Policy proposal for structural reform of the Mexican electricity industry

México, 1999

Contents

Figures and tables

Figures

Tables

Abbreviations

BLT	Build-Lease-Transfer
CFALLA	Cost of failure
CFE	*Comisión Federal de Electricidad* (Federal Electricity Commission)
COSEN	*Centro de Operación del Sistema Eléctrico Nacional* (Operations Center of the National Electricity System)
CfD	Contract for differences
CRE	*Comisión Reguladora de Energía* (Energy Regulatory Commission)
FtC	Financial transmission contracts
GW	Gigawatt
LFC	*Luz y Fuerza del Centro*
MEM	*Mercado Eléctrico Mayorista* (Wholesale Electricity Market)
MW	Megawatt
IPP	Independent Power Producer
PROFECO	*Procuraduría Federal del Consumidor* (Federal Consumer Protection Agency)
REN	*Red Eléctrica Nacional* (concessionaire for the national transmission grid)
SE	*Secretaría de Energía* (Ministry of Energy)

Foreword

The government has submitted a proposal to amend Articles 27 and 28 of the Mexican Constitution to Congress. The proposed amendment is intended to provide a basis for profound structural reform of the national electricity industry, in order to assure an adequate supply of reliable, high quality and competitively priced electricity in the long term.

To meet the growing demand for electricity that arises from national development, it will be essential to rapidly increase the supply of electricity, and to modernize and expand the transmission and distribution systems. Meeting these investment needs solely from state funds would impinge upon social spending. In fact, the resources required are so large that the government would have difficulty providing them even by diverting resources away from other social priorities.

The level of electricity infrastructure development required by the nation represents a considerable challenge. At stake is the welfare of Mexicans, both through the impact of the electricity sector on the competitiveness of the nation's industrial plant, and through the effect that electricity has on improving the quality of life of Mexican families.

To ensure the availability of public resources for social welfare and, at the same time, to meet the needs of the electricity industry, we need to further expand the scope for the participation in the industry by the private sector. The maturity of the economy and of the electricity industry, the technological developments and the availability of resources provided by international financial markets for electricity projects make this the right time to encourage such participation. This will be the best guarantee that the country will have an electricity sector which matches its potential for growth and which meets the progress and welfare aspirations of all Mexicans.

With the purpose of informing all interested parties as to the scope of the Constitutional reform initiative presented by the government, the *Secretaría de Energía* has outlined its policy proposal for structural change in the Mexican electricity industry in this document.

This document provides an overview of the structure proposed for the industry and describes the basic elements of this structure. One element consists of establishing an electricity market that promotes the efficiency and competitiveness of the electricity industry. Another element is establishing regulatory and institutional frameworks that define the responsibilities of the different participants in the new electricity industry

and the relevant powers of the *Secretaría de Energía* and of the *Comisión Reguladora de Energía*.

International experience shows that establishing the new electricity market and the regulatory and institutional frameworks will take at least two years. This document also describes in a general way the reform process needed to achieve an orderly transition to the new electricity industry.

The general vision of the new electricity industry presented in this document will be enriched with the feedback of all interested parties. In order to transform this proposal into a new institutional and regulatory reality, a wide range of participation is required, in addition to approval by the Legislative branch. Because of this, it is natural that some aspects of this vision will be modified as the reform process advances.

This proposal is part of the structural change initiatives being promoted by present administration. Mexico cannot afford to miss opportunities to attain the levels of efficiency and low costs reached by the electricity industries of other countries where barriers to competition have been eliminated. Nor can Mexico afford to waste the opportunity to devote resources to remedying poverty, inequality and a lack of human capital. The energy sector must be at the forefront in supporting the international competitiveness of the nation's industries and the welfare of all Mexicans.

Luis Téllez K.
Secretary of Energy

1 Overview

Electricity is essential for our society. Its supply has a direct impact on the productive sector and it is an important factor in the welfare of the people. Competitive pricing, high quality and reliability of electricity supply are all necessary conditions for the growth of our economy. For this reason electricity has been and will continue to be a priority for the Mexican government.

Current situation of the electricity industry

The electricity industry is characterised at present by two vertically integrated state monopolies. The *Comisión Federal de Electricidad* (CFE) and *Luz y Fuerza del Centro* (LFC) carry out, on an exclusive basis, the generation, transmission, distribution and the sale of electricity that is supplied as a public service, as set out in the Mexican Constitution.

For several decades, it was appropriate for the state to play an exclusive role, in order to integrate the national electricity system and to expand its coverage across the entire nation. The technology available, the scale of projects required, as well as the sources of investment that existed at that time all meant that the development of the industry, at this stage of growth, was centralized within the public sector. In order to consolidate the nation's electricity infrastructure in these conditions, it was natural to consider electricity as a strategic sector under the exclusive responsibility of the state.

Today, the enormous expansion requirements of the electricity sector, technological advances and the additional resources that must be found to finance other social needs all mean that the current structure, which limits private participation, must be transformed into one that facilitates wide social participation, within the context of effective regulation.

The challenges of the Mexican electricity sector

In the next six years, demand for electricity in Mexico will grow at not less than six percent per annum. During this period, investments of about US$25 billion will be needed to modernise the electricity system and to guarantee supply.

At least 13 GW of additional generation capacity will be required during this period in order to meet the needs of the country. This increase is equivalent to more than a third of today's available capacity, which was installed over a period of more than a century. In only a few years, it will be necessary to build what had previously taken decades. In addition, industry expansion must be achieved with more limited budgetary resources than in the past.

During the last three years, the strategy adopted by the government to face these needs has been to use private financing through Build-Lease-Transfer (BLT) arrangements and independent power production (IPP). The long term, fixed price contracts associated with these projects imply the assumption of the majority of the associated risks by the government.

In transmission, the challenge will be to modernize the network and to increase its reliability and security, and the quality of service, since a shortage of public resources has limited levels of investment in recent years. The result has been congestion in the national interconnected system, which prevents full use of generation capacity, increases the cost of producing electricity and reduces the system's efficiency and reliability.

Distribution presents no less of a challenge. Investment has been insufficient, especially during lean economic times. Today, the lack of resources and investment results in relatively high electrical losses. Furthermore, indicators of quality and reliability of service, especially in the centre of the country, are below those required for proper development. This is in spite of the valuable efforts of Mexican technicians and electrical workers. Increasing efficiency, introducing best practices throughout the nation, and improving quality indicators, will be high priorities, which will require significant effort and resources in the immediate future.

The investment requirements of the electricity sector during the coming years will place an unprecedented burden on the budget and the financing capacity of the public

sector. Any attempt to meet these requirements with public resources alone may not only put at risk the modernization and expansion of the electricity sector, but also divert funds essential to meeting other basic needs of Mexicans. The participation of the private sector in the electricity industry will reinforce the ability of the government to attain high priority objectives for social development and combating poverty.

Investments in the generation, transmission and distribution systems cannot be delayed. To go without these investments would put at risk the supply of electricity in the conditions required by a competitive economy, and would also undermine the ability of the national economy to create jobs.

Technological change

Organization of the electricity industry into vertically integrated monopolies is no longer necessary in view of technological advances and a reduction in economies of scale. Today there is no justification for maintaining monopolies in the generation of electricity, nor for preserving vertically integrated utilities.

During recent years, technological advances have altered the scope for participation and competition in the electricity sector. In generation, advances in both the durability of materials and manufacturing methods for combined cycle and gas turbine generator units have reduced the economic size of generation plants, and at the same time increased their efficiency, and cut their construction times and operating costs. As a result, it is now possible to introduce competition between generators, through the operation of an energy market open to many participants.

Furthermore, technological developments in communications and information technology have allowed significant improvement in the quality and reliability of transmission and distribution grids. As a result, various countries have opened up access to their transmission and distribution grids so that generators and users can choose who they deal with to buy and sell electricity. Hence, the justification for maintaining vertically integrated monopolies in the electricity industry has disappeared.

Reform experiences in other countries

In recent years, several countries have faced up to the challenges of developing their electricity industry. The solution employed by most countries is to promote structural change in the organization of the sector. This involves the move from a monopolistic, vertically integrated electricity industry to a disaggregated industry, with conditions for effective competition in the generation and sale of electricity, regulation of transmission and distribution, and with private participation playing a large role.

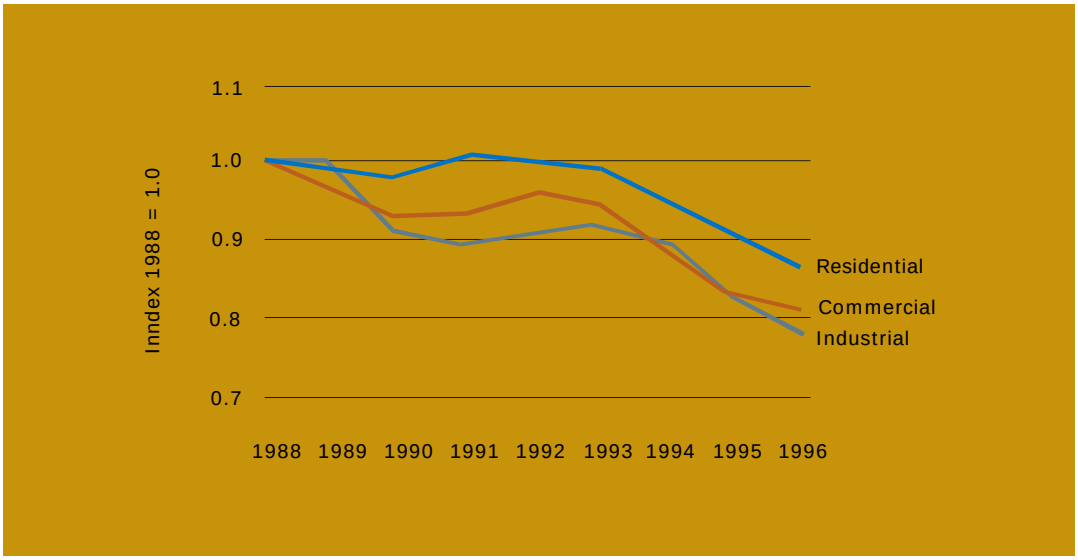
Some of the countries that have carried out this type of change are Argentina, Australia (Victoria), Bolivia, Canada (Alberta), Chile, Colombia, El Salvador, England, Guatemala, New Zealand, Norway, Peru, Spain and the United States (California and the Northeast states), amongst others.

England

England and Wales restructured their electricity industry in 1990. Even though they did not have a problem of demand growth, they did have a large number of obsolete high cost plants that needed to be replaced. The utilities insisted on the need for the state to build new electricity plants. However, the government opted to create an institutional framework for developing a competitive market and allowed new generating companies to compete using the latest technologies. In this case, the new capacity added since restructuring has been greater than necessary to meet demand and cheaper than initially forecast. The results have been as follows:

- Approximately 15 GW of new capacity has been built. Most of this capacity has come from low cost combined cycle gas turbines. The new plant has replaced less efficient and more polluting coal and oil-fired plant;
- New generating companies built approximately half of the new combined cycle gas turbine plants;
- Entry prices for new generators turned out to be 20 percent lower than forecast; and
- As a result of lower production costs, real electricity prices were reduced significantly, mainly in the commercial and industrial sectors.

Figure 1
Real electricity prices in the United Kingdom after deregulation (1988-1996)



Argentina

Argentina faced a chronic lack of investment in its electricity industry, high demand growth (over 7 percent per annum) and frequent supply interruptions. In response to this situation, a competitive energy market was introduced in 1992. Since then, the private sector has successfully financed the investments in generation, transmission and distribution and has eliminated the bottlenecks in electricity supply. The statistics are very informative:

- 2 GW of gas-fired capacity was added to the system and at least another 2 GW is under construction;
- Total installed capacity increased from 15 GW to 19 GW; and
- The number of generators increased from 14 to 45 (of which 40 are private).

In fact, there is currently excess capacity in the Argentine electricity market, which has lowered prices, directly benefiting consumers and the competitiveness of the economy. Nonetheless, the private sector still continues to invest in generation. In this case, the regulatory framework and expectations of growth have made investment in the electricity sector particularly attractive.

Guatemala

In 1996, Guatemala began a structural reform process in its electricity sector. The object of this reform was to split up the vertically integrated state monopolies in charge of electricity supply and to open up the industry to private sector investment. As in other countries, the definition of regulatory and institutional frameworks, the establishment of a competitive electricity market and the privatization of certain areas of the industry were the keystones of reform.

In the case of Guatemala, the government (mainly hydroelectric) and private generators coexist together in an electricity market that is operated by a private entity. All the industry participants are represented in this organisation to guarantee its impartiality. The transmission network is conceded to a state company, and the distribution systems to regional companies.

Less than two years after the reform process was begun, a number of private generation companies are participating in the market with new or recently-privatised plants. Additionally, the government recently concluded the privatization of the distribution companies in the capital of the country, receiving more than 500 million dollars. These resources, combined with budgetary savings from the operation and maintenance of the state electricity systems, have allowed the government to implement a national electrification program. With this program it was possible to increase electricity coverage from 40 percent of the population before the reform to 70 percent two years later.

Partial Reforms

Countries that attempted to introduce partial reforms have failed in their objectives. The reform experience in countries that made changes to their electricity industries without implementing a genuine restructuring has been one of inability to attract private investment or increase the capacity of the sector. To illustrate this, two examples can be cited:

- One Asian country established a model in which there was a central power purchaser with multiple tariffs, but no competitive electricity market. Interested investors required government guarantees to reduce the risks of their investment. However, the government was opposed to offering the necessary guarantees and the program had to be abandoned without a single MW having been installed.
- In 1992, a European country adopted a model where generators could either sell their production through long-term contracts or through a free market. No investors

participated in the free market because the fixed price in the long-term contracts was more attractive. As a result, the government assumed the risks of the projects, since it had to guarantee the financing and the profitability of investments.

Background to the Mexican reform

Reforms to the Electricity Law in 1992 (*Ley del Servicio Público de Energía Eléctrica*) created a limited opening for private participation in the sector from both foreign and domestic sources. This change recognised a need to bring the efforts of the private sector to expanding electricity supply, because of the financial limitations of the government. These reforms allowed participation in electricity generation to be made through self-generation, co-generation and independent production of electricity.

However, because of restrictions on self-generators and co-generators in the legal and institutional structure, the number of private participants is very limited. Furthermore, because the state utilities have the exclusive right by law to purchase power from IPPs, these projects require long-term contracts that, in practice, transfer many investment risks to the public sector.

Objectives of the reform

The Mexican government has developed a structural reform program in order to attract foreign and domestic private capital and to ensure that the country enjoys an efficient and competitive electricity supply. This program considers the particular conditions of the Mexican economy and its electricity sector and, at the same time, incorporates the best practices adopted in the reformed electricity sectors of other countries. The proposed structural reform takes into account the following considerations:

- The capability of the country to maintain a vital economy and to improve the living conditions of its people depends to a large extent on the expansion and modernisation of the electricity sector. Given the high growth rates of electricity demand forecast for the coming years, restructuring the sector is an inevitable step.

- Technological advances experienced during recent years enable the private sector to complement the government's endeavor to build up the electricity sector. A combined effort is the best guarantee that the country will have an electricity industry to match its potential for growth and to meet the aspirations of the Mexican people for progress and welfare. The state will exercise regulatory supervision over the electricity industry as a high priority activity in its development.
- The efficiency and the competitiveness of the national electricity industry will be promoted by an electricity market which will help to ensure that demand is met at every moment by the generation plants that offer the best terms for security, stability and price.
- The need to attain resources to pay for financial liabilities and labor costs of electricity companies and to establish a fund for the development of water infrastructure, as a high priority for the welfare of the people and development of the nation.
- The expansion of the electricity industry resulting from these reforms will convert the sector into one of the most dynamic parts of the economy.

Vision of the new industry

The structural reform proposed by the government is intended to establish an electricity sector capable of meeting growing electricity demand. The reform will make it easier to attract private capital, which will reduce the budgetary impact and the risks assumed by the state. The reform will also strengthen the regulatory powers of the government.

The public sector will continue to have exclusive responsibility for the generation of nuclear energy and the operation and control of the national transmission grid (electricity dispatch). In the other parts of the electricity industry the private sector will be able to participate fully.

Competition will be introduced in those activities of the industry where it is possible, especially in generation and marketing, which will be subject to a permit regime. The activities that are still natural monopolies, such as transmission and distribution, will be subject to a system of economic regulation, which will simulate competition conditions. The assets used in these regulated activities will be kept in state hands, so

a concession regime will be implemented to allow the private sector to operate them. Electricity distribution will be a public service.

The principal elements of the reform program can be summarized in ten points:

1. Transformation of the current state-owned entities of the electricity sector into specialized generation companies and distribution companies, and a transmission company to which the national transmission system will be assigned;
2. Creation of a decentralized government entity in charge of the system and market operations and of another state-owned entity responsible for nuclear generation;
3. Opening up activities of the electricity industry to domestic and foreign private investment;
4. Establishment of a short-term wholesale electricity market through which the generators will sell their energy in competitive conditions and in which the price will be freely determined;
5. Open access to the national transmission grid, including the possibility of large consumers (qualified users) participating, directly or through marketers, in the wholesale electricity market;
6. Development of long-term bilateral contracts, whose terms will be freely negotiated between generators, distributors, marketers and qualified users;
7. Establishment of regulations to allow those electricity systems within Mexico that are not interconnected with the national transmission grid to operate under special circumstances;
8. Application of a transparent and effective policy of subsidies, with explicit social welfare objectives;
9. Definition of a mechanism by the *Secretaría de Energía* in which the expansion of the national transmission system is planned and incentives for the efficient and competitive development of the electricity sector are created, if necessary; and
10. Development of a clear, transparent and predictable legal framework that offers legal security to private investments and permits the *Comisión Reguladora de Energía* (CRE), as an independent authority, to regulate transmission and distribution systems in terms of pricing, investment and quality of service to benefit final consumers.

Organisation of the new electricity industry will require significant changes to the current legal framework. It will be necessary to reform Articles 27 and 28 of the Constitution and secondary legislation, as well as to issue a new *Ley de la Industria Eléctrica* (Electricity Industry Law) and new regulations. The new legal framework will establish the responsibilities of the electricity sector participants and will define the powers of the *Secretaría de Energía* and of the *Comisión Reguladora de Energía*.

Reform process and transition

In order to guarantee an ordered, smooth transition to the new electricity industry, the government intends to organise the reform process in three stages.

In the first stage, CFE and LFC will be transformed into a number of specialized state-owned companies including several generating and distribution companies and one transmission company. This stage will also see the creation of a basic regulatory framework, and the design of the electricity market as well as the creation of the government entity responsible for system and market operations and the government entity responsible for nuclear generation.

During the second stage, which sees the beginning of operations in the electricity wholesale market, generation and marketing will be opened up to domestic and foreign private investment. Generators will be able to set up bilateral contracts with the new distribution companies and qualified users, with or without facilitation by marketers. In addition, new concessions will be granted to transmission companies interested in developing networks that are not interconnected with the national transmission system.

Finally, the state-owned generation and distribution companies and the transmission company will be progressively privatized. This process will be crucial to ensure a comprehensive, successful transformation of the electricity sector. The government will be in a position to carry out the privatization of public enterprises beginning in December 2000.

Successfully completing each stage of the reform process and organizing an ordered transition will ensure that the final structure of the new electricity industry corresponds to the policy objectives set out in this document.

2 The current structure of the industry

Evolution of the electricity sector has been driven by the technological, economic and social features of more than a century of Mexican history. Initially the private sector was responsible for construction of the electricity infrastructure and the supply of service. Later, from the 1960s, when electrification of the nation was needed for national development, the Mexican government assumed exclusive responsibility for supplying electricity and for expanding supply coverage. Since then, the state has dedicated significant financial resources to supplying electricity to the nation, making the development of industry and services possible, and allowing a growing number of Mexicans to enjoy the benefits of electricity.

Characteristics of the electricity sector

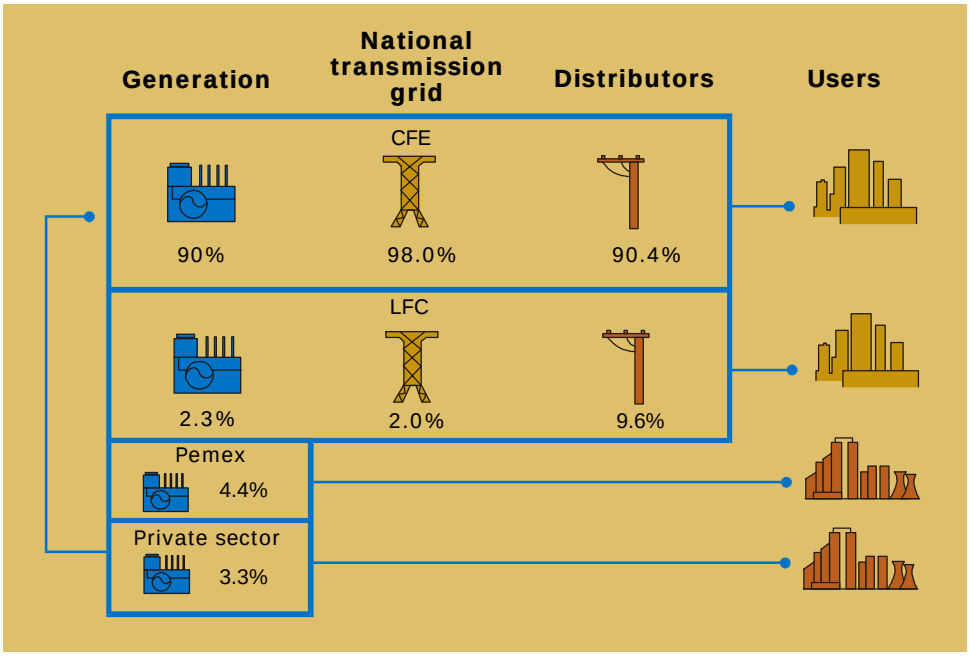
The generation, transmission, distribution and sale of electricity for public service are activities exclusively carried out by the *Comisión Federal de Electricidad* (CFE) and *Luz y Fuerza del Centro* (LFC). CFE has an obligation to supply electricity as a public service to the entire national territory with the exception of the Federal District and part of the states of Morelos, Hidalgo, and Puebla, where LFC is the supplier.

The installed generation capacity owned by these two public entities accounts for 92 percent of total capacity. The rest is owned by outside firms, including *Petróleos Mexicanos*, private self-generators and co-generators. In the near future, several IPPs will begin operation.

The installed generation capacity of the national electrical system is 36.1 GW, of which 53 percent corresponds to conventional thermal units, combined cycle units

and gas turbines; 28 percent to hydroelectric generation; 7 percent to coal; 6 percent to dual fuel units designed to burn either coal or oil; 2 percent to geothermal (in which Mexico is the third largest electricity generator in the world); and the remaining 4 percent to nuclear (a single station at Laguna Verde, Veracruz). The capacity consists of 168 generation stations, made up of 570 units. Of these stations, 79 are hydroelectric and the remainder is thermal, besides the one nuclear power station, one wind-powered and five geothermal stations.

Figure 2
Current structure of the industry



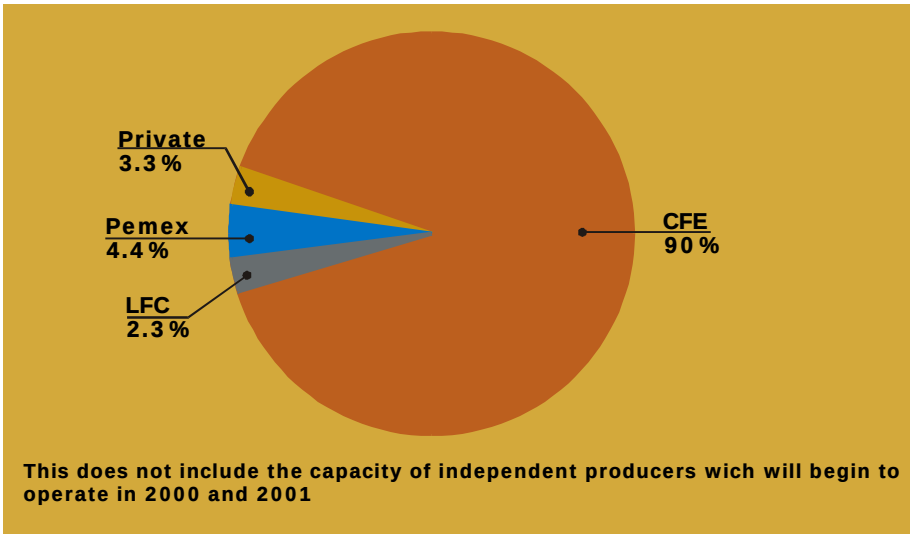
The electricity system is interconnected through two transmission networks, one covering almost the whole country, and the other serving the Baja California peninsula. For technical and economic reasons, the peninsula remains isolated from the rest of the system. The transmission grid consists mainly of 400kV, 230kV and 115kV (high-tension) lines with a combined length of 74 thousand kilometres. The distribution systems, which include medium and low-tension lines, have a combined length of 592 thousand kilometres.

It is estimated that in 1998 the number of users increased by 612 thousand to reach a total of 22 million users. All users are supplied by the two government-owned entities. Around 95 percent of Mexicans have electricity supply.

The electricity sector is currently organised on the following lines:

- **Planning** is CFE's responsibility. The *Secretaría de Energía* oversees the planning of the national electricity sector, while LFC is in charge of planning its own distribution system;
- **Generation** is carried out by CFE (with 90 percent of total generation capacity), LFC (with 2.3 percent), co-generators and self-generators (Pemex 4.4 percent and privately owned 3.3 percent). Three IPP projects (Merida III, Hermosillo and Río Bravo) will begin operations in 2000 and 2001;
- **Electrical dispatch** is responsibility of CFE;
- **Transmission** is responsibility of CFE and LFC. In the case of private generators, transmission is provided through the national grid under interconnection contracts;
- **Distribution** is responsibility of CFE throughout most of the country (90 percent of national distribution capacity) and of LFC in the central area (10 percent). CFE and LFC have divided their distribution systems into business units with a view to decentralizing operations.
- **Marketing** is responsibility of CFE and LFC. Private co-generators and self-generators are only authorized to sell energy to CFE and they cannot market their electricity directly to third parties. The IPPs have long-term contracts to sell all their production to CFE; and
- **End Users.** Only CFE and LFC can supply electricity to end consumers. However, certain industrial users have opted for self-supply or co-generation arrangements.

Figure 3
Participation in the current generation capacity



Private participation in the electricity industry

In December 1992, the Electricity Law (*Ley del Servicio Público de Energía Eléctrica*) was reformed to allow private sector participation in generation. Despite this important reform, participation by the private sector has been limited. The existence of a monopoly in the marketing of electricity and the existing regulations make private investment in electricity generation unattractive without government guarantees. Under current regulations, IPPs can only sell their production to CFE under long-term contracts.

Also, because of the lack of a market in which to sell their surplus production, co-generators and self-generators only satisfy their own electricity requirements. Thus, generation projects are only bankable for private investors when producers consume all the electricity that they generate or when the production is sold entirely to CFE through a long-term contract from an IPP type project.

Expansion of the national electricity system

The increase in electricity demand will require investment of around US$25 billion in the next six years alone to build 13 GW of additional generation capacity and to modernize the transmission and distribution systems in order to meet international standards of quality and efficiency of service.

Expanding generation capacity in this timeframe implies an increase that represents almost one third of the currently available capacity and is equivalent to several decades of past expansions. Investment requirements will continue to increase during the coming years.

During the last three years, the strategy of the government has been to fund these investments using private financing through BLT and IPP projects. To date CFE has arranged BLT contracts totalling 4.1 GW and three IPP contracts totalling 1.1 GW, representing 11.6 and 3.1 percent of generation capacity, respectively. Bidding processes are currently under way for new IPP projects.

Table 1
CFE's electricity generation projects

Project	Location	Type	Date	Capacity (MW)	Investment (Millions of USD)
Samalayuca II	Chihuahua	BLT	1992	521.7	509.2
Cerro Prieto IV	B. California	BLT	1996	100.0	130.9
Rosarito III	B. California	BLT	1996	550.0	396.8
Monterrey I	Nuevo León	BLT	1996	489.9	391.7
Chihuahua	Chihuahua	BLT	1996	417.8	322.4
San Carlos II	B. California S.	BLT	1997	37.5	52.8
Guerrero Negro II	B. California S.	BLT	1997	9.0	16.1
Tres Vírgenes	B. California S.	BLT	1997	10.0	15.8
Mérida III	Yucatán	IPP	1996	531.5	290.0
Río Bravo I	Tamaulipas	IPP	1998	568.6	271.6
Hermosillo	Sonora	IPP	1998	252.7	114.6
El Sauz (Bajío)	Guanajuato	IPP	1998	475.0	300.8
Saltillo	Coahuila	IPP	1998	245.0	111.3
Altamira II	Tamaulipas	IPP	1998	450.0	191.2
Monterrey II	Nuevo León	IPP	1998	450.0	191.2
Tuxpan II	Veracruz	IPP	1998	450.0	191.2
Campeche II	Campeche	IPP	1998	245.0	114.5
TOTAL				**5,803.7**	**3,612.1**

The transmission grid has high electrical losses and some sections have capacity and reliability problems. This makes efficient utilization of generation capacity difficult.

The congestion of some transmission lines prevents some low cost generation plants from operating at their maximum capacity. This increases the total cost of electricity production. In recent years, the investments necessary to improve the performance of the transmission network and to increase its reliability, safety and quality of service have been delayed due to budgetary restrictions.

Due to overloaded distribution lines and equipment, the lack of investment in the distribution sector has been reflected in technical losses equivalent to 10 percent of low-voltage sales. The lack of investment is also reflected in non-technical losses due to a shortage of meters and other equipment. This has caused higher production costs, more intense use of fuels and deterioration in the quality and reliability of service.

Investments are needed in generation, transmission and distribution systems. Without these investments, the supply of electricity to the people, the competitiveness of the economy and, as a result, the productive sector's capacity for job creation, will all be in danger.

Impact on the public budget

The main problem of the current electricity industry is the strain on public sector finances caused by making large investments out of a limited public budget. This is particularly so when the budget lacks sufficient resources for other high-priority objectives such as public safety, programs to alleviate extreme poverty and other social programs in health and education.

The IPP program is not a suitable way of removing the investment requirements of the sector from the public budget. The IPP program presents the following disadvantages:

- Once the plants have entered operation, the annual payments made by the government reduce the availability of funds to finance other priorities of the public sector;
- The government assumes the majority of the risks associated with the projects, given the existence of CFE as a monopoly buyer and therefore the need for a long-term fixed price contract; and

- When these projects are financed through bank loans, they limit the ability of other Mexican private companies to issue debt. The international banking sector considers IPP contracts to be part of Mexico's global debt.

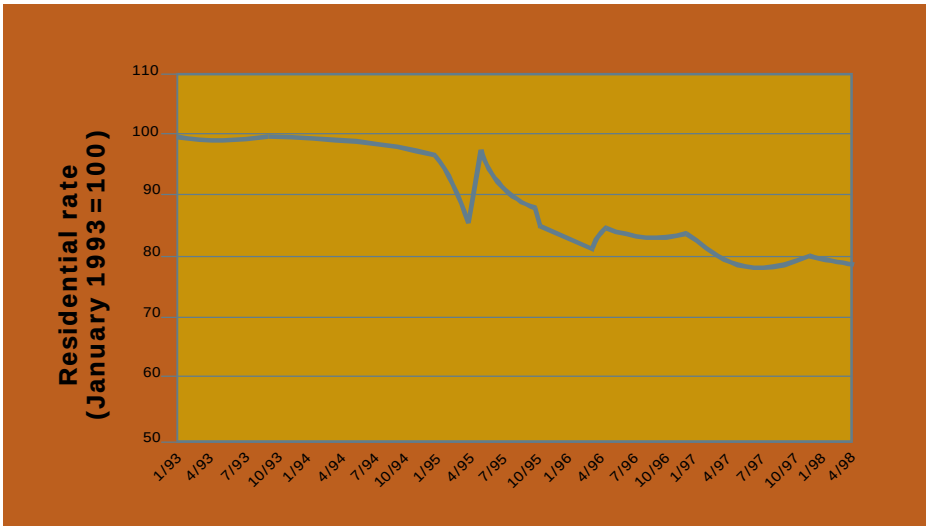
In competitive electricity markets in other countries, it has been demonstrated that private investors are prepared to assume the risks of their projects. When there is a competitive market, power stations are built without state guarantees, and without even the need for long-term contracts for the sale of generation. Therefore, the reforms proposed by the government will attract important private investment to the electricity sector on terms more favorable to the country.

Lack of commercial incentives

At present, the two entities in charge of electricity supply are operated as government departments with a strong impact on the federal budget. The budgetary importance of the electricity sector generates a conflict between the macroeconomic objectives of the government and development of the electricity industry. The control of inflation and national budget constraints, among other objectives, have a large bearing on the investment decisions adopted by CFE and LFC.

The government has set tariffs, not wholly on the objective basis of the industry's costs, but on the need to meet macroeconomic constraints. The tariffs for agricultural and residential use are not sufficient to allow CFE and LFC to recover their corresponding costs. To illustrate the magnitude of the subsidy that users receive, the difference between prices and costs in the residential sector is more than 50 percent.

Figure 4
Residential tariffs deflated by CPI
(Tariff class 1-200 KWh consumption)



There are excellent reasons for initiating or maintaining subsidies, but the current policy of giving them out in a general way through tariffs is putting the financial viability of the sector in danger. It would be preferable for any required subsidies to be made transparent and directed at those who really need them.

Due to the budgetary constraints, the government has been unable to fund necessary investments, particularly in the transmission and distribution sectors. The result is that some efficient generation plants are unable to get their power to the users. This increases the cost of electricity.

Lack of competition

Another disadvantage is the lack of competitive incentives within the existing structure; without which there are insufficient incentives to increase efficiency, even through the efforts of the Mexican electricity workers and technicians.

The IPP program introduced competitive bidding for the construction and operation of new power plants. However, this competition remains restricted to the initial award of contracts, after which the IPPs enjoy a protected price and a guaranteed market. Furthermore, the state assumes the principal risks of the project.

A truly competitive electricity sector has the effect of reducing costs and encouraging innovation. In a wholesale electricity market, competition exerts constant downward pressures on price. In those sectors in which competition cannot exist (transmission and distribution), economic regulation is introduced to impose the same incentives as competition. The current structure of the electricity industry does not provide any such incentives.

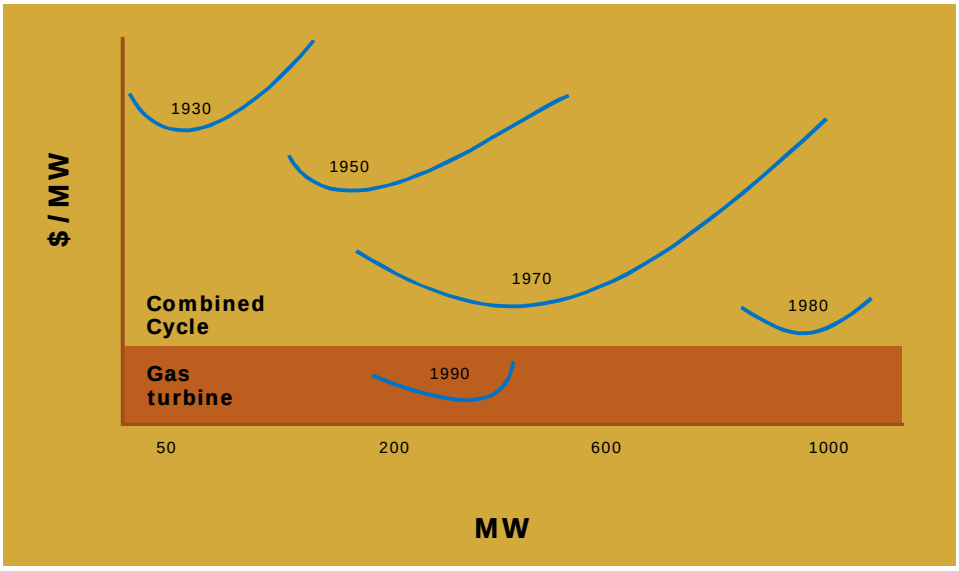
Lack of justification for continuing with vertical integration

Given the technological changes and reduction in the optimal size of efficient generating plants, organization of the electricity industry into vertically integrated monopolies is no longer necessary.

For decades, vertically integrated monopolies were the prevailing form of organization for electricity sectors around the world. The optimum plant size grew larger each year. For this reason electricity generation was thought to be a natural monopoly and it was more efficient for a single company to provide electricity in a given area. This was the prevailing organization structure until the 1980s.

However, today, there is no justification for maintaining monopolies in electricity generation nor is there any justification for preserving the vertical integration of other activities in the industry. The technological changes since the 1980s have reduced the optimum plant size. These changes are due to advances in the durability of metals, as a consequence of the space program, and to the introduction of combined cycle gas turbines, which operate on gas at high levels of efficiency.

Figure 5
Optimal plant size (cost curves 1930-1990)
Thermal plants



This permitted generators to compete using smaller plants, and to reduce their construction times. This also allowed small companies to finance new generation facilities and to site them in the most convenient locations.

Although the monopoly in generation is no longer necessary, the economies of scale and integrated operation still apply to the distribution and transmission wires within a

geographic area. For this reason these sectors must be still considered natural monopolies.

The ability to establish competition in generation has produced new ways of organizing the electricity industry. At the same time, the reasons that justified the vertical integration of generation, transmission and distribution have lost force due to technological changes in telecommunications and the ability to process large amounts of data at low cost. The participation of a large number of generation companies in the industry makes it desirable for none of these companies to control transmission or distribution.

In most of the countries that have restructured their electricity industries, distribution and transmission activities have been separated in order to introduce competition in generation and electricity marketing. Transmission is a service provided to a few users (generators, distributors, qualified users), while distribution is a service supplied to the general public. This implies that attention must be given to customers. Having several regional distribution companies permits distributors to be more responsive to the needs of their communities. It also facilitates regulation, because it permits the comparison of performance between distribution companies.

3 The new electricity industry

The vision of the electricity industry outlined in this document corresponds with a competitive sector, with largely private participation. The proposed institutional framework is similar to those which have been successfully applied in other countries over the last decade, and which have been subject to much scrutiny.

In the new electricity industry, the existing CFE and LFC will be broken up into specialized generation, transmission and distribution companies.

System operation and nuclear generation will be performed exclusively by new government entities as part of the federal public administration. The other electricity industry activities will be considered activities in which public and private sectors will participate.

Under the proposed institutional arrangement, generation will be in the hands of a large number of public and private companies. These will operate existing electric plants under 30-year, renewable permits. All generators connected to the national transmission grid will participate in the wholesale electricity market, and will compete to sell their output. In this way, competitive forces will be brought to bear, not only on green field developments, but also on the operation of existing plants.

Transmission and distribution activities will require a concession. These concessions will be granted for 30 years and will be renewable. The new concessionaires will be able to profit from the transmission and distribution systems, with the obligation of expanding and maintaining the assets. The new company in charge of the national transmission grid will be called *Red Eléctrica Nacional* (REN).

A new decentralised state-owned entity (COSEN, or *Centro de Operación del Sistema Eléctrico Nacional*) will undertake system operations and dispatch. This organisation will also be responsible for operating the wholesale electricity market.

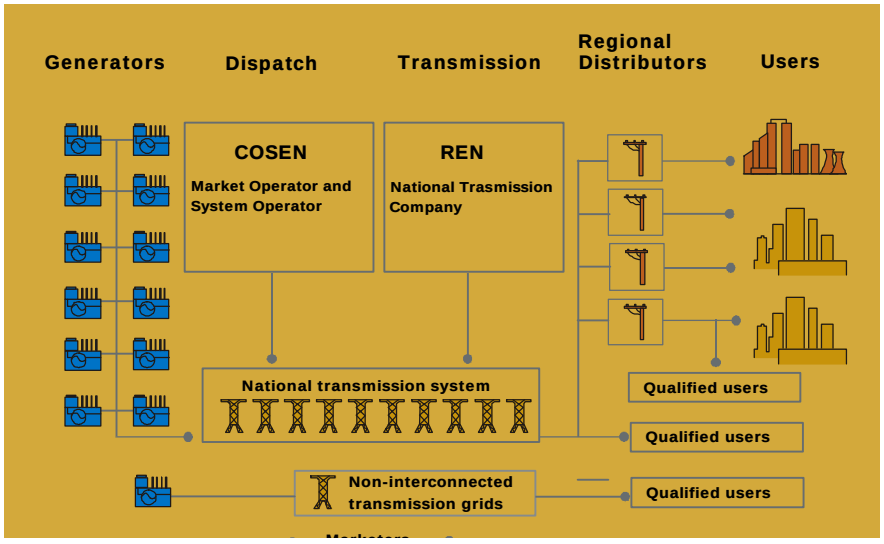
Large users (qualified users) will have the option of contracting for supply either with the distribution company or with the generators, both directly or through marketers.

Vision of the electric industry

The new industry will have many more participants than the current structure. The industry will be desegregated into different segments. For this reason, both CFE's and LFC's activities will be assigned to the following companies:

- A government-owned entity will be in charge of the generation of nuclear-electricity power;
- Generation companies will be responsible for the production of electricity;
- The transmission company (REN) will hold a concession for the national transmission system. It will be responsible for its expansion and maintenance, ensuring the transmission of electricity through high voltage lines from generators to the facilities of distribution companies and qualified users;
- Regional distribution companies will be responsible for transmitting electricity through medium and low voltage lines, and for supplying final users; and
- COSEN will control system operations, the electricity market and dispatch.

Figure 6
Vision of the new electricity industry



In the new electricity industry, generation companies will sell energy to distributors, marketers and qualified users in an open and competitive market.

The option of granting concessions to other transmission companies will also exist, allowing the development of new transmission lines by private interests, where these do not interconnect with the national system. Where such interconnection does occur, the infrastructure will form part of the national transmission system. In addition, marketing companies will be responsible for arranging energy trades among the different generators and between the generators and qualified users.

Introduction of competition and regulation in the sector

Functional segmentation of the electric industry and the creation of an electricity market requires the institutional framework to be adapted, in order to achieve a clear separation of activities and to strengthen the regulatory power of the state. The existence of natural monopolies in the transmission and distribution segments, as well as the technical and economic complexities of the industry, also requires strengthening the *Secretaría de Energía* (SE, Secretariat of Energy) and the regulator (CRE, *Comisión Reguladora de Energía*).

Competition in generation

The creation of a competitive electricity market is an essential element of the new proposed institutional framework. To guarantee private investment in the sector, and to establish an efficient system, it is essential for the development of generation companies to take place in a competitive environment with clear rules. Competition in the electricity industry will be focused particularly in generation.

The Laguna Verde nuclear plant will also participate in the electricity market. However, due to the nature of its activities, it will be subject to special operating rules for selling its output as a price taker.

The proposed industry structure anticipates the possibility that generators will sell their production through the electricity market or celebrate bilateral contracts with distribution companies, qualified users or marketers, allowing the creation of a short-term market and a long-term contracts market.

Economic regulation of transmission and distribution

Transmission and distribution of electricity are natural monopolies. The existence of more than one transmission or distribution company for the same zone would involve wasteful duplication. Since competition is not likely, the best alternative is economic regulation.

Within the proposed structure, the state will be entrusted with establishing methodologies to regulate tariffs and other conditions to protect users and to simulate competitive conditions wherever possible.

Generation companies

Within the proposed institutional framework, all generators connected to the national transmission grid will participate in the electricity market operated by COSEN. This competitive regime will create incentives for electricity plants to optimize efficiency by using better technologies and reducing their costs. This will translate into a reduction in electricity prices.

In order to define the assets that will be assigned to the new generation companies resulting from the restructuring of CFE and LFC and to ensure that the market promotes the supply of electricity at low cost, the following criteria will be applied:

- The existing electricity plants will be grouped by taking into account the size, type and location of each plant to guarantee effective competition;
- The balance of plant types, relative profitability, and relative accessibility to transmission capacity and fuel that result from these groupings will be taken into consideration; and
- The contracts held by CFE with independent power producers will be assumed by the new generating companies, subject to prior agreement between the interested parties.

The generation of electricity will require a permit, which will be granted by the CRE once the legal, technical and financial requirements established in the legislation and regulations are satisfied.

The generation companies will have to abide by official Mexican standards and other technical specifications. Authorities will verify that they do not engage in monopolistic practices. Apart from this, no other major requirements will be established for

companies wishing to participate in generation. On the contrary, new entry will be encouraged.

Transmission companies

The transmission assets currently used by the CFE and LFC will be assigned to the REN and will constitute, with the exception of some non-interconnected lines, the national transmission system. It will also be possible to grant concessions to other companies for the construction, operation and maintenance of new transmission infrastructure that is not interconnected to the national system.

The REN will be responsible for the switching, maintenance and expansion of the national transmission system, but not for operating the system, which will be COSEN's responsibility. In the case of transmission grids, which are not interconnected to the national system, the concessionaires will be responsible for operation, construction, expansion and maintenance of these grids.

The SE will be responsible for planning the expansion of transmission capacity. The transmission grid concessionaires will be obliged to expand the grid and to meet the quality standards contained in the terms of their concessions. The CRE will regulate the price, the quality of service and the investment requirements.

Distribution companies

The distribution companies will be responsible for construction, expansion, development, operation and maintenance of the distribution grids and for supplying electricity to final users.

The country will be split into separate distribution zones. The distribution grids of CFE and LFC will be divided up among several new companies, each one in charge of one distribution zone. In defining the number of new specialised companies and distribution zones, the following factors will be considered:

- The characteristics of the corresponding distribution zone;
- The minimum scale for efficient and profitable operation; and
- Existing standards of distribution in the respective regions.

Having many companies rather than a single company will provide benchmarks for comparing performance, and will sharpen incentives for increased productivity. Additionally, it will introduce competition in electricity purchasing.

Electricity distribution has the characteristics of a natural monopoly; therefore, the CRE will regulate the tariffs, service quality and investments of the distribution companies. Electricity distributors will operate existing assets under 30-year renewable concessions, granted by the CRE.

The distribution activity can involve the delivery and sale of electricity. However, where qualified users acquire electricity directly from generators or marketers, distribution will only involve the delivery of electricity. The distribution companies will be responsible for metering customers' usage, sending bills and collecting payments.

The government will maintain its commitment that electricity service will be available to all Mexicans. For this reason, the distribution companies will be obliged to meet all service demands within their concession zone that are economically viable. In the cases of electrification of rural as well as deprived urban zones, the government will guarantee their development through an investment support mechanism.

The CRE will also be able to grant additional concessions to provide a distribution service in a specific area as a sub-distributor. This implies that distribution companies will not retain exclusivity within their zones.

Users

There will be two types of electricity customers: distributor-supplied users and qualified users, who will have a choice of supplier.

Distributor-supplied users

Distributor-supplied users will be those who have relatively low consumption, such as small- to medium-size companies and residential consumers. These users will receive a bundled service from their distribution company, which will include the delivery and the sale of electricity. The price paid to the distributor will be regulated and it will integrate the costs of electricity and the corresponding transmission and distribution tariffs.

The reform will permit these users to benefit from competition in electricity generation and from the incentives on the transmission entity and distribution companies to improve their efficiency and reduce costs. This will have a positive impact on the consumer's end prices.

Qualified users

Qualified users will be those who have high consumption, such as large industrial companies. Qualified users will initially be required to register with the CRE and to demonstrate that they consume more than 5.0 GWh annually. The CRE will have the power to progressively relax this restriction. Currently, there are around 350 users with these characteristics, and their combined demand sums to about 30 percent of Mexico's total generation capacity.

For this type of user, the benefits of choosing a supplier can be greater than the cost of contracting the integrated supply with the distribution company. For this reason, qualified users will be able to acquire energy from a generation company, the electricity market, marketers or to contract their supply from the distribution company of their region. Where necessary, a qualified user can also contract with the distribution company for delivery of electricity only.

Marketers

Marketers will be able to buy electricity from generating companies and in the electricity market, and to resell it under special conditions to distribution companies and qualified users. They will also be able to participate as intermediaries between buyers and sellers. In most competitive markets, this marketing activity has been developed by generation and distribution companies.

The principal benefits for the new electricity industry offered by marketers are the following:

- Aggregation of services, according to the needs of different users;
- Risk management;
- Price arbitration; and
- Independent and flexible financing plans.

Within the proposed institutional framework, the marketing activity will be competitive and prices will not be regulated. Generating and distribution companies will only be permitted to market electricity through independent subsidiaries. Furthermore, distributors will only be allowed to do so outside of their own service area. The marketing activity will require a permit, to protect consumers. Permits will be granted by the CRE, to anyone who can meet pre-determined standards.

System and market operator

The national transmission grid constitutes the physical system through which electricity is sold to or acquired from the electricity market. The system's operation will therefore be of crucial importance. For that reason, it is proposed that this function be assigned to a government entity.

Independent system operator

The system operator will be independent of other market participants, in order to avoid conflicts of interest and discrimination. Moreover, as the users of the system fulfill commercial transactions with each other, one of the fundamental requirements of the new system will be the guarantee of non-discriminatory access through clear rules and procedures.

The principal responsibilities of COSEN as the independent system operator will be the following:

- To maintain the security of the system;
- To balance supply and demand through the co-ordination of generators;
- To dispatch the system at least cost and to manage constraints on the grid in an efficient manner;
- To obtain ancillary services for transmission;
- To run emergency procedures when the system is at risk; and
- To co-ordinate maintenance programs for generation and transmission.

Market operator

While the system operator controls the physical system, the market operator controls the financial flows of the system. The principal responsibilities of COSEN as the market operator will be the following:

- To ensure that market operation rules promote a competitive market;

- To administer the electricity wholesale market and to determine the price according to market operation regulations;
- To establish and to supervise metering and energy settlement systems;
- To collect the charges for transmission from distributors, generators and qualified users, and to pay the REN for use of the national transmission grid;
- To collect charges for ancillary services and to pay those who provide them; and
- To contract for risk management in the financial markets in order to prevent extraordinary price increases in the electricity market.

In most of the countries where successful restructuring has taken place, the functions of the independent system operator and of the market operator have been combined within one body. Based on these experiences, this structure will also be adopted in Mexico.

COSEN

The law will create a public body called COSEN (*Centro de Operación del Sistema Eléctrico Nacional*) to carry out the system and market operations. COSEN will be a not-for-profit entity and will act independently of other industry participants. Furthermore, COSEN will advise the SE with respect to planning the expansion of generation and transmission.

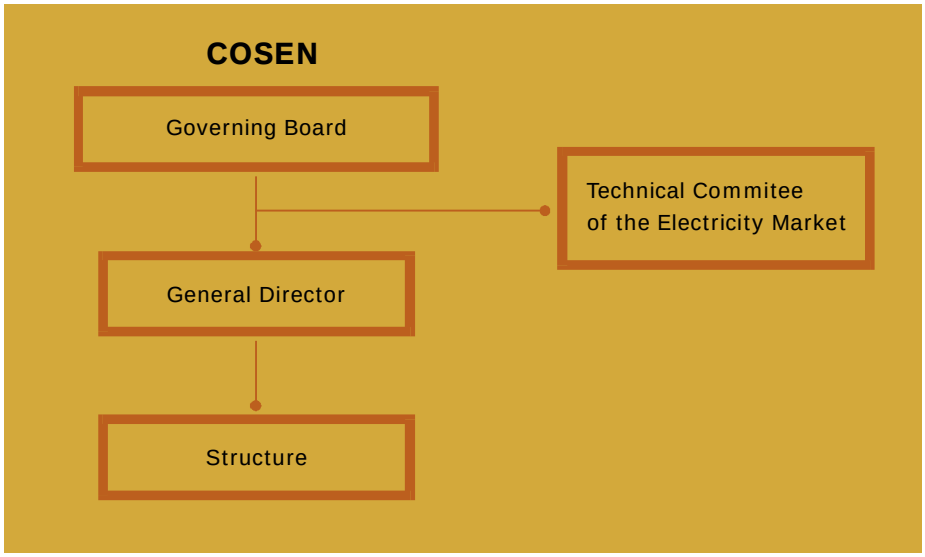
To assure its independence, COSEN will have a Governing Board of nine members, all of whom will be appointed by the Secretary of Energy. Each segment of the industry will have a representative, one proposed by generators, an other by distributors, an other by transmission companies and an other that represents qualified users. The five remaining members will not represent a particular constituency. The standards of technical capability and professional experience of the members will be established by law. At least five members of the Board will have to be active public servants. The Secretary of Energy will name the President of the Board. The Governing Board will name the General Director of COSEN. The Secretary of Energy will have veto power over this nomination.

The purpose of the Board will be to supervise the management of COSEN's activities, with a view to serving the competitive market as effectively and efficiently as possible. In this regard, the Board will monitor the performance of the General

Director to ensure that the various functions of COSEN are being discharged without excessive costs being imposed upon market participants. One of the principal functions of the Board shall be to decide whether to propose changes to the market operation rules, in accordance with the experience acquired in the process.

COSEN's Governing Board will have a special committee of representatives of market participants whose members cannot also be on the Board. This committee will provide technical input to the process of changing market rules.

Figure 7
COSEN's structure



COSEN will be a decentralized entity of the federal public administration, independent of generators, distributors, qualified users and marketers. It must be independent of these groups, because its decisions can affect their income and expenses. To ensure private sector interest in the industry, it is essential that potential investors have confidence in the rules of the game being fair and transparent. COSEN must provide this confidence by assuring investors that the wholesale electricity market will be handled in a non-discriminatory manner.

COSEN also needs to be independent from REN for similar reasons —it will make decisions that will affect the profitability of REN. The separation of COSEN from

REN will also bring about a framework that is easier to design, administer and enforce. It will avoid conflicts of interest and be more transparent.

Institutional development

A fundamental element in the reform process for the electric industry is the technical, functional and legal strengthening of the institutions responsible for supervising the efficient operation of all participants. In this sense, the SE and the CRE will have important roles in the development and orchestration of structural change in the sector.

Secretaría de Energía

The SE will carry out energy policy and lead the structural change in the electricity sector. Furthermore, it will plan the electricity system with respect to expansion of generation and transmission. The planning of generation will be indicative to provide investors with signals about opportunities that exist. In contrast, the SE's prescriptive planning of transmission should assure adequate expansion of the sector.

The magnitude of these tasks makes it necessary to strengthen the SE with resources and capable personnel, even involving the transfer of some of CFE's and LFC's human resources.

Comisión Reguladora de Energía

The CRE is a professional body, independent of the SE with technical and operative autonomy as provided by the Law of the Regulatory Commission for Energy. Until now, the CRE has essentially concentrated on natural gas regulation; therefore, its equipment and technical personnel will have to be appropriately strengthened to undertake its new responsibilities in the electric industry.

The CRE will be responsible for the technical and economic regulation of the electricity sector. The principal obligation of the CRE will be to protect consumers' interests in the short and long run. To encourage the confidence of consumers and new companies in the application of the new regime, the decisions of the CRE will continue to be autonomous and independent.

4 The electricity market

In the reformed electricity industry, the generation companies will be selling electricity to distributors, marketers and qualified users in an open competitive market, called *Mercado Eléctrico Mayorista* (MEM), or Wholesale Electricity Market. The MEM will be operated by COSEN, which will conduct the daily scheduling process and real-time dispatch of generators using the national transmission system.

The first step to establish the MEM will be the creation of the COSEN as an independent body. This chapter describes the proposed operation of the MEM and its relationship with the long-term bilateral contracts market.

Operation of the MEM

COSEN will operate the MEM, in conjunction with its responsibility to dispatch the system economically and reliably. Since the MEM operates close to real-time dispatch it must be subject to more rules than ordinary markets. These rules ensure that the electricity supply system provides a sufficient and reliable supply of power at the moment when trades are fulfilled.

The rules of the MEM will be issued by COSEN. The initial market rules will be developed as part of the restructuring process, under the supervision of the SE and CRE, and will be passed to COSEN for implementation. COSEN will be responsible for the dispatch of the energy produced by the generators and the control of the national transmission system and will set spot prices according to the market operating rules. COSEN will dispatch the generating units so as to meet load at minimum cost.

To operate the MEM, COSEN will carry out the following activities:

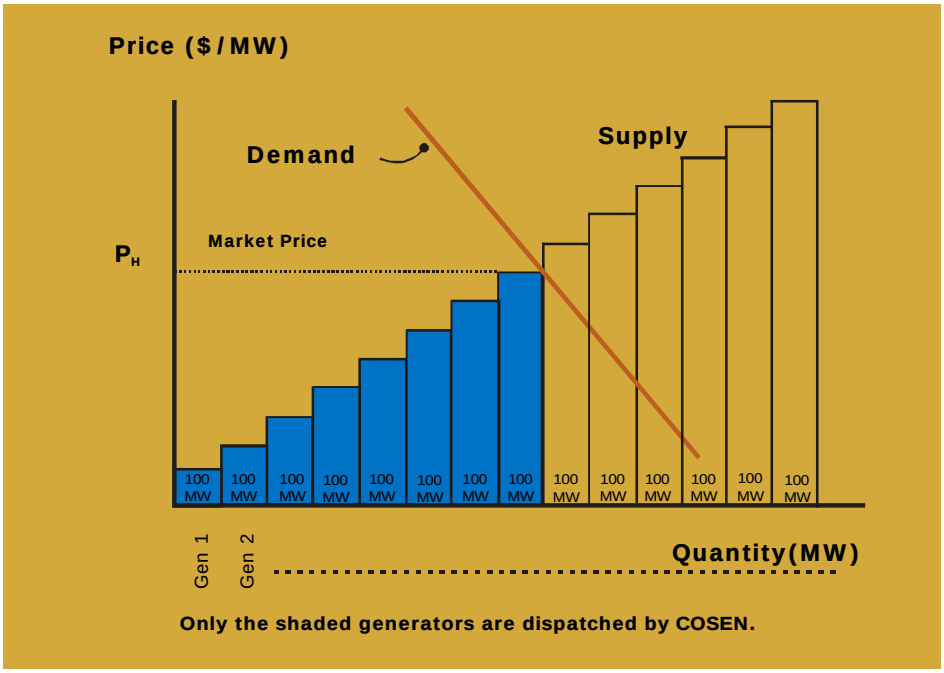
- Process information from the generators with respect to available energy and the prices they are prepared to offer, by each generation unit;
- Determine the level of load to be purchased by the distributors and the qualified users;
- Use the information from these two sources to issue instructions to generators so that supply equals demand at the lowest possible cost, allowing for transmission constraints;
- Determine the market prices according to market rules; and
- Provide the mechanisms through which buyers pay for energy acquired and sellers charge for energy provided.

MEM price formation

Generators will submit their offers for sale of electricity one day prior to dispatch (pre-dispatch), indicating the quantity of energy available and the minimum price they are prepared to accept for it. COSEN will aggregate these offers to form a "supply curve". It will select the lowest price generator offers, in order to minimize the total cost of supply.

The rules will specify that the price paid to all generators be equal to the offer of the last (most expensive) generator dispatched in each generation hour. This is called the Last Accepted Offer (LAO). All generators will be paid this price, and all purchasers will be charged this price. Generators whose variable costs are below this price will therefore receive a contribution towards fixed costs. Prices will be set for each hour. When demand is low, prices will also be low since only the more efficient generators will be operating. As in any market, when demand is high, prices will also tend to be higher.

Figure 8
MEM price formation



Locational energy prices

The description of price setting in the previous section assumed there were no transmission constraints on the system and that any generating plant could be dispatched to meet demand. When there are no constraints on the transmission system, the dispatch of generators will typically consist of an ordered list of the least expensive generators (as indicated by their offer prices) necessary to meet demand on the system at that time.

When for some reason the transmission system is congested, the least-cost dispatch may involve expensive generators running in some locations, while some cheaper generators are not running in other locations. In these cases, because of transmission congestion, it is impossible to transport additional energy from the cheapest sources to the locations where it is needed.

When there are transmission constraints and the overall electricity supply system is dispatched in a least-cost manner, the marginal cost of electricity will vary between different locations and hence, prices for energy will also vary by location. This is

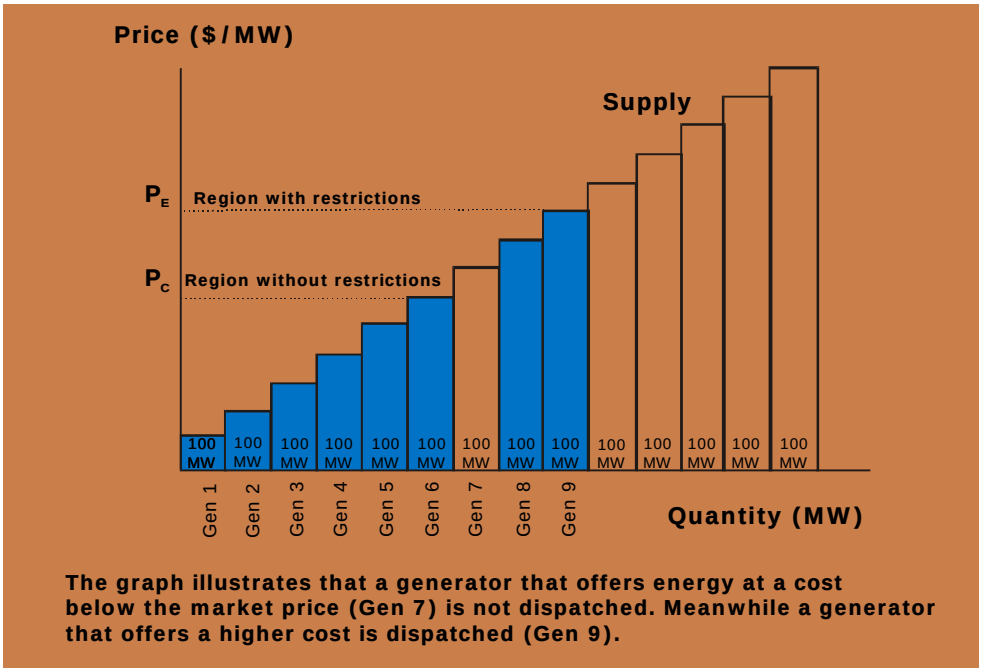
called locational pricing. Each location's price will be based on the generator which can produce an increment of energy for that location at least cost. The price thus incorporates costs arising from transmission constraints. These constraints mean that some regions will consume more expensive energy than regions where import restrictions do not exist.

Locational prices give appropriate signals for the production and consumption of energy and create incentives for the development of new generation and transmission facilities in the zones where they are needed. Generators in regions where energy is scarce will receive a higher price for energy than generators in the regions where energy is plentiful. This will encourage new generation facilities to be constructed in high priced areas, where new investments are needed, and discourage investment in areas where energy is abundant.

Locational prices provide the same incentives for consumers. High prices will discourage consumption where energy is scarce. Low cost areas will attract intensive users of electricity such as industrial plant.

Locational prices also provide signals for investment in new transmission facilities. A significant difference in prices between two areas indicates to the market that investments in new transmission facilities would be valuable. Additional transmission capacity would enable more energy produced at low cost to flow to high priced regions. The marginal value of the new transmission investment is equal to the price difference between regions. This can be compared to the cost of the new transmission investment to determine whether or not a new investment is profitable.

Figure 9
Price formation with transmission restrictions



Programming the energy dispatch

Pre-dispatch

COSEN will determine once per day the pre-dispatch schedule for the coming day, i.e. the schedule of generation and demand for each hour. Generators will submit offers to sell energy for the coming day. COSEN will determine day-ahead locational prices and quantities necessary to meet load. Generators will have to provide price information one day in advance. Those generators making commitments in the pre-dispatch will either generate to meet their commitment, or will be required to purchase energy from other generators in the market. This process will take place automatically through a defined settlement mechanism.

There are many advantages in having forward markets where the price is determined the day before. Most generation plants cannot increase their production suddenly, but require advance notice. Advance planning is especially needed to co-ordinate hydro and thermal generating plants. The pre-dispatch also facilitates the scheduling of generators for the quantity they will generate on the following day.

Forward markets also provide price certainty to the generators. They will know the price they will receive for their output in advance of operating and incurring any costs. Furthermore a generator knows that if its offer is accepted by COSEN in the day-ahead market, the price it will be paid will at least equal its offer price.

Real time dispatch

Actual consumption can be higher or lower than the forecast levels. Generation that was scheduled in advance may not be available in real time due to operating problems. Alternatively, generating plants may return from maintenance earlier than expected, increasing the amount of generation available for dispatch, or the clearing price in the day-before market may be such that the generator prefers to let someone else generate in his place.

COSEN will select the generators with the cheapest offers to meet customer demand, subject to maintaining system security with available transmission capacity. COSEN will calculate locational prices. These real-time prices will be used to settle any deviations between what generators and purchasers actually produced or consumed, and the day-ahead quantities. Generators will be paid or charged the real-time price for the differences between their day-ahead sales commitments and the quantity actually produced.

Setting prices when capacity is limited

In a competitive market the price for electricity is based on the variable cost of generation. However, it is possible that the variable costs not be high enough to incentivize construction of new plants. Generators have to be able to recover their fixed costs, including a return on investment.

For example, during the peak demand hour of the day, the price of the market must be higher than the variable cost of the last generator running, or that generator would never have an opportunity to recover its fixed costs.

CFALLA

In order to provide incentives for sufficient capacity to be available during periods of peak demand, the government is considering the adoption of a method similar to that now used in UK, Australia and Argentina. In those countries, a form of capacity payment is incorporated into the hourly energy price. The payment is based on two factors:

- The estimated value to consumers of energy not served (the cost of failure or CFALLA); and
- The probability that failure will occur (the loss of load probability or LOLP).

The price fixed by MEM will incorporate a component of CFALLA when demand is close to the available generation capacity. This will provide compensation to the generation units that are available for dispatch.

Because of this mechanism, generators will be incentivised to invest in new generation capacity with the expectation of obtaining the highest MEM prices, when demand is at its highest. The CFALLA mechanism will have the benefit of assuring that generation will be available when it is most valuable —when the possibility of shortage is highest. It will also incentivize those consumers on an hourly tariff to reduce consumption during those hours.

Price adjustments for capacity restrictions

Unlike other goods that can be stored, electricity requires this type of payments because the market must instantly balance supply with demand. In shortage situations, buyers and sellers have very little time to adjust their offers and their production decisions. The markets for other goods do not have to reach equilibrium as rapidly and they have time for offer prices to increase during times of shortage and for consumers to reduce their consumption when the price rises.

Normally, the price paid to all generators will be equal to the offer of the last generator dispatched in each hour. However, to help guarantee reliable operating conditions during periods of high demand, this market price rule will be modified when reserve capacity margins are low. The market price is thus defined as the weighted average of two factors: the price of the last accepted offer to generate (LAO) and the cost of failure (CFALLA). The weight is the loss of load probability (LOLP). The formula for the market price is therefore:

$$\text{Market price} = LAO * (1-LOLP) + CFALLA * LOLP;$$

where: $0 \leq LOLP \leq 1$.

It follows that the greater the surplus capacity (high reserve margin), the smaller is the loss of load probability (LOLP) and the market price will be determined almost entirely by the offer price of the last generator dispatched (LAO). Generators would

add capacity when the expected sum of all these payments over all hours of the year was greater than the cost of installing new capacity.

Extraordinary capacity and price hedging mechanisms

K Factor

To guarantee sufficient capacity margins, the possibility of granting the SE the power to introduce additional incentives for new generation investment will be studied. These incentives will include a capacity payment through what is called a K Factor payment. Generators that are part of this scheme will receive this payment for available capacity. The K Factor payments will be charged to the distributors and thereby passed on to consumers.

The K Factor will be applied as an annual fixed payment to new generators per KW of available capacity. The SE will define the required capacity, which will receive this payment. The size of the K Factor payment would be decided by auction. Generators would be invited to bid for a supplemental annual payment. Those with the lowest bids would be chosen, up to the specified amount of capacity required by the SE. The winners of the bids would only be paid the K Factor when their plant is available. The need for this K Factor payment will diminish, as the MEM becomes established.

Price hedging

In addition, to offset the possibility of high prices in years with unusual climatic conditions (e.g. dry hydro years) there will be an obligation to purchase price hedging instruments. COSEN will arrange this service on behalf of customers. The fees for the service will be allocated among the distribution companies, and passed on to the consumers. If the market price were very high, COSEN would apply hedging to reduce prices that customers have to pay. In this way the costs for users will be smoothed between normal years and years with high prices. Qualified users may arrange these contracts for themselves, if they so wish.

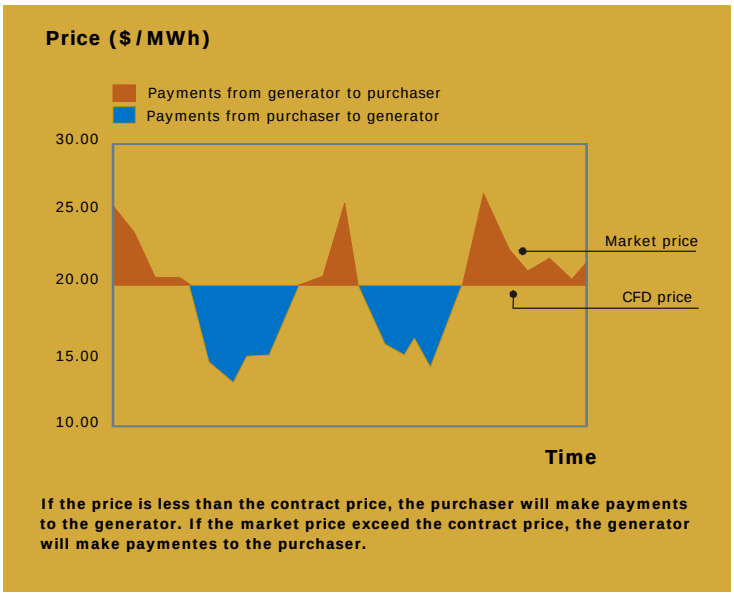
Bilateral contracts

The second element of the proposed electricity market is bilateral contracts. Bilateral contracts are needed due to the fact that the prices in the MEM vary according to time of day and season. To decrease this volatility generators will be able to make contracts with distributors, marketers and qualified users. These contracts will be freely

negotiated and will be for the long-term price of electricity. They will be in the form of financial contracts or contracts for differences (CfDs).

Figure 10
Contracts for differences (CfDs)

Contracts for differences are agreements to pay the difference between the price fixed



in MEM and the contract price. COSEN does not need to know about the bilateral contracts. Irrespective of whether a generator has a contract, it will submit spot market offers. Each generator will be paid by COSEN according to the price set in the MEM, independently of whether or not the generator has a bilateral contract.

In some hours, the market price will exceed the contract price. In these cases, the generator will make payments to the purchaser equal to the difference between the market price and the contract price. In other hours, the market price may be less than the contract price. In these hours, the purchaser will make payments to the generator, equal to the difference between the contract price and the market price. The payments for differences will be made independently of the payments in the MEM.

Ancillary services

The transmission system requires additional inputs so that the power is delivered to the customers at a stable frequency and voltage. These inputs are referred to as ancillary network support services. The main types of ancillary services that are necessary to the operation of the system include:

- **Frequency control or regulation.** This service provides the ability to maintain the system frequency at sixty cycles per second (60Hz). Generators are the only possible providers of this service.
- **Operating reserves.** Operating reserves provide additional generation capacity in the event that generating sources fail while in operation or demand increases unexpectedly. This service includes instantaneous reserves (provided in a very short time scale by units that are on line and generating), and non-instantaneous reserves (provided by units that can be started within a given time). These services are provided primarily by generators, although customers may be able to provide reserves through load reduction. Arrangements for load reduction will be voluntary and will be compensated through an interruptible load tariff. In order to supply the service, customers must be able to respond to COSEN's instructions.
- **Voltage control.** This service will be provided by generators and the transmission company at the request of COSEN. Voltage control involves the production or absorption of reactive power (VARs) in such a way as to maintain the voltage in the system within acceptable limits.

- **Black-start services.** Some electrical energy is needed when generating plants first start. Black-start services are provided by generators that can begin operation without taking energy from the network. These units assist in the restoration of the system (start-up of the remaining generators) when a general blackout occurs.

COSEN will be responsible for defining standards for provision of ancillary network support services, and for purchasing them as economically as possible. COSEN will pass the costs through to market participants.

Metering and settlement

COSEN will be responsible for arranging billing and settlement in the MEM. The market rules will guarantee that generators are paid for electricity they produce and ancillary services provided, and that distributors, marketers and qualified users connected to the national transmission system pay for electricity they consume.

The distribution companies will be responsible for metering, billing and collection for the services that they supply to their customers. COSEN will not have any participation in the bilateral contracts market.

Finally, COSEN will specify the necessary metering requirements for generators and purchasers. Since prices in the MEM will vary by hour, all settlements must take place on an hourly basis, in order to account for the differences in prices. In order to account for what is purchased and sold in each hour, accurate meters capable of measuring hourly consumption and demand will be required.

5 Regulatory framework

The new institutional framework of the electricity industry will require significant changes to the current legal framework and a large number of new regulations. The new regulations will establish the responsibilities of the players that will participate in the electricity sector and will define the responsibilities of the *Secretaría de Energía* and the *Comisión Reguladora de Energía*. To achieve this it will be necessary to:

- Amend the Mexican Constitution;
- Pass a new law governing the electricity industry (*Ley de la Industria Eléctrica*);
- Modify the Ley de la Comisión Reguladora de Energía and other laws;
- Establish regulations to implement the *Ley de la Industria Eléctrica*;
- Grant operating concessions and permits for companies in the industry;
- Create official Mexican standards for operations and maintenance in the industry;
- Issue directives drawn up by the CRE; and
- Issue the operating rules of the MEM.

General principles of regulation

The participation of public and private sectors in the electricity industry will require a clear and transparent legal framework, as well as a stable and independent institutional framework that gives certainty to all participants.

The regulatory framework has as its objective to create an efficient structure for the industry and to combine the economic regulation of natural monopolies (transmission and distribution) with the promotion of competition in the potentially competitive activities (generation and marketing).

Regulation will be designed with the additional objective of attracting new investors to the sector, promoting their efficient operation, and allowing them to obtain reasonable profits. The authority will not intervene in the industry sectors where there is effective competition.

Economic regulation

Economic regulation is a relatively new concept in the Mexican energy sector. It will play an important role in the development of the electricity market. Regulation is a substitute for competition in those areas in which competition is not possible, or when competition is in its initial phase. One of the main objectives of regulation is to protect consumers against the market power of companies in certain sectors, which can be exercised to the detriment of consumers.

The regulator will use instruments such as control of prices, costs, investment and quality of service. To avoid conflict of interest, the regulator must be independent of whoever fixes the macroeconomic objectives of the country. Any conflict of interest could negatively affect the competitiveness of regulated companies. For example, the fixing of tariffs in the regulated sectors should not be a response to the inflationary objectives of the government, but to the cost structure of providing the service. Regulation must provide incentives so that companies that participate in the regulated sectors operate efficiently.

The objective of the reform is to introduce competition to generation and energy marketing, allowing the market to control the price of energy. The transmission and distribution companies will have to be subject to regulation of tariffs and quality of service.

The regulatory authority

CRE will be responsible for economic regulation of the electricity sector. Its principal function will be to protect consumers' interests in both the short and long term. In the short term consumers require that the CRE establishes standards for quality of service and that it regulates the transmission and distribution tariffs. In the long term, consumers will need a reliable supply, i.e. a sufficient supply of electricity at an adequate price and quality. Therefore the CRE will have to monitor the application of the regulatory framework so as to:

- Attract sufficient capital to the sector;
- Encourage efficient operation of the companies; and
- Avoid excessive intervention in the decision making of the participants.

The CRE's main responsibilities in the electricity sector will be:

- To monitor compliance with the regulations, for which the CRE will have the power to demand financial and operating information from regulated companies;
- To grant permits and concessions;
- To issue rules which apply to regulated activities;
- To promote competition between participants and coordinate with the *Comisión Federal de Competencia Económica* (Federal Competition Commission) for the control of anti-competitive practices;
- To establish the bases for tariff regulation and to establish quality standards for the provision of transmission and distribution services;
- To approve and verify the investment plans of the transmission and distribution companies;
- To provide mechanisms for the solution of disputes between industry participants (customer complaints will be handled by PROFECO, the consumer protection agency of the government); and

- To impose sanctions for non-compliance with the regulations.

Permits

Generators and marketers will not be subject to economic regulation but will be required to obtain a permit from the CRE to carry out their activities, without prejudice to the other federal and local regulations that establish the applicable legal arrangements. Permits for electrical generation will be granted for 30 years and permits for marketing will be granted for five years. Both types will be renewable.

Concessions

The transmission and distribution companies will be subject to economic regulation by CRE and will require concessions to use the corresponding infrastructure. Concessions will be granted for 30 years. They will be renewable and they will not confer exclusivity. The companies holding the concessions will be obliged to offer open access to the wire networks at regulated prices.

Transmission and distribution tariffs

The transmission and distribution of electricity will be subject to a price-cap tariff regime. The tariffs will be re-set every five years and will be calculated for each company, depending on the company-specific costs, the investments that they have to make, the anticipated maintenance programs and a reasonable return on investment. The regulated transmission tariffs will include the charges levied by COSEN and the costs of ancillary services.

At the beginning of each five-year period, the CRE will establish initial tariffs through a cost of service methodology. These tariffs will be updated between tariff reviews using a mechanism of incentive regulation. The adjustments to the initial tariffs will consider the effects of inflation, movements of the exchange rate, productivity improvements by the companies and unexpected changes to factors outside the control of the concession holders. The following factors will have to be considered:

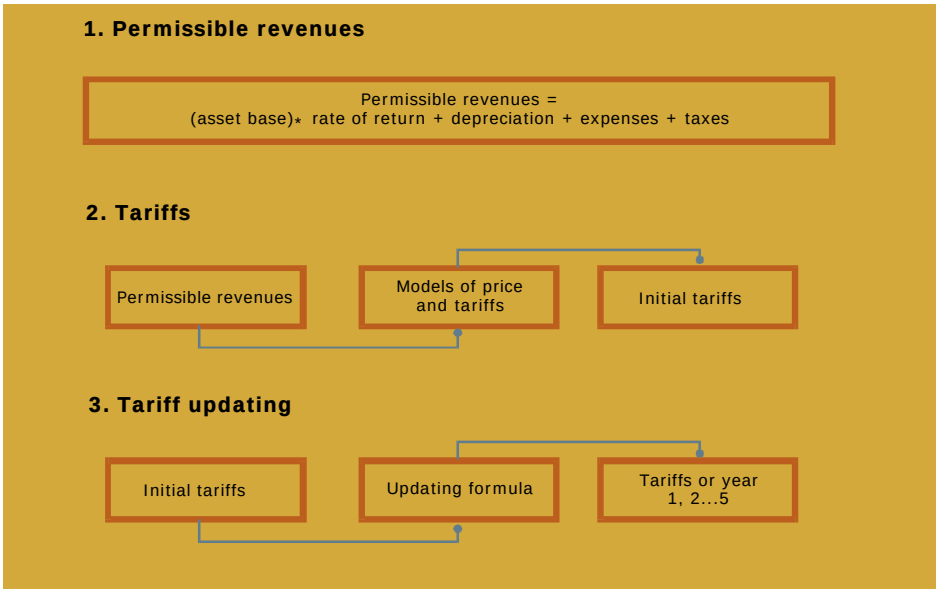
- A price index for the industry that incorporates the effects of inflation and shifts in the exchange rate on economic activity;
- A parameter that reflects long-term trends in companies' productivity growth.- Productivity earnings should be shared with users through lower real tariffs. The parameter will be defined by the CRE using an objective methodology in consultation with the regulated companies and will be established at the same time as the five year tariff review; and

- Unexpected costs outside the control of the concession holders.- These costs will be transferred to users. Examples are the modification to the tax rate or the creation of new taxes which had not been anticipated in the five-year review.

Incentive regulation is effective in incentivizing companies to reduce production costs and to avoid over-investment. This type of regulation separates the price companies receive from the costs they incur, in much the same way as competitive markets do. Companies will be able to retain savings from additional efficiency gains during the five-year period between tariff reviews. After five years, when the tariffs are reviewed these savings will translate into additional benefits for consumers, through the fixing of lower real tariffs.

In summary, the concession holders' tariffs will be defined on the basis of the costs of service, including a reasonable return on investment. These tariffs will be revised every five years. At the end of this period, these tariffs will be reviewed to initiate a new cycle. This tariff framework has been used in other parts of the world and has proved to be a successful and acceptable approach for both consumers and investors.

Figure 11
Tariff methodology



Price formation for end users

Prices for end users

In general, the price to consumers will be made up of the price of generation, and the transmission and distribution tariffs. The market (MEM) determines the generation price, while the transmission and distribution tariffs are regulated by the CRE.

For end users, the price of energy will be a weighted average of the cost of energy purchased directly in the MEM by distributors and the price fixed in their bilateral contracts, plus the corresponding transmission and distribution tariffs. Qualified users will be able to choose whether to contract with a generator, a distributor, a marketer or to purchase energy directly from the MEM. Thus, the price of energy for qualified users will be the price of the MEM or the contracted price, plus the transmission and, in some cases, distribution tariffs.

$$P_{\text{end users}} = \text{Avg}\,(P_E, P_C) + T_T + T_D$$
$$P_{\text{qualified users}} = (P_E \text{ or } P_C) + T_T + T_D$$

where:
P_E = price of the MEM;
P_C = contract energy price;
T_T = regulated transmission tariff; and
T_D = regulated distribution tariff.

Prices in the MEM will be calculated each hour and will be published daily. The consumption of qualified users will be metered hourly, so that their bills will reflect the cost of consumption according to the hourly price. This will encourage these users to reduce their consumption in those hours when the price is high, which contributes to the stability of the system.

Transmission expansion

There will be two methods of transmission expansion: the expansion undertaken by REN, as concession holder of the transmission system, and privately planned expansion. Furthermore, other concession holders will be able to develop transmission networks that are not interconnected with the national transmission system.

Expansion required of REN

REN will be required by the terms of its concession agreement to make investments in the transmission system. Under this scheme, expansion of the national transmission system will take place according to the following:

- REN will submit its proposed expansion plan to the SE. The *Secretaría*, with assistance of the COSEN and the CRE, will analyse these proposals and develop the final transmission expansion plan, which will include major expansions, reinforcements and upgrades;
- The SE will identify projects that are necessary to satisfy the public interest and that are technically feasible;
- REN will develop the investment plan for expansions identified by the SE;
- As part of the process of setting initial tariffs and their subsequent five-year reviews, REN will submit to the CRE the investment programs required by the SE; and
- REN will only be able to recover, through tariffs, the cost of expansion programs identified by the SE as being in the public interest.

Furthermore, REN will be required to maintain and reinforce the transmission system. This will be anticipated in the costs of providing the transmission service and will therefore be also recovered through the transmission tariffs. This means that REN must have the necessary funds available to meet the cost of these obligations. A clear distinction between major investments and routine investments for maintenance and upgrades will be made in the regulations and terms of the concession.

Financial transmission rights

Users and other interested parties will be able to build expansions to the national transmission system that would not otherwise have been made under the SE planning process. These expansions will create assets to be granted to REN in exchange for financial transmission contracts (FtC) to the benefit of individuals who finance the corresponding expansions. The cost of this type of expansion will not be transferred to the users of the national transmission system through tariffs.

Transmission systems which are not connected

The regulations will make it possible for other concession holders to develop transmission networks that are not interconnected with the national transmission system. The regulatory treatment of this new infrastructure will be as follows:

- All the transmission lines will require concessions;

- The company holding the concession will have the right to operate and use the new infrastructure during the life of the concession (30 years renewable);
- Non-interconnected networks may be operated directly by the concession holder, under the terms of the regulations;
- When a network is interconnected with the national transmission system, the assets will form part of the assets granted in concession to the REN, in exchange for FtCs; and
- All the transmission systems will be subject to non-discriminatory open access and will be regulated by the CRE.

Other issues for transmission

Transmission tariffs will be designed to promote open access and efficient use and expansion of the national transmission system. These tariffs will recognise the locational price of energy, and will reflect the marginal cost of transmission congestion and network losses.

Principles of tariff regulation

The costs of the national transmission system will be recovered through tariffs charged to all connected users. These tariffs will permit recovery of the costs of the existing transmission investment and those investments made as a part of SE's planning process, including a reasonable return.

Quality of service

REN and the other transmission concession holders will be subject to quality of service regulation and will be given performance incentives to assure that maintenance is performed optimally. Penalties will be applied for failing to meet required quality standards.

Relationship between REN and COSEN

REN will be responsible for maintaining the assets of the transmission concession and for expanding the national transmission system under the terms of SE's planning mechanism. COSEN will be responsible for the operation of the national transmission network (electricity dispatch). These are separate functions and there will need to be a specific agreement between REN and COSEN regarding operating procedures.

Specific issues for distributors

Regulation will establish technical and performance standards for the distribution companies. These will include voltage quality, and the security and reliability of service. When these standards are not met, the CRE will have authority to apply economic penalties equivalent to distributors' investment programs. The objective of imposing penalties is to incentivize strict fulfillment of investment programs and adequate maintenance of the distribution networks.

Obligations of distributors

The principal obligations of the distribution companies will be the following:

- Connections to users will be responsibility of the distributors. When the work required for connection does not exceed the limit specified by regulations, the distributor will only be able to charge the authorized tariffs. When connections exceed the established limit, the users will pay the additional costs. Customers can appeal to PROFECO if they believe they are being overcharged, or they can contract a third party to do the necessary connection work, including any reinforcements, while complying with technical standards. The new assets will be passed over to the distributors as part of the concession assets granted to the distributor;
- The distributors will be obliged to meet all economically viable requests for service. Expansion of the distribution system will be planned by each distribution company and will be subject to CRE's approval. The concession holders will be obliged to expand the grid for new users and to meet additional requirements of existing customers, where the expansion costs could be recovered through the authorized tariffs. In the case of electrification of rural as well as urban zones the government will establish a transparent subsidy mechanism to allow these types of projects to be developed; and
- The distribution companies will be obliged to offer services to qualified users in their service areas at regulated tariffs.

Subsidies

Currently electricity price subsidies are given through the electricity tariffs. In 1998 the general subsidies were about US$3.1 billion. Using tariffs to deliver subsidies has several important disadvantages:

- They are an inefficient means of redistributing income;
- They encourage inappropriate consumption patterns; and

- They reduce the availability of fiscal resources.

In the restructured electricity industry, the government will maintain its policy of offering subsidies to customers that need them. However, the general subsidies will be replaced by effective redistribution mechanisms that directly benefit those who require support.

The amount, recipients and duration of the new subsidies will be clearly and transparently defined. The lack of transparency in the current subsidy does not allow the amount of the subsidy to be identified and creates inefficiencies.

To make subsidies transparent, the price charged by each sector of the industry (i.e. generation, transmission and distribution) must be made explicit. The subsidies granted by the government to specific groups of customers will be identified in their corresponding bills.

Regulation of COSEN

Efficient and non-discriminatory operation by COSEN is fundamental to the success of the new electricity system. Regulation of COSEN will be the responsibility of the CRE.

The initial rules for operating the market and the transmission system will be established through the restructuring process, under supervision of the SE and the CRE.

In addition, the CRE will be responsible for regulating the charges levied on generation and distribution companies for COSEN's services, and the charges for the ancillary services that COSEN has to buy in order to run the system.

Limitations on cross-ownership

Vertical integration

In order to prevent predatory competition and to ensure that there are no cross-subsidies from regulated activities (transmission and distribution) to non-regulated activities (generation and marketing), limits on the vertical integration of companies within the sector will be established. This will also ensure that there are no impediments to free access to the transmission and distribution systems. The limits on vertical integration will be the following:

- REN may not own generation or distribution assets and may not engage in buying or selling electricity. If REN is permitted to participate in generation or distribution businesses it will have incentives to restrict third party access to the national transmission system. The separation of REN's activities from other participants ensures free and non-discriminatory access to the grid. It also avoids cross-subsidies which could be used in a predatory manner to eliminate competition in unregulated activities.
- Distributors' ownership of generators will be limited to minority holdings without control of the company, and generators' ownership of distributors will be similarly limited. This restriction eliminates the possibility that some of the costs of the competitive activities (non-regulated) might be passed to the regulated activities. The increased costs of the regulated activities would allow higher regulated tariffs and, therefore, higher prices to the consumer. This restriction will also remove the incentive to give preferential treatment to another company simply because they are part of the same group.
- Distribution companies will only be permitted to sell electricity at unregulated prices to qualified users located outside their local concession area. This rule is intended to overcome the potential conflict of interest between distribution and marketing. If a distributor is allowed to sell energy within its own concession zone it may restrict competitors' access to its network. This restriction will mean qualified users have the option of buying energy from marketers other than their local distributor at a competitive price, or to contract with their local distributor at a regulated price.

In cases where partial cross-ownership is permitted, separate accounting will be required as well other arm's length measures. This is designed to allow CRE to monitor compliance with regulations and to ensure that the costs of competitive businesses are not allocated to regulated businesses, where they might be passed on to regulated customers.

Horizontal integration

The government will prevent the existence of dominant operators that can exercise their market power. In the generation sector, market power is when one player controls a significant market share and can maintain a high MEM price thereby generating super-normal profits.

Producers achieve this objective by reducing output, which raises the price and creates an artificial shortage. In other words, the dominant producer has the power to manipulate the MEM price to its benefit. However, this only works if the resulting increase in price benefits the same player that limited output and not third parties. Hence only players with a large market share can reduce output profitably.

The Federal Competition Commission has the power to place restrictions on the market share that a single company can control. The Federal Competition Commission may act on its own initiative, or on information received from COSEN, the CRE, or any other interested party.

Special circumstances

Exceptions will be made to the rules prohibiting vertical integration and horizontal concentration in cases where a competitive market is infeasible. This is currently the case for Baja California Sur, which is small and is not interconnected with other regions. There is little scope to develop competitive trading. Baja California Sur will therefore be reconstituted as a vertically integrated independent company including generation, transmission and distribution, which will be regulated by CRE.

Baja California is not interconnected with the national electricity system in Mexico. It does, however, import power through interconnections with the United States. Given the potential for importing energy, the increasing numbers of users and the high level of demand growth in the region, it is possible that competition may be established in the future. Therefore even though the Baja California transmission grid will not be interconnected with the rest of the national transmission system, the corresponding transmission assets will be considered part of the national transmission system and will be granted in concession to REN. The government's intention is that only one company will have the distribution assets and that the generating companies will sell their production to this company. Generators will contract with the distributor until the market has developed.

Finally, the regulations will permit development of isolated electricity systems in which the generators and distributors will be granted the transmission concession for grids which are not interconnected with the national transmission system.

6 Reform process

One of the principal objectives of the electricity sector reform is to establish market conditions and regulations that permit the private sector to complement the efforts of the state in developing a new electricity industry. The state's function in the new electricity industry will not be as exclusive participant, but it will be to regulate participants on a level playing field for the benefit of final users.

Steps of the reform

To implement this reform a series of tasks must be carried out in the correct order:

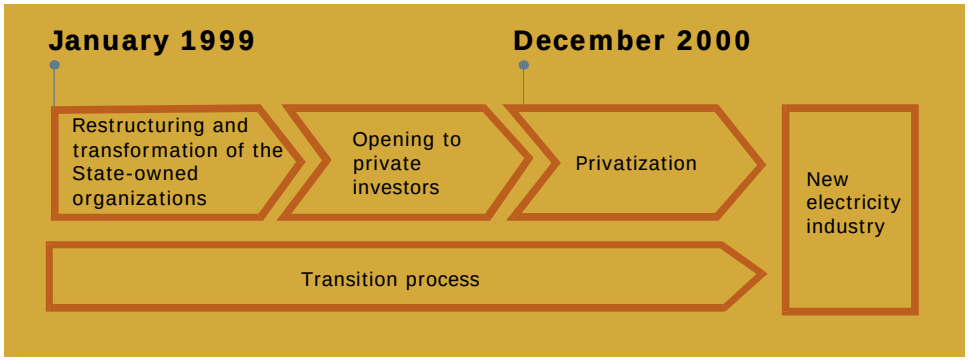
- Firstly, the CFE and the LFC will be split into separate state-owned companies specialising in generation and distribution, and a single transmission company (corporatization of public entities). Also, a decentralised state entity in charge of nuclear generation will be created, as well as COSEN.
- Secondly, electricity generation and marketing must be opened to domestic and foreign private investment in order to encourage competition in those sectors where competition is possible; and
- Finally, some state-owned companies will be gradually privatized, with the objective of encouraging participation of workers in ownership of the companies, collectivizing capital (pension funds) and obtaining resources to develop infrastructure for drinkable water, sewage and waste-water treatment.

The reform process will have to be accompanied by development of transparent and predictable regulations as well as by the institutional strengthening needed to achieve structural reform in the sector.

The order of the reform process is also important. Private investor participation will only be feasible if market conditions and basic regulations exist to guarantee the security of their investments. Hence, it is not possible to privatize state-owned

companies as long as a vertically integrated, state-owned entity dominates the sector or if the regulatory and institutional frameworks are not defined.

Figure 12
Reform process



Restructuring and transformation of public organizations

In this first phase, the CFE and LFC will be split into separate state-owned companies: several generation and distribution companies and a single transmission company (REN). In this stage both the basic regulatory framework and the market design will be established, and both the SE and CRE will be strengthened. COSEN and a state-owned decentralized entity in charge of nuclear generation will be created. The regulation of the new public companies through permits and concessions will begin to operate in parallel with market operations.

One of the basic elements of the structural change during this stage will be the granting of budgetary, administrative, and financial autonomy to the new public companies that participate in the generation, transmission, and distribution activities.

The objective is to allow them to operate in a competitive environment. These companies will be commercial enterprises, and they will compete on equal terms with the new operators in the market. These companies will be administered using commercial principles and will be subject to strict management control through performance agreements.

The new public companies will be legal entities able to own property in their own right and each will report directly and independently to the government through the *Secretaría de Energía* as head of the sector. Each company will be accountable for its own financial results.

The creation of the new companies will require the determination of the number and composition of the new companies, separation and re-allocation of assets, liabilities, contracts, staff and financial flows, creation of new accounts, design of concessions and permits, appointment of Boards of Directors and so on.

To implement this stage, the SE will present a restructuring program to the CFE and LFC based on the creation of strategic business units. These units will be transformed into the new specialized public companies and will be constituted to meet the aims of the restructuring program.

Opening up to private investment

The step of opening up the sector to private investment will be marked by the start of wholesale electricity market operations. At this stage, the legal framework will permit the establishment of private generation and marketing companies, once they have obtained a permit from the CRE. Furthermore, concessions will be granted to transmission companies interested in developing networks or systems that are not interconnected with the national transmission system. Also at this stage the definition of qualified users will be determined.

The new public and private generation companies will compete against one another in the electricity market. Furthermore, generators will be able to establish bilateral contracts with the new distribution companies and with qualified users, with or without the intervention of marketers.

The objective of this stage is to permit the entry of new participants into the electricity industry and to establish the technical and financial competence of the state-owned companies. This will allow the eventual divestiture of the new public companies.

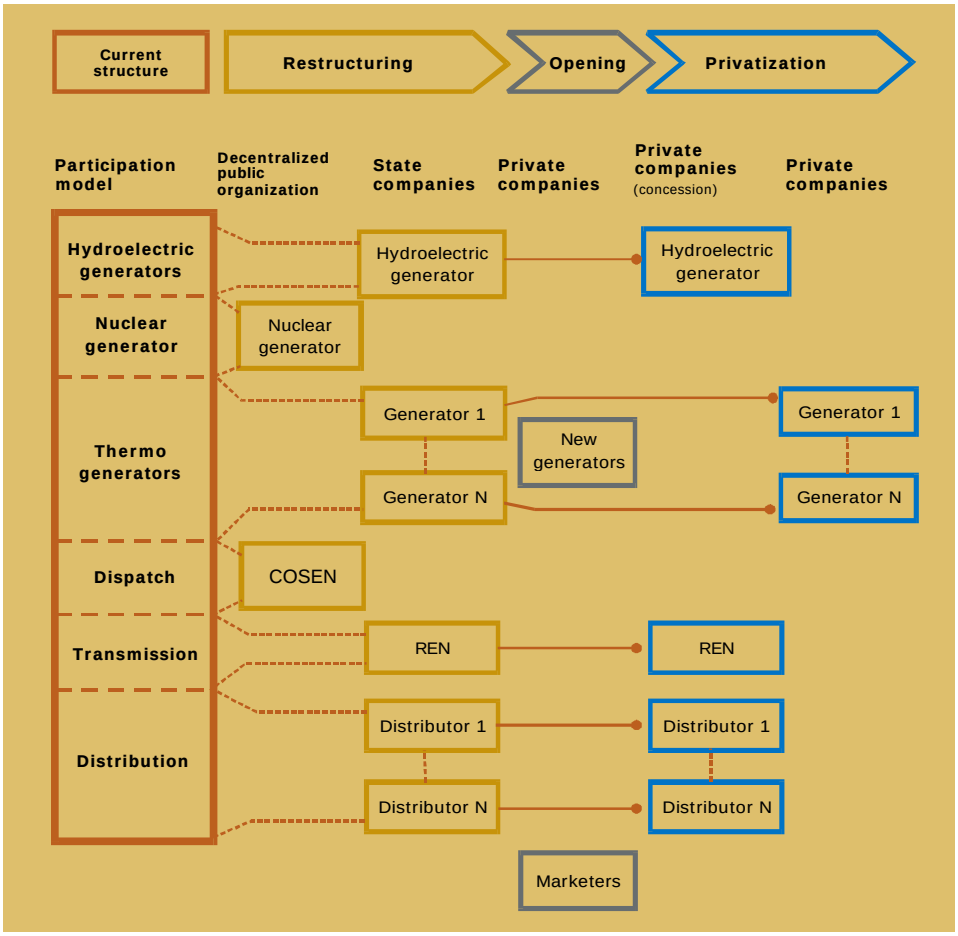
Privatization

The publicly owned generation and distribution companies, as well as REN, will be progressively privatized. Privatization will be crucial to the successful transformation of the electricity sector. However, due to initial concentration of effort on the development of the regulatory and institutional framework, and on the establishment of the electricity market, the government will not be in a position to privatize the public companies until December 2000.

The state-owned generation companies, in particular those that operate thermal plants, will be privatized. There will be companies whose assets will consist mainly of generating plants and IPP contracts. Once privatized, these companies will have time to establish their performance and competitive potential in the market.

The hydroelectric generation plants in the south of the country (on the Grijalva and Balsas rivers) will be granted in concession to the private sector. Because of their size and effect on market price, they should be operated commercially. It is unlikely that the private sector will participate in the generation sector without the guarantee that these plants will operate on a commercial basis.

Figure 13
Public and private participation



Electricity companies are considered to have low risk in a growing industry. For this reason, one of the objectives that the government will pursue is widespread ownership of the capital of privatized electricity companies. In this way, pension funds will be able to participate in ownership of these companies, either as direct shareholders or through financial markets.

Motivation for privatization

In a restructured industry managed by the government, the costs of the sector draw upon budgetary resources or public debt. The growth of the industry would be restricted by the public sector budgetary and financial capacity. In these conditions, it would not be possible to attract private capital without state guarantees. It would be

difficult to expect private sector investment without government support while other participants in the market operate on a non-commercial basis.

The motivation for transferring restructured companies to the private sector has several lines of reasoning.

Elimination of budget pressures

Firstly, pressures on the budget are eliminated and additional revenues are obtained from the sale of existing plant. The main objective of the reform is to create value which can only be achieved upon conclusion of integral reform: the injection of private capital, the removal of the sector from government macro-economic policy objectives that affect the freedom of the sector and the efficiency gains that competition will introduce.

Attract private capital

Secondly, private capital must be attracted without the need for state guarantees. The existence of a wholesale market and bilateral contracts are required because the new generators need to know that they can sell their output to more than one potential buyer.

Furthermore, new private companies must know that other players already in the market and entering the market will have commercial incentives similar to their own. If a large number of generating companies remain in state ownership there will be no guarantee that they are playing by the same rules as the private companies. Potential entrants will not be able to determine the other companies' objectives. If they remain in government hands, they may be subject to the same macro-economic pressures as the current industry. This would mean that the state generators might not demand the same rate of return on capital as the private sector.

These circumstances would limit participation by new entrants. The objective is to attract new capital to the market and to ensure that all participants operate under the same commercial principles and profit requirements.

This cannot be achieved without privatization. After privatization, the government will continue to share in the profits of the sector through a larger tax collection, which will be possible thanks to a more dynamic sector and more profitable companies that operate in it.

In summary, some the benefits of privatizing state electricity companies are as follows:

- A dynamic industry which creates well remunerated employment;
- Elimination of pressures on public spending and public debt;
- The income from privatization;
- Expansion of the tax base;
- Elimination of the need to fund future investments with public resources;
- Lower prices for industrial consumers, which increases the competitiveness of exports as compared to imports; and
- Lower electricity prices.

Options for privatization

Privatization of the state electricity companies can be carried out through three mechanisms: transfer of a controlling interest in the companies through bidding (trade sale); placement of stock in the securities market (float); or a combination of both methods. The actual decision on how to proceed will be made closer to the time of privatization, in view of conditions in international financial markets and other pertinent considerations at the time.

The central objective of the privatization program will be to minimize the costs of electricity supply to the final user subject to the government receiving a reasonable return from the sale of its assets. Under this principle, considerations relevant to the privatization mechanism include:

- Flotation will require a rigorous preparatory process, the drafting of a detailed prospectus, the establishment of accounting systems and a track record of trading must be established for the company.
- A trade sale may imply significant savings in terms of time and transaction costs. Nevertheless when the company is not fully established and has no performance record, the sale price may be affected.
- It is probable that the government will wish to maintain minority share holdings in the privatized companies for some time. Furthermore, a percentage of the shares of the

distribution companies may be reserved for users, and some of the nation's state governments may be interested in purchasing companies' shares.

The distribution companies will be easier to prepare for privatization than the generation companies. They will be regulated monopolies that will not face the uncertainties of competitive markets. Their future solvency will be established through adequate tariffs that guarantee a reasonable return on investment.

REN is a wires business and it may be the easiest to prepare for privatization. In other countries transmission companies have not presented any sale problems and the companies that purchase them normally have vast experience in transmission expansion.

The generation companies' prospects depend heavily on the development of a competitive market, and therein lies uncertainty. The vesting (transition) contracts described in the next chapter will lessen initial uncertainty to some extent. A flotation is not desirable until a clear operating track record has been established. In this case, a trade sale is more feasible.

7 Transition and final structure of the industry

The reform process will incorporate actions to guarantee an orderly and smooth transition toward the new electricity industry. These actions will, among other factors, take into account:

- The reliability of supply during the transition towards a well-developed electricity market, in terms of the daily operations and investment flows;
- Establishment of vesting contracts between the new generating and distribution companies;
- The government assuming the obligations made to independent power producers (IPPs);
- A re-definition of the IPP bidding program; and
- Preservation of the rights of current and retired employees.

The design of an orderly transition process will be instrumental in making the final structure of the new electricity industry correspond to the policy intentions outlined in this document.

Transitional issues

Vesting contracts

Vesting or transitional contracts have been used in other countries to bring stability to the market in its initial months and years. They are energy contracts made between generators and the distributors at the time of the creation of the new state-owned companies. They normally cover most of the generation output, and they run for a period of three to five years, to be replaced with freely negotiated bilateral contracts.

The transitional contract price will directly affect the initial revenues of generators and distributors. If the price of the vesting contract is high, generator profits will be high. This is a way to deal with the stranded costs of some generators.

Existing IPP contracts

Transition to a new industry structure will require that obligations under existing IPP contracts and other power purchase agreements (PPAs) be honoured. Some contracts may be prematurely terminated by mutual agreement, through a payment to the IPP, or some other means that compensates for termination.

Under the new industrial structure, the long-term contracts resulting from IPP projects will have to be recovered by the new tariffs. The payment obligations of these contracts will be transferred to the new state-owned generation companies. This will be backed by transitional contracts with the distribution companies.

Investment during the transition

It is essential to maintain the reliability of the service during the transition period in terms of both daily operations and investment flows. To allow an ordered transition towards the new structure the following actions will be taken:

- The government's continuation of the IPP program, once this has been re-constituted;
- Establishment of obligatory investment programs for transmission and distribution companies; and
- The possibility of introducing K Factor payments to generators in the initial market.

In principle, once the new state-owned companies begin operations, the IPP program will be replaced by the K Factor payment mechanism. The need for the K Factor payment will gradually diminish, as the market becomes established.

During the transition the government will maintain an active policy of risk mitigation through the measures described above. Once the new electricity market is sufficiently well developed and the regulatory framework has been tested, the market's own mechanisms will ensure adequate investment in generating plants without the need for the government to share any of the investment risks.

Redefinition of the IPP program

During the transition period, the IPP bidding program will be modified to accommodate the coming changes in the industry. In particular, the government will attempt to ensure that the new energy trading contracts:

- Fit within the new regulatory framework and electricity market;
- Guarantee fair conditions for investors once the transition takes place; and
- Establish more flexible conditions to guarantee that a smooth transition to the new regime takes place, that stranded costs are avoided, and that the investment risks are shared with investors.

Labor issues

The proposed reform has the objective of protecting the labor rights of electricity sector workers and improving their working conditions. A large private sector participation in the electricity industry will mean an increase in investment that translates into more employment and training opportunities for Mexican electricity workers.

The new electricity industry will offer diverse opportunities to workers in the sector. The opening of new companies and the installation of new generation plants, transmission and distribution lines will require capable and specialised personnel through the country. Given these new sources of work, new employment opportunities will exist throughout Mexico. In addition, given that salaries will increase as a function of the productivity of each activity, the labor conditions of the workers will improve.

Retired electricity workers will retain their acquired rights. The government will establish a mechanism that guarantees these rights in toto.

In summary, the reform will not impose any costs on the workers. On the contrary, they will benefit in terms of training, labor conditions and the development of professional and salary opportunities. The improvement of conditions will depend to a large extent on the active participation of workers in the process of change.

Final structure of the industry

Once the new regulatory and institutional framework is established and after restructuring and privatization, the new electricity industry will have the following

characteristics:

- Private companies will be in charge of most of the thermal generation and the hydro generation of the south of the country (in particular, in the Grijalva and Balsas rivers);

- A separate public company will be in charge of the hydro generation plants in the north of the country. It is unlikely that these plants could be granted in concessions to private parties due to the fact that they fulfil multiple purposes (electricity generation, irrigation and flood control). Their generation capacity is variable and unpredictable;

- The government entity that handles the nuclear plant will also participate in the wholesale market. This plant will not be corporatized nor privatized and it will remain in the hands of the public sector. The nuclear plant will always be a price-taker and, therefore, will not interfere with incentives in the electricity market;

- Other generation companies will participate in the electricity market;

- REN will have a concession on the national transmission grid to maintain, reinforce and develop the infrastructure of the interconnected system. Furthermore, private transmission companies will have concessions to operate isolated systems;

- Electricity distribution through medium and low voltage networks will be granted in concessions to regional distribution companies that have previously been privatized;

- Marketers will participate in the market and they will be able to carry out the activities of price arbitrage and risk management. This will encourage the development of competition in the electricity market;
- The electricity market will become fully operational, and long-term bilateral contracts will have been developed between generators, distributors and qualified users;
- The SE will drive the country's energy policy. It will establish the planning guidelines for transmission expansion, and will draw up indicative plans for the expansion of generation capacity;
- The CRE will have the resources required for adequate regulation of the industry. It will approve changes to the rules of wholesale electricity market operations. The CRE will fix, through the respectivemethodology, the tariffs of REN and of the distribution companies and it will issue the rules that these companies will have to follow in the future; and
- The government will establish a policy for subsidies directed at the segments of the population who need them.

Glossary

The concepts used in this document are defined as follows:

Ancillary services	Inputs necessary for delivering electricity to users at stable frequency and voltage. Among these services are: frequency regulation or control, operating reserves, voltage control, and black-start services.
Bilateral contracts	Contracts by which generators and buyers (distributors, marketers and qualified users), can freely negotiate the electricity price at a given time. This mechanism can decrease the volatility of the wholesale electricity prices in different times of the year, and hours of the day. These arrangements are in the form of financial contracts, or contracts for differences (CfDs).
Build-Lease-Transfer (BLT)	Financial contracts where the private investor builds an electricity plant and the plant is leased and operated by CFE. At the end of the lease period, the asset is transferred to the state.
Co-generation	Electricity generation produced simultaneously with steam or other types of thermal energy used in an industrial process, or the generation of electricity from the waste heat of an industrial process.
Combined cycle gas turbine plant (CCGT)	Electricity generation plant, which includes one or several gas turbine generators whose exhaust gas feeds a boiler which produces steam to drive a steam turbine, thereby driving a generator.
Concession	The act by which the state gives the right to supply a public service or to operate a government asset.
Contracts for differences (CfDs)	Financial agreements between a generator and a purchaser (distributor, qualified user or marketer) to pay the difference between the contract price and the market price.
Corporatization of public companies	Transformation of the CFE and LFC into various specialised state-owned generation and distribution companies and a parastatal transmission company.
COSEN, Centro de Operación del Sistema Eléctrico Nacional	The decentralised federal government entity in charge of operating the national transmission grid and the electricity market.

Cost of failure (CFALLA)	The estimated value to consumers of energy not served.
Distribution	Transportation of electricity through medium and low voltage tension lines.
Electrical dispatch	Activities related to the operation of the national transmission grid and the electricity market.
Financial transmission contract (FtC)	Contracts for the financial transmission rights that will be given to private investors in exchange for the expansion to the national transmission system. The assets will pass to form part of the assets granted to the REN. These instruments will be negotiable.
Generation	Electricity production.
Horizontal integration	Concentration of companies in the same electricity activity.
Independent Power Producer (IPP)	A generating company whose electricity production is to be sold to CFE, which is obliged to acquire the electricity under the terms and conditions of contracts.
K Factor	An instrument used by SE to promote new investments in generation, which consists of an annual fixed payment to new generators per kW of available capacity.
Locational prices	Different prices for energy, which result from transmission restrictions.
Loss of load probability (LOLP)	The probability that the electricity system will have a service interruption because of lack of generating capacity.
Marketing	Acquisition of energy to be sold to end users, or the intermediation between generators and purchasers of energy.
National transmission grid	Group of assets such as high-voltage electricity lines, sub-stations, and other equipment used to transport the electricity sold in the market.
Natural monopoly	Economic activity where competition is inappropriate, unpractical and difficult to realise. Its main characteristic is that the average cost of production or supply from one company is lower than the cost that could be achieved by several companies.
Pre-dispatch	Process by which COSEN, using economic criteria, balances the generation offers with the electricity needs of distributors and qualified consumers on the day ahead.
Price hedging instruments	Financial risk management instruments used to protect users from energy price volatility in periods of high demand.
Price of the last accepted offer (LAO)	The price offered by the last generator called to generate by the market.

Qualified user	Users with annual consumption of electricity higher than the required consumption threshold fixed in the regulation. Initially, to meet this requirement the user has to register with the CRE and demonstrate that they consume more than 5.0 GWh per year.
Regulated activities	All activities in which competition is not possible, and as a result need to be subject to rules which simulate conditions of competition, e.g. distribution and transmission.
Red Eléctrica Nacional (REN)	The company which will be the concession holder for the national electricity grid.
Self-generation	The production of energy to meet the producer's own physical or contractual needs.
Stranded costs	Costs that result from investments made before the reform of the electricity industry, which cannot be recovered under the new operating rules.
Strategic business units	Transitional commercial units created within CFE and LFC, which will be transformed into new specialised government-owned companies.
Sub-distributor	Holder of a concession to supply electricity for public service in a distribution area previously granted in concession.
Transmission	Transportation of electricity through high-voltage lines.
Vertical integration	Aggregation into the same company of sequential activities for the supply of electricity.
Vesting or transition contracts	Energy trading contracts created between generators and distributors when the new state-owned companies are created. These contracts stabilize the market in the initial years of operation.
Wholesale Electricity Market (Mercado Eléctrico Mayorista, MEM)	Mechanism through which generators sell their energy under competitive conditions and where the price is fixed freely by supply and demand.