in Mexico) in its own facilities, large amounts are left over. This excess has few economic uses, and therefore has historically been priced at a discount to natural gas to encourage its use in generating stations, creating the dependency on HSF0 that is being addressed today. Thus, even if petroleum production could be increased enough to satisfy the increasing demand for gas, ever larger amounts of HSF0 would be created as a by-product,

Figure 7
Natural Gas Deposits in Mexico



which would be a significant burden for PEMEX. Moreover, the amount of gas produced for each barrel of oil extracted (expressed as the gas-to-oil ratio, or GOR) will likely decrease significantly in the future. The current system-wide GOR is 1300 cubic feet of gas per barrel of oil, but most new production is expected to come from the heavy oil produced in the Gulf of Campeche, which has a GOR of less than 600.

Finally, because the supply of associated gas production is driven by the economic incentives affecting petroleum production, rather than those affecting gas directly, it is considered to be potentially unreliable by many developers.

Option 3: Utilize More HSFO. By installing scrubbers and other pollution control devices on some existing and future generating stations, CFE could continue to use large quantities of HSFO and reduce the quantities of additional gas that will be necessary. A similar option would be to enhance refining and desulfurization capacities to break down HSFO into lighter, more valuable products and reduce the environmental problems of that which remains. This strategy has the advantage of helping to solve PEMEX's problems with excess HSFO. It has several disadvantages, however, the most important of which are the high cost of such investments and the low thermal efficiency of fuel oil relative to gas. Despite these drawbacks, some action has already been taken in this direction, as PEMEX announced recently that it would invest \$1.4 billion in 1995 to reduce its dependence on HSFO. These funds will finance the construction of a desulfurization plant at the Tula refinery and a coking plant at the Cadereyta refinery.

Option 4: Development of Dry Gas Resources. Mexico has official gas reserves of 70 trillion cubic feet (TCF), although the actual level by some estimates is two to five times that amount, since the areas with the greatest potential have not been systematically explored. These resources have two significant advantages over associated gas: they avoid the reliability and "energy balance" (i.e., what to do with more HSFO) problems discussed above; and they are closer to the areas of rapidly expanding electricity demand. As illustrated in Exhibit 7, most associated gas is found in the southeast, which currently supplies 76 percent of all domestic production. Dry gas, however, is found principally in the northeast, the second-fastest area of increasing power demand in the country. Unfortunately, two significant impediments prohibit the large-scale development of these fields: resource constraints prohibit PEMEX from engaging in the required level of exploration, and private firms are currently prohibited from doing so. These restrictions may be eased somewhat in the future, however, since this option may be the cheapest and most beneficial for the country in the long run.

Given the relative advantages and disadvantages of these options, it is likely that the strategy chosen by SE will incorporate components from each. Since the last three options have relatively long lead times, imports will almost certainly increase in the near term as gas-fired plants under construction are finished and the economy continues to recover. Increasing imports indefinitely seems unlikely to be an option favored by the Government, however. Associated gas and HSFO will continue to be produced, since they are driven by PEMEX's hard currency goals from the export of crude. Because of the declining GOR noted above, however, associated gas production will probably remain relatively flat even as petroleum production increases. Scrubbers and refinery enhancements have already begun to be implemented, and will probably continue to be, but SE has expressed a strong commitment to moving towards gas, so these efforts will likely have only a marginal impact on the overall demand for gas. Finally, because none of these three options has the potential to completely address the expected increase in demand for gas, it seems likely that the northeastern dry gas fields will be opened for participation in some capacity by the private sector in the near-to-medium term. Gas shortages or the need to dramatically increase imports can be avoided if this occurs in a timely fashion; if not, independent producers could face supply problems or escalating prices.

Pricing and Contractual Terms

PEMEX has recently undergone dramatic changes in response to demands from its customers and resource constraints. The organization was restructured in October 1992, and has since been significantly downsized. Four different companies were created, one of which is PEMEX Gas y Petroquímica Básica (PEMEX Gas and Basic Petrochemicals). Within this company is the Subdirección de Gas Natural y Azufre (Subdirectorate of Natural Gas and Sulfur). Responsibility for gas contracts to industrial customers now lies with the Gerencia de Comercialización de Gas Natural y Azufre (Office of Commercialization of Natural Gas and Sulfur). In an effort to reduce bureaucratic delays and duplication of forms and approvals, this office has been designated as the single point of reference for all transactions relevant to power developers and other industrial clients.

PEMEX is currently working on a draft of a new commercial gas contract. Although the document has not been released for public review, PEMEX has provided various details concerning its components. The intent behind the new contract is to approximate as closely as possible the terms of a standard commercial fuel supply contract that would be used in the U.S. or abroad. Thus, the options available in the contract include short or long-term durations, firm or interruptible service, fixed or escalating pricing and indexing to alternative fuels. In addition, discounts will be available for volume, "stability" of consumption and geographic zone. Unfortunately, these provisions have not yet been defined in more detail, so it is unclear to what extent they will achieve PEMEX's stated objective.

3. BUSINESS AND INVESTMENT CLIMATE

3.1. Macroeconomic Trends and Policies

After enjoying growth rates of over six percent a year from 1958 to 1982, Mexico entered a period of severe economic turmoil which culminated in the massive capital flight and high external debt levels that faced President-Elect de la Madrid in 1982. With dangerously low foreign exchange reserves and interest payments on long-term debt equal to 28 percent of export earnings, the Administration took drastic measures to increase its non-oil exports. This program came at the expense of consumption and fixed investment, however, ushering in a five-year period in which annual GDP growth averaged below 0.1 percent and inflation remained unacceptably high. The response to this inflation threat was the first *Pacto de Solidaridad Economica* (Economic Solidarity Pact), introduced in 1987 as an agreement between the Government, business and labor to freeze prices, wages and the exchange rate and to lower tariffs. As a result of the *Pacto*, maximum tariff rates were cut from 45 to 20 percent and inflation was reduced from 159 percent in 1987 to 52 percent in 1988.

The Salinas Administration came into office in 1988 and the following May released its *Plan Nacional de Desarrollo* (National Development Plan) for 1989-94, which had the twin goals of six percent GDP growth and a reduction in inflation to the levels of Mexico's trading partners. Part of the strategy for achieving these objectives was to increase investment, which was accomplished by privatization of state enterprises, deregulation of strategic sectors such as banking and transport and policies to encourage foreign investment and the return of flight capital. This plan marked the beginning of the dramatic reforms of which the current private power program is a component.

Growth exceeded the Plan's targets until 1991, but was intentionally slowed by the Government in 1992 to reduce inflation and import levels that were considered unacceptably high. The tool for accomplishing this slow-down was the series of agreements that succeeded the original *Pacto*. These have all incorporated predictable, daily devaluations of the peso, periodic adjustments to prices and the minimum wage and fiscal restraint on the part of the Government. The results of these efforts have been impressive, as illustrated in Table 11.

An important aspect of the Government's strategy has been its efforts to develop a closer trading relationship with the U.S. in particular, and to open its economy to foreign investment and import competition in general. The benefits of this strategy have already been realized, with overall trade expanding rapidly during the first half of 1994 as NAFTA came into effect. Exports rose sharply, even with a decline in oil sales, and were responsible for the modest economic growth that was achieved. Non-oil exports were up 22.1 percent in the first four months of the year and manufacturing exports increased 23.7 percent.

Table 11
Key Economic Indicators
1989-1993

Indicator	1989	1990	1991	1992	1993
Change in GDP (%)	3.4	4.5	3.7	2.7	0.4
Change in CPI (%)	19.7	29.9	18.8	12.0	8.0
Growth in M1 (%)	37.7	54.6	83.9	87.5	15.8
Interest Rates (%)	44.6	37.4	22.3	18.8	14.7
Imports (\$mn)	23,500	29,779	38,184	47,652	65,368
Exports (\$mn)	22,900	26,773	27,120	27,399	51,832
Trade Balance (\$mn)	(600)	(3,006)	(11,064)	(20,253)	(13,536)
Reserves (\$mn)	6,860	10,274	17,547	19,000	24,537
Exchange Rate (NP/\$)*	2681	2959	3105	3229	3.10

SOURCE: Economist Intelligence Unit, 1994; Lagniappe Quarterly Monitor, 1994; Business Latin America, 1994.

* The New Peso (NP) replaced the old Peso on January 1, 1993, at a rate of 1,000 to 1. The exchange rate as of August 1994 was NP3.35/\$.

Things have not been so bright on the monetary front, however. Despite successful efforts to keep inflation under control and conservative fiscal policies, the peso has come under severe pressure in the currency markets. The proximate cause of this pressure was the assassination of Presidential candidate Luis Donaldo Colosio, which caused both capital flight and a halt in capital inflows. As a result, foreign exchange reserves declined by 35 percent during the first half of 1994 as the central bank tried to defend the peso, and the central bank has responded by boosting interest rates in addition to buying dollars. Rates on 28-day treasury certificates (CETES), a key interest-rate indicator, have almost doubled, increasing from 8.81 percent in February to 15.84 percent in July. The resulting increase in interest rates throughout the economy has slowed growth precisely when the Government was trying to stimulate it, with the result that GDP growth in the first half was only 0.5 percent. The Government's efforts to manage the political uncertainty that is hindering economic recovery will be a key factor in the health of the economy over the near and medium terms.

3.2 Investment Incentives and Regulations

Past and Current Trends in Foreign Investment

Over the course of the past decade the Mexican Government has taken broad strides to encourage and augment both direct and indirect foreign investments flowing into Mexico. This stance towards foreign investment is evident from the previous two National Development Plans (NDPs), instituted in 1983 (to 1988) and 1989 (to 1994). The premise of these plans was to adopt a liberal approach towards foreign investment by eliminating procedural impediments. In addition,

the Government and private-sector financial institutions have established the Mexican Investment Board, a non-profit organization to promote foreign investment. The Board disseminates information on establishing operations, incentive programs and other aspects of doing business in Mexico. As a result of these policies, direct foreign investment increased more than five-fold between 1983 and 1992, as indicated in Figure 8. Preliminary data from the first half of 1993 indicates an annual level of well over \$4 billion.

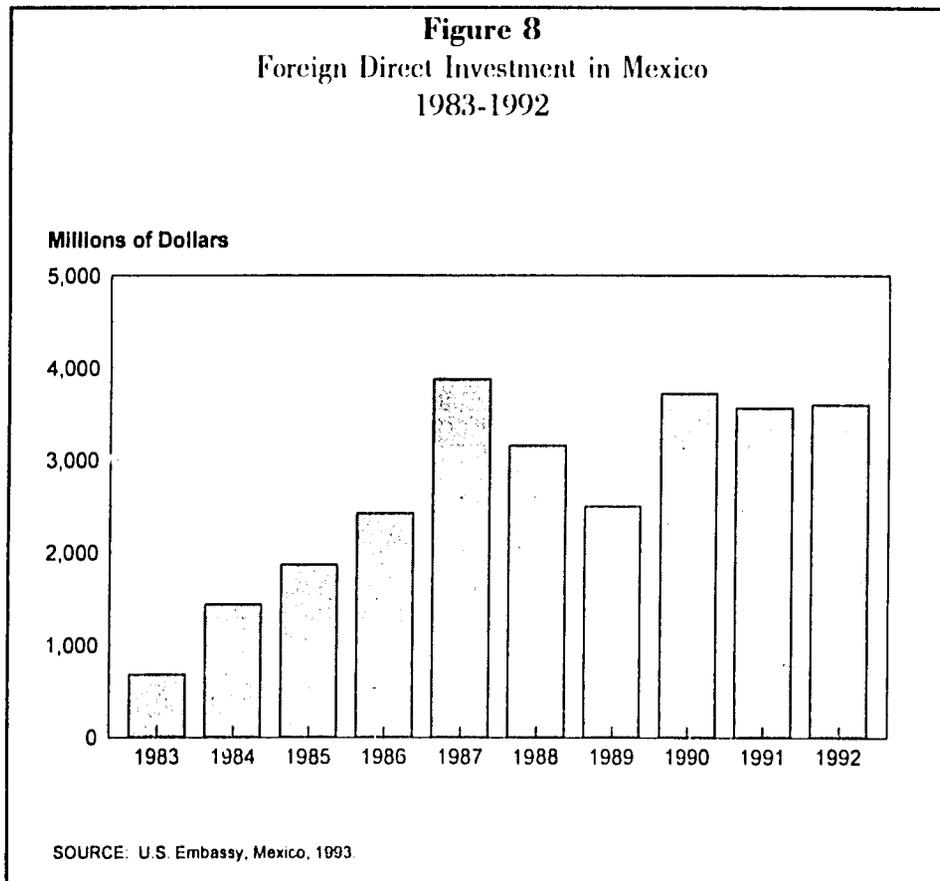
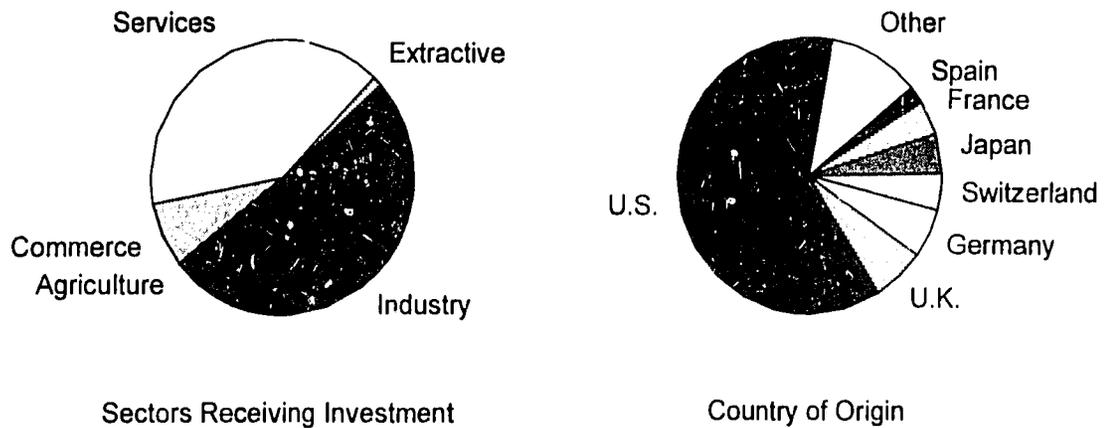


Figure 9
Sources and Uses of Foreign Direct Investment
1992



SOURCE: U.S. Embassy, Mexico, 1993.

This influx of foreign investment into the Mexican economy consists of contributions from several countries. As would be expected, the U.S. has been the largest investor, followed by Great Britain, Germany, Switzerland, Japan, France and Spain. Although investment has been concentrated in the industrial and service industries, significant quantities of funds have also been committed to sectors such as agriculture, commerce and extractive industries. Foreign firms now account for 10 of the largest 50 firms Mexico. These trends are illustrated in Figure 9.

Laws and Regulations Governing Foreign Investments

Regulations Specific to Foreign Investment. The defining legislative works regulating foreign investment in Mexico are the *1973 Law to Promote Mexican Investment and Regulate Foreign Investment* (the 1973 Law), the *1989 Amendment to Foreign Investment Regulations* (the 1989 Amendment) and the *1993 Amendments to the Foreign Investment Regulations* (the 1993

Amendments). These laws are aimed at regulating investments in Mexican corporations and establishing a framework to promote certainty, competitiveness and clarity with regards to investments.

Under the guidelines set by these regulations, not all sectors of the economy are open to foreign investment. The restricted sectors identified in the regulations can be categorized as either those in which foreign investment is prohibited or those in which majority ownership by foreign national or corporations is permitted upon review. Investment in power generation has been moved from the first to the second category by reclassifying certain activities as "other than public service", as explained at length in Section 1.

Majority investment in restricted/reserved sectors (other than electricity, which is now governed by the procedures described in Section 1) must be approved by the National Foreign Investment Commission (NFIC). This autonomous regulatory body is headed by an Under Secretary at SECOFI, who is charged with the authority to review and approve all potential applicants. To guarantee effective and efficient review of all applications submitted to the NFIC a maximum waiting period has been established. If an application is not reviewed within 45 calendar days of its receipt, automatic approval is granted. In addition, exemptions from NFIC approval will be granted if the following six guidelines are met:

- the investment does not exceed \$100 million;
- direct external funding is provided for project;
- the location is outside of the major industrial metropolitan areas of Mexico City, Monterrey and Guadalajara;
- the investment will not require net foreign exchange during its first three years;
- it provides permanent jobs and training; and
- it utilizes the necessary to adhere to environmental requirements.

Under the 1973 Law a National Register of Foreign Investment (NRFI) was established at SECOFI. The purpose of the NRFI is to maintain information on the parties involved in the investment project and the capital stock invested. All foreign investment projects, with or without NCF review, must be registered with NRFI. The registry must be periodically provided with information on the economic, financial and balance of payments data for projects to update their status.

General Commercial Regulations. The 1973 Law and the 1989 and 1993 Amendments provide a broad framework for regulating foreign investments flowing into Mexico. Such investments are also subject to a variety of commercial regulations that address the following issues:

- foreign exchange;
- labor and social security laws;
- taxation; and
- trade policies.

Foreign Exchange. Mexico repealed its foreign exchange controls in November 1991. The New Peso is now freely convertible with all other currencies, and there are no restrictions on the remittance of profits abroad, the repatriation of capital or the repayment of intercompany loans and/or interest. Moreover, no proof of registration or of having brought foreign currency to Mexico is necessary when purchasing foreign currency for repatriation purposes. However, the Government offers no guarantees of convertibility and all transactions in the exchange market depend on the availability of the desired currency.

Labor Laws and Social Security. Mexico's labor laws were originally drafted in 1931 and subsequently revised in 1970. These laws specify workers' rights and protections and set guidelines governing employee-employer relations.

The standard work week for Mexican employees is 48 hours with one paid day of rest, though as a matter of practice only 44 to 40 hours are usually worked. For overtime, workers must receive twice their normal hourly rate and for any overtime in excess of nine hours they must be compensated at three times their hourly rate. Employees are entitled to seven mandatory holidays per year and also when federal and local elections are held. Paid vacation is accrued yearly, with a minimum of six days of paid leave for the first year.

Employees are guaranteed a minimum wage of 14.27 New Pesos per day, which is approximately \$4.60. However, more than 90 percent of the work force receives in excess of this amount. Both Mexican and foreign employers must provide certain mandatory fringe benefits in the form of bonuses. In addition to their salary, workers receive a 25 percent vacation bonus and an annual bonus equal to two weeks pay in December. All business are also mandated to engage in profit sharing. Employees are entitled to receive 10 percent of a company's annual taxable income, to be distributed in two equal parts -- the first based on salary and the second on days worked. In addition, employers often provide supplementary benefits as a part of collective bargaining agreements.

Employers must also contribute a share of employees' social security insurance. The Mexican Social Security Institute (IMSS) insures all workers for sickness, maternity leave, occupational hazards, disability, old age, job loss and death. Insured female employees also have the right to day care for their children. Social security premiums are incurred by both the employee and the employer and insurance under IMSS is compulsory. The employer's share of this cost averages 12-15 percent of base salary. A recent addition to the social security program is the Mandatory Retirement Savings System. This program is designed to supplement the retirement pension provided under social security. Employers contribute two percent of each employee's salary to a dedicated bank account that can be used for retirement. The existence of organizational pension funds is rare in Mexico, since the majority of the labor force is quite young and such a long-term benefit is not a factor in obtaining or retaining employees.

Overall fringe benefits, including those mandated by the labor laws, add significantly to labor costs, representing an added burden on the base wage of up to 100 percent.

Taxation. Federal tax liabilities for companies operating in Mexico consist of federal corporate taxes, value added taxes and payroll taxes (the social security levies discussed above). Taxes levied at the state and local level include state payroll taxes and local real estate taxes. There are no state corporate income taxes.

The corporate tax rate is currently at 35 percent, which for Mexican branches of foreign corporations is only levied on income derived from operations in Mexico. Dividends for repatriation are exempt from taxation as long as they are distributed from taxed profits. If dividends are paid from above a company's profit line, they are subject to a 34 percent tax rate.

The value added tax (VAT) is levied on the consumption of all goods and services produced in Mexico. The tax is levied at a flat rate and is determined with respect to the service or good to which it is being applied. VAT is also payable on imported goods and services rendered by non-residents for use in Mexico.

Trade Policies. The recent liberalization of trade policies and practices has translated into liberal import/export practices. Import duties have been significantly reduced and import permits have been eliminated for most goods. Similar steps have also been enacted for exports.

4. RECENT REGIONAL DEVELOPMENTS

4.1. Domestic

The two recent domestic occurrences with the potential to affect the Government's overall commitment to the private power program were the events in Chiapas State at the beginning of 1994 and the Presidential elections. Chiapas had the potential to divert the Government's attention from its long-term reform goals, or to induce a slowing of the reforms as a concession to the political forces represented by the insurgents. Government actions since the initial uprising and the response of the Mexican public, financial markets and foreign direct investors suggest that neither is likely. The reform program is being implemented as planned, and the potential for further unrest seems limited at best.

Presidential Elections

The presidential elections in September of 1994 seem also to have had little effect on the Government's program of economic liberalization and reform, of which the private power initiatives are a part. President Ernesto Zedillo ran on a platform based on the continuation of the economic policies successfully pursued by the Salinas Administration, a strategy which is borne out by the September 1994 renewal of the *Pacto para el Bienestar, la Estabilidad y el Empleo* discussed above. The central goal of the Pacto is lower inflation, but it also contains measures to enhance social welfare in Chiapas and similar regions, as well as the investment-boosting provisions discussed in Section 3.1. The overall picture presented by this action and the public pronouncements of the Administration point to more of the same on the economic front, which should enhance the prospects for closing the first private power deals under the current program.

4.2. International

North American Free Trade Agreement (NAFTA)

The most important recent international event with repercussions for private power development is of course NAFTA. Its overall impact on the power sector is perceived to be relatively minor, however, due to the Mexican Government's insistence on retaining the Constitutional protections discussed in Section 1. As a result, the effect of NAFTA is likely to be indirect, in the form of increased demand for power caused by whatever boost the Agreement gives to Mexico's economy. A more specific benefit may come from increased cogeneration opportunities in industries favorably affected by the opening of Canadian and U.S. markets.

Direct Impact. Chapter Six of the Agreement addresses the energy sector, and it opens -- at the insistence of Mexican negotiators -- with a confirmation of the countries' mutual respect for their Constitutions, which in the case of Mexico means national control of energy resources. It then approaches the liberalization of the energy sector through a series of exceptions to these Constitutional protections. Annex 602.3 of the Agreement contains the provisions relevant to

power generation by private parties, and is simply a restatement, in more general terms, of the rights established by the 1992 Electricity Law and its by-laws discussed at length above. The Agreement also requires that existing Mexican tariffs on electricity imports be reduced from their current 10 percent level to zero over a five-year period, but this will have little effect since increased imports are constrained by a lack of cross-border infrastructure and technical factors. NAFTA therefore will have little if any direct impact on the prospects of U.S. power developers pursuing opportunities in Mexico or directly across the border.

Indirect Impact. The most likely impact of NAFTA on prospects for private power developers is from its effect on the overall growth rate of the demand for power. Estimates vary widely on the magnitude of increases in Mexico's GDP from the Agreement. A survey of various attempts to model the long-term increase in the growth rate of Mexican GDP conducted by the U.S. Department of Commerce found estimates ranging from 0.1 to 11.4 percent. Figures in the lower range, however, did not include the impact of reductions in non-tariff barriers, increased direct foreign investment or dynamic changes in the economy. One of the few attempts to include dynamic gains of free trade show Mexican GDP increasing by a total of 50 percent in real terms over 25 years.

Whatever the actual figure, any increase of more than one or two percent will likely have significant effects on the demand for electricity. As noted in Section 1, the high and low GDP growth rates cases used by CFE for forecasting purposes differ by only two percentage points, but they lead to a difference of 26 TWH per year in consumption by 2003, a 17 percent increase over the low-growth case.

The effect on cogeneration opportunities may be more direct. Several of the industries with significant cogeneration in Mexico have been analyzed by the U.S. Department of Commerce and other parties to determine the likely impact of NAFTA's provisions. The results of these analyses are summarized below.

Secondary Petrochemicals. NAFTA will have only a small impact on investment in this sector in the short term, due to adverse market conditions world-wide. Over the long-term, however, substantial investment could be realized in Mexico. This would occur because PEMEX currently produces more basic petrochemicals -- the feedstock for secondary processes -- than the secondary industry can handle. An expansion of this secondary capacity has been hindered by restrictions on foreign investment, but these will be substantially eliminated by the Agreement. Specifically, the number of basic petrochemicals over which PEMEX has a monopoly will be substantially reduced, and a clause limiting foreign direct investment in secondary petrochemicals to 40 percent will be eliminated.

Petroleum and Basic Petrochemicals. There will be little impact on investment in these areas, since PEMEX will continue to maintain monopoly rights over all activities. Although some basic petrochemicals will be reclassified as secondary in order to open them to private participation, PEMEX will continue to control feedstock supplies.

Steel. The Agreement will have a minor net impact on the Mexican steel industry. Although exports to the U.S. of "commodity" steel products are expected to increase, these will be offset to some degree by increased imports of specialty products such as high-grade flat rolled products. Moreover, Mexico allowed 100 percent foreign investment in steel manufacturing beginning in 1989, and the wave of investment produced by that opening has already been completed.

Sugar Refining. There is a potential for increased production of sugar and its associated refining activities in Mexico, due to its competitive advantage relative to high-cost producing areas in the U.S. such as Texas and Hawaii. The ultimate impact on the industry is impossible to predict, however, because production and consumption levels in both countries are dramatically distorted by price controls and quantitative trade restrictions, which will be reduced very gradually by NAFTA. Thus, the final impact on investment in Mexican sugar refineries depends for the foreseeable future on variable such as Mexican policies controlling sugar prices and production costs, the support price of corn and the amount of duty-free corn (which is the ingredient for high-fructose corn syrup, a sugar substitute) allowed into the country.

5. POTENTIAL PRIVATE POWER OPPORTUNITIES

5.1. IPP and Cogeneration Possibilities

Planned Generation Capacity. CFE expansion plans, as detailed in the DDP, call for the addition of 14,639 MW of additional capacity in the period from 1994 to 2003. This is to be supplied by 6,479 MW that are either in construction or contracted for (which CFE designates as "promised capacity") and 8,169 MW of "additional capacity". The vast majority of the latter is potentially open to development by U.S. private parties. Table 12 presents the major installations under construction or contract as of the end of 1993.

In addition to these obligations, CFE is party to several power sales contracts with utilities in California, Texas and Belize. Import contracts include: 150 MW supplied by El Paso Electric Co., to terminate in December 1996; and 70 MW of summer capacity from Southern California Edison to Baja California, to terminate in September 1996. Export obligations include: 150 MW and 70 MW from Baja California to San Diego Gas & Electric and Southern California Edison, respectively, both to terminate in September 1997; and 5 MW to the Belize Electricity Board, which has been in effect indefinitely since 1989.

Table 12
Generating Stations Under Construction or Contract
December 1993

Name	Units	Type	MW	Operation Date	Region
Topolobampo II	2	HSFO	160 each	10/91,1/95	Northwest
Huites	2	Hydro	200 each	1/95,6/95	Northwest
Samalayuca II	3	CC Gas	173 each	1/97,6/97,1/98	North
Carbon II	2	Coal	350 each	7/95,1/96	Northeast
Aguamilpa	3	Hydro	320 each	1/91,1/91,7/91	West
Azufres	3	Geo	5,1.5,1.5	2/91	West
Chilatan	2	Hydro	11 each	3/97,5/97	West
Maritaro	2	Geo	20 each	3/97,6/97	West
Petacalco	2	Coal/HSFO	350 each	7/91,1/95	West
San Rafael	8	Hydro	3 each	11/96	West
Zimapan	2	Hydro	110 each	6/95,9/95	West
Adolfo Lopez Mateos	4	HSFO	350 each	3/91,7/91,3/96,7/96	East
Humeros	1	Geo	5	3/91	East
Laguna Verde	1	Nuclear	675	6/95	East
Temascal II	2	Hydro	160 each	6/96,9/96	East
Cerro Prieto III	4	Geo	20 each	12/96,3/97,6/97,9/97	Baja C.
Tecate	2	Hydro	30 each	3/97,6/97	Baja C.
Felipe Carrillo Puerto	1	CC Gas	80	2/91	Peninsula

SOURCE: SE, October 1994.

After accounting for "promised capacity" and export/import contracts, CFE forecasts indicate an additional 8,160 MW of generating capacity will be needed by 2003. The largest share of this capacity will be in the Northeast, West and Central Regions, which together account for 65 percent of the total, as illustrated in Table 13. Baja California will require 800 MW, with the first additions needed in 1996 to handle summer peaking needs, which will be met by imports until through 1995.

Table 13
Additional Capacity Requirements by Region
1996-2003

Region	1996	1997	1998	1999	2000	2001	2002	2003	Total
Northwest	0	0	0	250	100	100	100	150	700
North	0	0	0	200	200	150	150	150	850
Northeast	0	0	0	250	350	400	500	700	2,200
West	0	0	40	40	200	350	750	500	1,880
Central	0	0	0	0	150	765	150	150	1,215
East	0	0	0	0	0	0	0	0	0
Peninsula	0	0	220	0	220	0	0	0	440
Baja C.	100	100	0	100	200	100	100	100	800
Baja C. South	0	0	0	0	37	0	0	37	75
Total	100	100	260	840	1,457	1,865	17,50	1,787	8,160

SOURCE: SE, October 1994.

As indicated in Table 14, CFE's expansion plan anticipates that combined-cycle and hydro facilities will provide a large share of the total capacity to be added during the coming decade. The figure for combined-cycle will undoubtedly be much higher than that indicated in the table, however, since the technology for "undetermined" capacity will be proposed by prospective developers, who tend to favor combined-cycle gas facilities where feasible. A total of 6,125 MW of "additional" capacity falls into the undetermined category, or 75 percent of the total additional capacity to be added.

As part of its long-range planning process, CFE is in the process of conducting or has finished site studies for several thermal generating stations, as illustrated in Table 15. These sites are therefore likely to be among the first put up for bid.

Table 14
Total Capacity Requirements by Technology and Status: 1994-2003

Technology	Promised Capacity (MW)	Additional Capacity (MW)	Total Capacity (MW)
Combined-Cycle	599	440	1,039
Dual (Coal or HSFO)	700	0	700
Hydroelectric	1,952	1,515	3,467
Conventional Steam	1,720	0	1,720
Coal	700	0	700
Geothermal	133	80	213
Nuclear	675	0	675
Undetermined	0	6,125	6,125
Total	6,479	8,160	14,639

SOURCE: SE, October 1994.

Table 15
Potential Generating Stations with Site Studies Terminated or in Process

Region	Probable Location	Total Capacity (MW)
Northwest	Puerto Libertad	700
North	Rosarito I (Expansion)	600
Northeast	Puerto Altamira	2,600
West	Punta Prieta II (Expansion)	37.5
Central	Puerto San Carlos	37.5
East	Colm	2,600
Peninsula	Valladolid	220
Baja C.	Tijuana	220
Baja C. South	El Chino (Geothermal)	10
Central	Zumpango	300
Central	Tenancingo	300
Central	Benstam	100
Total		8,055

SOURCE: SE, October 1994.

CFE also has plans to add substantial hydro capacity. As noted above, the DDP calls for 3,467 MW of hydro capacity to be added over the next ten years, and CFE is in the process of or has finished feasibility studies at 13 hydro sites with a combined potential capacity of 6,719 MW. All but two of these sites are in the East and West Regions.

Table 16 details the thermal generating plant configurations used by CFE for long-term planning purposes, as well as their operating characteristics.

Table 16					
Characteristics of Thermal Generating Plant Configurations Considered by CFE					
Technology/Fuel	MW	Gross Efficiency (%)	Economic Life (yrs)	Load Factor	Own Use (%)
Conventional Steam (HSFO)	2 x 350	36.96	30	.650	6.3
	2 x 160	33.89	30	.650	6.3
	2 x 84	31.88	30	.650	6.3
	2 x 37.5	29.38	30	.650	6.3
<i>Combustion Turbine</i>					
Aeroderivative (Gas)	1 x 45	31.10	30	.125	0.9
Industrial (Gas)	1 x 50	26.31	30	.125	0.9
Industrial (Gas)	1 x 100	26.76	30	.125	0.9
Aeroderivative (Diesel)	1 x 44	30.99	30	.125	0.9
Combined-Cycle (Gas)	1 x 220	46.78	30	.650	3.0
Int. Combustion (Diesel)	2 x 32.5	45.70	20	.650	5.2
Coal	2 x 350	37.58	30	.650	7.6
Coal/HSFO w/o Desulf.	2 x 350	37.58	30	.650	7.6
Coal/HSFO w/ Desulf.	2 x 350	39.45	30	.650	12.0

SOURCE: SE, October 1994.

Taking into account all of the above parameters for its long-term goals, CFE has developed expansion options for each region, using combinations of new capacity, re-powering of existing facilities, transmission links to other regions and imports. These options will be updated and refined in subsequent DDPs, but at the present time they provide the most authoritative guide to the long-term expansion of the Mexican power sector, and to the most likely opportunities for private developers.

Northwest. The 700 MW required by this region could be built at the Puerto Libertad generating station already operating in northern Sonora. Other possibilities include a combined-cycle gas

facility supplied by the 16 inch pipeline running from Naco to Hermosillo, or a hydro facility at the Soyopa site, also in Hermosillo, which is estimated to have a capacity of 50 MW.

North. Options for the 850 MW required include combined-cycle gas facilities or the expansion of transmission links to the Northeast Region.

Northeast. Total capacity requirements for this region are 2,200 MW. Combined-cycle gas facilities could be built at several points close to PEMEX gas pipelines, including the re-powering of the Monterrey station. Other options include coal or coal/HSFC facilities on the Gulf of Mexico using imported coal, or possibly the utilization of coal gasification techniques.

West. This region's requirements of 1,900 MW could be met by several facilities for which site and/or feasibility studies are already underway. The potential thermal site called Colmi, which is located close to the border of Colima and Michoacán, could accommodate up to 2,600 MW of coal or coal/HSFO facilities, and would be a candidate for the application of coal gasification technology. Several potential hydro sites have also been evaluated, including: the Santiago River valley; the El Cajón site in Nayarit, with a potential capacity of 750 MW; Arroyo Hondo in Jalisco, which has a potential 170 MW site; and San Francisco, also in Jalisco, with a potential of 328 MW. A final option is the possibility of increasing geothermal capacity to 80 MW by implementing potential projects at El Chino and La Primavera.

Central. The 1,215 MW required could be met with the modernization and/or re-powering of existing stations, the construction of combined-cycle gas facilities or development of several hydro sites. The most important of the latter is La Parota, a potential 765 MW facility in Guerrero. Another option would be the development of hydro sites in the East Region, such as Atexaco and Xúchiles.

East. This region has no need for additional capacity, but facilities could be located here that would supply power to the Central Region, as mentioned in the previous paragraph.

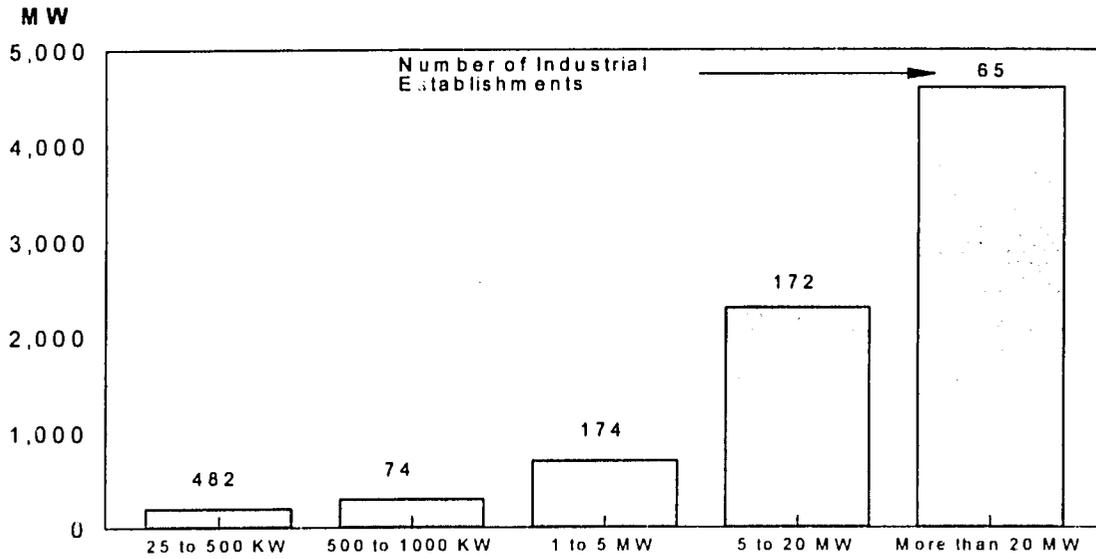
Peninsula. The 440 MW required by this region will be supplied by the two 220 MW units to be built for the Merida III project, which is currently in the bidding stage. For the period after 2003, or to supply power to the East and Central Regions, the options include additional combined-cycle units, re-powering of existing facilities or the development of potential hydro sites on the Usamacinta River.

Baja California. A total of 800 MW of additional capacity will be needed on the northern peninsula, where a shortage of summer peaking capacity is currently being met by a 70 MW contract with Southern California Edison, which expires in 1996. One possibility would be to replace the four 75 MW conventional HSFO units at Rosarito I with six 100 MW gas-fired combustion turbines, which would increase the station's total capacity to 900 MW. Other options include rehabilitating the existing Rosarito units and building new combined-cycle units, buying capacity from U.S. utilities or some combination of the above.

Baja California South. Only 75 MW of new capacity will be required in the southern peninsula. Possibilities include an expansion of Punta Prieta II, a new HSF0 unit at Puerto San Carlos, or an internal combustion units similar to those already in use at Puerto San Carlos.

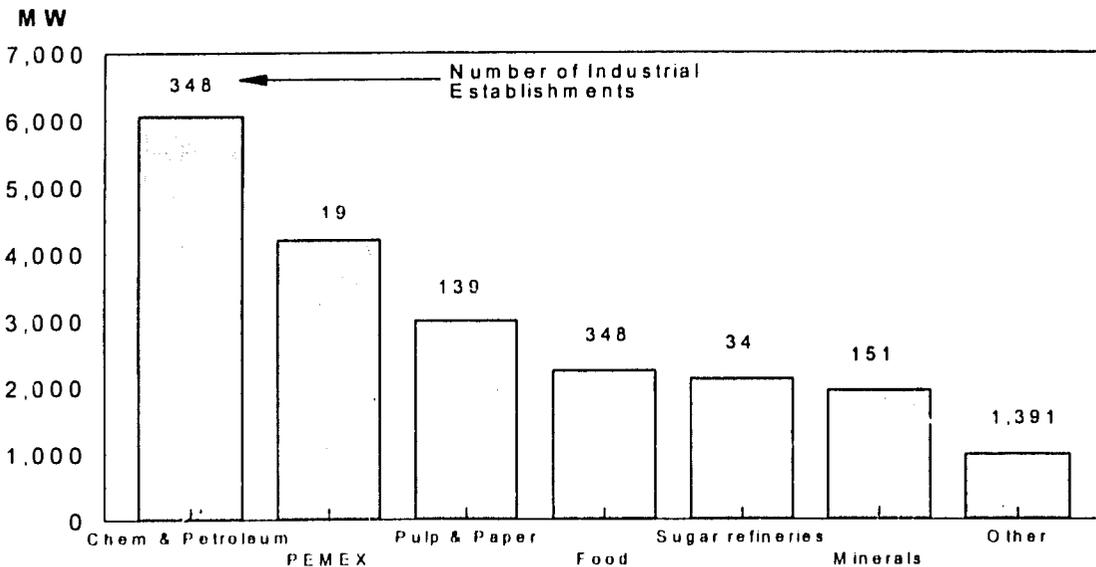
Cogeneration Opportunities. Substantial opportunities exist for the development of cogeneration facilities. As part of its mandate to provide encouragement and technical assistance to potential cogeneration developers, CONAE has commissioned several studies attempting to estimate the potential capacity that could be economically developed, given Mexico's current and future industrial base. The most recent results of these efforts are shown in Figures 10 and 11. As would be expected, the largest share of potential capacity is found in PEMEX facilities, but opportunities exist in the industries that already have their own generating capacity, such as pulp and paper, food, minerals and sugar refining. In terms of total megawattage, most of this potential exists in large industries -- i.e., those with cogeneration potential of 20 MW or more. A large share of the total potential capacity, however, is found in the large number of smaller companies with appropriate thermal operations.

Figure 10
Maximum Cogeneration Potential in Mexico: 2003
Distribution by Size of Potential Generating Unit



SOURCE Mascorro, 1994

Figure 11
Maximum Cogeneration Potential in Mexico: 2003
Distribution by Industry



SOURCE Mascorro, 1994

CRE has already granted 18 cogeneration or self-supply permits, the details of which are provided in Table 17. As the table illustrates, the agro-industry and commercial/service sectors absorbed the majority of these permits.

Table 17 Cogeneration and Self-Supply Permits Granted by CRE		
Applicant	Permit Type	Sector
Energia de Nuevo Leon, S.A. de C.V.	Cogeneration	Various
Proteinas Industriales de la Laguna	Cogeneration	Agro-Industry
Suministro Energetico Industrial	Cogeneration	Various
Productos Ecologicos, S.A. de C.V.	Cogeneration	Manufacturing
Fermentaciones y Sintesis, S.A. de C.V.	Cogeneration	Agro-Industry
Productora de Papel, S.A. de C.V.	Cogeneration	Paper
Almidones Mexicanos	Cogeneration	Agro-Industry
Fabrica la Estrella, S.A. de C.V.	Cogeneration	Agro-Industry
Industrias Monfel, S.A. de C.V.	Cogeneration	Manufacturing
Cartones Ponderosa, S.A. de C.V.	Cogeneration	Paper
Departamento del Distrito Federal	Self-Supply	Commercial/Services
Departamento del Distrito Federal	Self-Supply	Commercial/Services
PEMEX Exploracion y Produccion	Self-Supply	Petroleum
Gobierno del Estado de Sonora	Self-Supply	Commercial/Services
Gobierno del Estado de Sonora	Self-Supply	Commercial/Services
Gobierno del Estado de Sonora	Self-Supply	Commercial/Services
Gobierno del Estado de Sonora	Self-Supply	Commercial/Services
Minera Hecla, S.A. de C.V.	Self-Supply	Mining

SOURCE: CRE, January 1995.

5.2. Financing Options and Constraints

Power project development in Mexico will almost certainly follow the model of similar projects in other parts of the world, relying on limited or non-recourse project finance. Given the Mexican Government's stated intention to avoid providing comprehensive sovereign guarantees, such financing will be a challenge for the first projects that are completed.

Although a large number of financial techniques are being used or considered for project finance -- including Eurobonds, Rule 144a funds, industrial credit companies and corporate capital

allocations -- the first projects to reach completion in Mexico will likely have relatively straightforward debt-equity structures and funding sources. This is due to the novelty of project finance in Mexico, as well as in the rest of Latin America, where to date only one limited-recourse power project has reached financial closure -- the Mamonal power plant in Columbia. This novelty, combined with CFE's reticence to date to provide contractual terms acceptable to lenders, suggests that the transaction costs of the first projects will be relatively high, making a simple financial structure more appealing and affordable. The following paragraphs discuss sources for equity, debt and insurance for such a structure.

Sources of Equity

In the context of project financing, the principal source of equity is usually some combination of the project sponsors and third-party investors. The following often play the latter role in project finance structures for private power development.

Investment Funds. Several funds with a regional and/or sectoral emphasis supply equity to power and similar infrastructure projects. All but the last in this list are based in the U.S.:

- Energy Investors' Fund
- Prudential Power Funding Associates
- Metlife Capital
- Global Power Fund
- Scudder Latin America Trust for Independent Power
- Sumitomo (Japan)

Multilateral Institutions. *The International Finance Corporation (IFC)*, a branch of the World Bank that lends to the private sector, has only been funding infrastructure projects since July of 1992, but it has recently become extremely active in the funding of independent power plants. None of this activity, however, has been in Mexico. The overwhelming response from potential developers has strained the IFC's human and financial resources, with the result that it is concentrating its efforts on those countries that need the most assistance, a category into which Mexico does not fall. Moreover, the perception until recently among IFC project officers was that regulatory reform had not progressed sufficiently to make Mexico competitive with other Latin American countries that are further along in their reform programs. There is a possibility of involvement in the future, however, since the institution has long been active in Mexico, and has followed events in the power sector closely. The IFC provides several types of financing assistance. The most widely used is its Loan Syndication Program, under which it arranges financing from groups of banks while designating itself as the primary risk taker. This program mobilizes seven dollars for every one the IFC invests. It also provides capital to some of the funds mentioned in the previous section, and makes direct equity investments of \$1 to \$100 million, usually taking a 5-15 percent position in the company. It rarely gets involved in projects below the \$20 to \$50 million range, however.

The *Inter-American Investment Corporation (IIC)* fulfills an analogous role for the Inter-American Development Bank (ADB). The IIC will provide up to one third of a project's equity, with a cap of \$10 million, which limits the size of the projects in which it is involved to approximately \$40 million. All ventures financed by the IIC must be at least 51 percent locally owned, and must promote the economic growth and development of the Latin American region.

Capital Goods Suppliers. The following companies, all of which are reported to be active in Mexico, are potential sources of project equity:

- General Electric Company
- Westinghouse Corporation
- Asea Brown Boveri
- Siemens
- Solar
- Air Products
- Babcock & Wilcox
- ABB/Stal
- Ansaldo
- Ahlstrom
- Mitsubishi
- Kawasaki

Industrial Credit Companies. A final potential source of equity is industrial credit companies, such as General Electric Capital and Commercial Union.

Sources of Debt

Securing project debt is the most difficult aspect of project finance, since lenders have no recourse to the assets of the project company in the event of non-payment. The following are potential sources of project debt for power development in Mexico.

Multilateral Agencies. In addition to the IFC, whose loan activities were described above, the IIC will provide direct loans of up to \$6 million. It also provides subordinated and convertible loans of up to 12 years, as well as loan guarantees, share placement services and surety bonds.

Mexican Development Banks. Two of these institutions are active in the energy sector, *Nacional Financiera (NAFINSA)* and *Banco Nacional de Obras y Servicios Públicos (BANOBRAS)*. Neither is likely to play a major role in providing debt for project finance, however, due to size limitations on lending that prohibits their involvement in large-scale projects.

Export-Import Bank of the United States (EXIM). The U.S. EXIM bank has been quite active in Mexico, and has also been increasing its emphasis on project-finance infrastructure deals. Latin America is the second most frequent source of proposals for its project-finance loans, after Asia. The EXIM's programs include assistance in obtaining pre-export working

capital, insuring against political and commercial risks of non-payment by foreign customers, guaranteeing loans to customers of U.S. companies and making direct loans to foreign buyers of U.S. goods. In addition, the agency provides intermediary loans to third-party banks or institutions and offers eight different types of insurance policies. To qualify, products or services must have at least 50 percent U.S. content and cannot be militarily related. In addition, transactions must have a reasonable chance of repayment and must not adversely affect the U.S. economy.

U.S. Commercial Banks. Several U.S. banks have project finance specialists based in Mexico, include Chase Manhattan, Chemical Bank and Citibank. Although these institutions are playing an increasingly active role in the newly competitive Mexican banking sector, their project finance commitments are likely to be hindered somewhat by country lending limits imposed in the wake of the 1980s debt crisis.

Mexican Commercial Banks. Since the privatization of Mexico's banking sector was completed, competition has increased significantly with the merger of several large institutions and the arrival of various foreign banks. As with U.S. commercial banks, however, this will likely provide few sources of lending for project-finance developments. Mexican banks will play a limited role in project finance because of the dollar-denominated nature of the debt. Some participants believe that they may provide peso debt for local construction expenditures, but given the capital-intensive nature of power plants, this will constitute a relatively small portion of the total debt required to finance a project. The largest Mexican banks include the following:

- Grupo Financiero Serfin (merged with Grupo Financiero Inverlat in September 1994)
- Bancomer
- Banamex

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