

The Mexican Electricity Sector: Economic, Legal and Political Issues

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1. History of the Mexican Electric Power System

The origins of the Mexican Electric Power System can be traced back to the year 1879, when the first thermoelectric plant started its operation, mainly to satisfy the textile industry in the city of Leon, in the state of Guanajuato. At these early stages, the main goal of the electricity supply industry was that of satisfying the demand of the textile and mining industries (like “Real del Monte” mines in Pachuca).¹

Originally, these efforts in meeting electricity demand were carried out by vertically integrated privately owned monopolies, regionally distributed throughout the most important industrial centers in the country. Given the limited generation capacity of regional private monopolies, and the increase in electricity demand, it was necessary to shift to more sophisticated electricity supply companies, which naturally placed no importance to social aspects of electricity, such as rural electrification.

In 1881, the Mexico City’s government signed a contract with the Compañía Mexicana de Gas y Luz Electrica to get the electrification of the city. In 1889, there was the construction of the first hydro plant to satisfy the energy needs for the mining industry in Batopilas, Chihuahua. With this, the industry saved a lot of money in costs. Many of the efforts to introduce electricity at that time were in the mining industries. We have the examples of Santa Ana in San Luis Potosi in 1895 and of Boleo and Real del Monte in Pachuca in 1897.

Later on, there were other industries that start using this technology in their process of production. At the same time, the excess production was sold to some residential and commercial users that took advantages of the new technologies to

¹ Guillermo Rodríguez y Rodríguez, *Evolución de la Industria Eléctrica en México*, en “El Sector Eléctrico de México”, México, CFE y Fondo de Cultura Económica, 1994

generate electricity. This phenomenon was such a success that these earlier plants were unable to satisfy the growing demand for electricity. This created the incentives for entering the electricity business. Some clear examples of this were the Compañía Mexicana de Electricidad Siemens y Halske and Compañía de San Idelfonso. However, the investments were not enough to satisfy the local needs for transportation and electrification. Given these tendencies there were the creation of many power plants. By 1899 there were 177 power plants in operation, some of them built with national investment. It is important to note that although there were some Mexican investment in this sector, the highest proportion came from foreign investment. This is the case for companies like Mexican Light and Power Company, Puebla Light and Power Company, Chapala Hydroelectric and Irrigation Company, Guanajuato Power and Electric Company, and Rio Conchos Electric Power and Irrigation Company. For a more detailed information about earlier foreign investment, see Table 1.

Table 1: Number of Power Plants in Mexico in 1900, 1905 and 1911.

<i>Zone</i>	<i>1900</i>	<i>1905</i>	<i>1911</i>
North	2	2	5
Mexican Gulf	3	4	8
North Pacific	0	0	1
South Pacific	0	2	4
Center	13	27	45
<i>TOTAL</i>	<i>15</i>	<i>35</i>	<i>63</i>

From this table we can see the concentration of the industry around the center of the country (that is, around Mexico City). The reason was very simple, plants were built close to the more densely populated and more industrialized cities which were in the center of the country. Under this development the rural areas were well behind this pattern of growth with some few exceptions were some national plants were willing to make business. In order to have an idea of the progress in this sector, we can compare the total plants in the center of the country with some regions in the United States. For

example in the state of New York there were a total of 256 plants by 1902. That is, Mexico in 1911 had 25% of the plants that the State of New York had in 1902.

In table 2 we can see the installed capacity for these same years which gives us an idea about the size of the industry in our country. The same concentration pattern is found around the center of the country with 85% of the total installed capacity in 1905. However, after that year the tendency were reverted and some other states start to get a higher and higher proportion to the total capacity. By 1911, Mexico City and its neighbor cities got only 79% of total installed capacity.

Table 2. Installed Capacity in the electricity sector in 1900, 1905, and 1911

<i>Zone</i>	<i>1900</i>		<i>1905</i>		<i>1911</i>	
	<i>Capacity in Kw.</i>	<i>%</i>	<i>Capacity in Kw.</i>	<i>%</i>	<i>Capacity in Kw.</i>	<i>%</i>
North	442	2.0	442	0.7	10784	6.5
Mexican Gulf	6530	29.1	8036	13.0	17194	10.4
North Pacific	0	0	0	0	4800	2.9
South Pacific	0	0	571	0.9	1306	0.8
Center	15458	68.9	52988	85.4	131016	79.4
<i>TOTAL</i>	<i>22430</i>	<i>100.0</i>	<i>62037</i>	<i>100.0</i>	<i>165100</i>	<i>100</i>

Early private investors

The first investors in the Mexican Electric Power System were private investors, mainly foreign, to whom the government had granted concessions at very low prices. Given this incentive, as well as the demographic growth of Mexico in the early 1900's, foreign corporations were attracted to invest in electricity generation in densely populated areas.

These concessions to private investors, modeled the development of the Mexican Electric Power System in the beginning of the 20th century, and as stated before, given the nature of private entities (seeking to maximize profits), did not include

principles such as the “universal access” to electricity, or rural electrification. Furthermore, several aspects of this administrative law instrument (concession), such as its duration, were not very clear, and were most of the time interpreted in benefit of the private investor. There were several other initial problems, such as determining which was the competent authority -government office- for the granting and regulation of concessions, and in general for electricity policy and regulation².

Under these schemes and given the growth of population and industrialization of the country there was a great need for financial resources. During the period from 1891 to 1900 there was an investment of only 75 million dollars in the electricity sector. The main sources were Canada, France, Germany, and the United States. Germany was mainly investing in commercialization of electric equipment. The French investment was in the textile industry. The Mexican investment during this period was minimal around 12 million dollars. In Table 3 we can see some of these investments by country and year. We see that France and the United States were the countries that invested more resources during these years.

Table 3. Investment by country in current dollars

<i>Country</i>	<i>1900</i>	<i>1910</i>	<i>1920</i>	<i>1924</i>	<i>1926</i>	<i>1928</i>	<i>1930</i>	<i>1934</i>	<i>1935</i>
Mexico	12	-	20	-	-	13	-	-	10
France	-	140	-	270	-	-	296	-	347
Canada	-	80	-	-	-	-	-	-	175
United States	-	-	190	-	31	-	-	90	-

Initial Institutions and its evolution

It was until the mid 1920's that the government realized of the social, political and economical relevance of the electricity supply industry. During these years the first attempts to regulate these over-privileged private enterprises were carried out, with the establishment of the “National Commission of Motive Power”, which tried to prevent

² Guillermo Rodríguez y Rodríguez, op. cit.

monopolistic behavior of electricity companies, and broadly speaking, tried to regulate the industry in such a way that it would still be attractive to private investment.³ Around this same period of time, the first law specifically related to the electricity supply industry was issued. It was the “National Electric Code”, published in the Official Gazette of the Federation on May 11, 1926. Under this law, there were some changes to the Constitutional text, declaring electricity a public good and conferring upon Congress attributions to legislate in matters related with the electricity industry.

With this new framework for the electricity sector in Mexico, there was some kind of success to get rural electrification. However, the private companies did not make enough investments in these areas. Then, the Mexican government tried to make an improvement in such areas by creating a public company. In 1937 the “Comision Federal de Electricidad” (CFE) was established in order to provide electricity service to those areas considered by private electricity companies as not profitable. This was an initial step towards the nationalization of those entities engaged in the generation and distribution of electricity.

The creation of CFE was also an important factor in the consolidation of the hundreds of regional electricity monopolies, which took place during the 1940’s and 1950’s. This consolidation of all regional generators was necessary due to the direct relation existing between the plant’s size and the plants efficiency, and the technical difficulties to measure the feasibility of several generators using the same transmission grid.⁴ The main sources of funding for CFE during those years were public investments under different schemes. Some of these were the following: (a) federal investment, (b) tax of 10% over energy consumption, (c) CFE’s resources, (d) local debt, and (e) foreign debt. These investments were a great relief for the sector because the private investment during the period from 1939 to 1943 were negligible.

This process led to the consolidation of the Mexican Electric Power System, a previous step to the 1960’s decree, which nationalized the electricity industry. During

³ Guillermo Rodríguez y Rodríguez, *op. cit.*

⁴ Secretaria de Energia, “Proposal for the electricity sector modernization”, México, 2002

this same year "Luz y Fuerza del Centro" (LFC),⁵ the second state-owned electricity enterprise,⁶ was incorporated.

This situation led the Mexican electricity supply industry to transform into a vertically integrated state owned monopoly, reflecting the most popular idea at the time: to consider the electricity supply industry as a "natural monopoly". This monopoly was formed by two state enterprises: CFE and LFC.

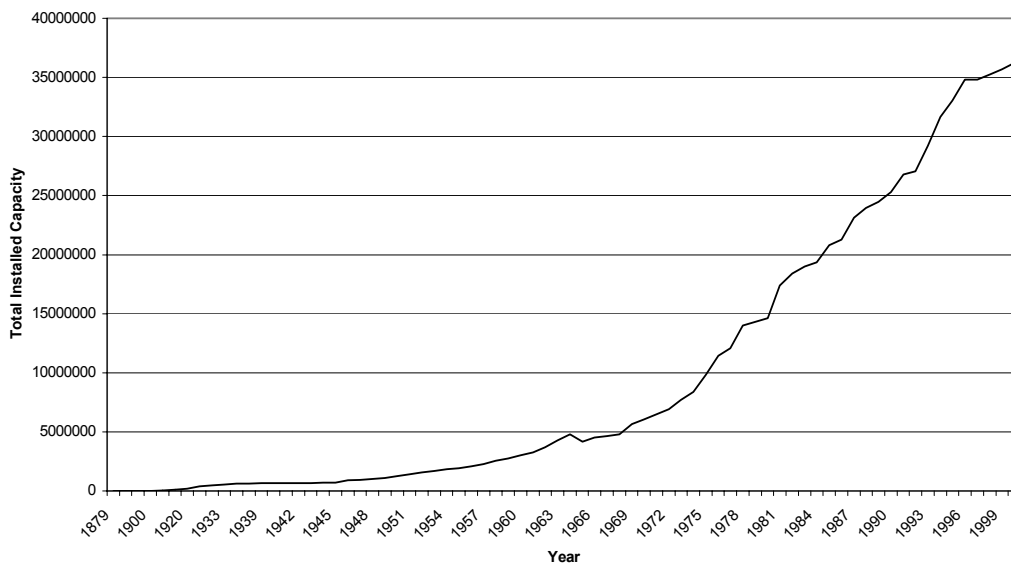
⁵ According to www.lfc.gob.mx in 1960 President Lopez Mateos, decided to purchase the stock of the private holding "Compañía Mexicana de Luz y Fuerza Motriz", and its subsidiaries, which had its origins in the "Mexican Light and Power Company, Ltd.", a Canadian holding which had been in Mexico since the late 1800's. The new state-owned corporation was renamed "Luz y Fuerza del Centro" and provided (and still provides) electricity to the central region of Mexico, comprising the states of Mexico, Morelos, Puebla, Hidalgo, and Distrito Federal.

⁶ CFE and LFC, still generate, transmit, distribute and supply, most of the electricity in Mexico

2. Restructuring Strategies during the 1990s

Nonetheless, technological developments during the 1980's, such as the introduction of combined-cycle gas turbines, the reduction of efficient size in plants, the introduction of real-time metering which made it possible for several generators to use the same network, among others, changed the “natural monopoly” paradigm. These new elements in the market start demonstrating that it was indeed possible for small size companies to compete within the same system.

As demand kept growing very fast, these new technologies were a partial answer to the increasing need in power capacity in our country. In Graph 1 we can observe an exponential increase in installed capacity from 1900 to 2000. There was an increase from 22,430 Kws. in 1900 to 36,213 Mws. in 2000.

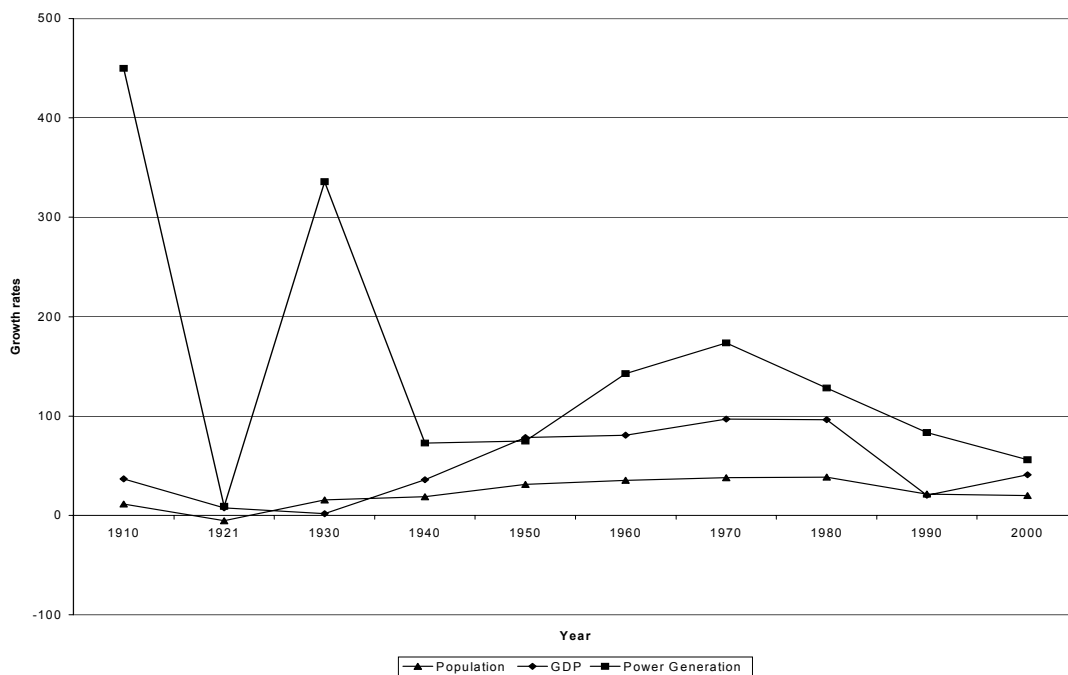


Graph 1: Installed Capacity from 1879 to 2000.

During the 1990's the demand for electricity, excluding the exports, grew from 92.1 Twh. to 145 Twh. This represented an annual growth rate of 5.1% and it increased to 6.6% during 2000. This rate was much greater than the population growth which was around 1.8% per year during this period. Moreover, it also was greater than the growth

in the GDP which accounted for a rate of 3.3% per year. We can see these growth rates in Graph 2.

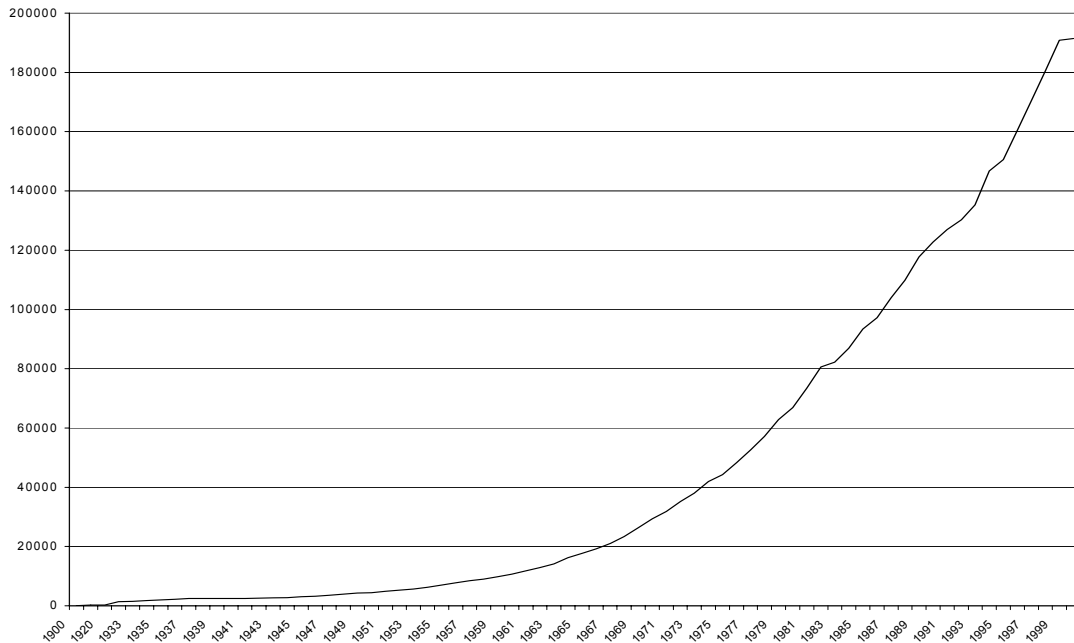
One of the main problems in the electricity sector in our country has been the demand growth rates, which some times have been greater than the growth rate in installed capacity. Under these circumstances it has been imperative to modify continuously the legal framework for this sector. There have been a lot of changes around the energy sector during this decade with many legal changes in the primary and secondary laws as well as some proposals to modify the Mexican Constitution. To put these changes in the context of the Mexican electricity sector, we will discuss briefly the evolution of the system until year 2000.



Graph 2: Growth Rates for Population, GDP and Power Generation.

In Graph 3 we have the total generation from 1900 to 2000. Under this tendency it is expected to have a total production of 320.4 Twh. by 2009. That is, it is needed to install an additional production of 128.7 Twh. form 2000 to 2009, which put extraordinary financial pressure on the sector.

Graph 3: Total Generation (in Gwh) from 1879 to 2000.



This financial pressure has been a constant characteristic over time for the Mexican electricity sector. Until the early 1980's, the Mexican government had the resources to finance the needed growth. But, from the late 1980's to now there has been a constant problem to get the enough resources to invest in this (and other infrastructure) sector. There has been also an exponential growth in the resources allocated to the sector. These were needed to satisfy the increasing demand. Most of these investments were made by the federal government.

It is also important to distinguish among the different technologies used in the power generation in our country. In this way we will know about the energy needs to produce the power in Mexico. In Table 4 we have the composition of the Mexican Electricity Sector by year 2000.

Table 4: The Mexican Electricity System in 2000 (Number of Plants)

<i>Technology</i>	<i>Central Stations</i>	<i>Plants</i>
Hydro	78	217
Steam	29	97
Combined cycle	7	35
Turbo gas	36	90
Internal combustion	8	82
Geothermal	6	32
Dual	1	6
Carbon	2	8
Nuclear	1	2
Wind	2	8
<i>TOTAL</i>	<i>170</i>	<i>577</i>

The main source of power generation is the hydroelectric generation with a total of 217 out of 577 plants. With this technology Mexico takes advantage of the hydrologic sources in our country. They are located mainly in the south of the country where we can find the biggest hydro plants. These plants account for 26.6% of total generation (see Table 5) with 9,619 Mw. On the other hand, there are 97 steam plants in the country with a generation of 33,075 Gwh, which is around 39.4% of the total generation in the country. These are the two main sources of power generation with more than half of the total generation.

Reflecting these new circumstances, in 1992, the Public Electricity Service Act was amended to allow for private investors to participate in the generation of electricity by means of self-generation, co-generation, build-lease-transfer (BLT) projects and independent power production (IPP). Power surpluses produced under the two first schemes have to be sold to the CFE or exported, while IPP's sell their supply to the CFE under long-term contracts that transfer the risks of projects to the public sector and which translate into contingent liability for government. Up to 1999, 4,548.9 Mw of capacity had been assigned by the CFE to 14 projects through public bids. 1,336.7 Mw under the BLT scheme and 2,948.2 Mw under the IPP scheme. Another 900 Mw were

expected to be bid in three more IPP projects in the short run. However, there was still an additional capacity of 15,804 Mw that had to be met, which meant more opportunities for private investors (see Secretaria de Energia (1999)). Even though these investments accounted for around 4% of total installed capacity by the end of 1999, they were not enough to cope with the continuously increasing demand by all users, mainly residential and industrial. By the end of the 1990's the demand for more investments to satisfy the financial needs asked for a new configuration in the industry. It was time to take advantage of new technologies and to bring new players to the sector to satisfy the expected growth for the next 10 to 15 years.

Table 5: Mexican Electricity Sector in 2000 (Capacity)

<i>Technology</i>	<i>Effective Capacity</i>		<i>Total generation</i>	
	<i>Mw</i>	<i>%</i>	<i>Gwh</i>	<i>%</i>
Hydro	9,619	26.56	33,075	17.28
Steam	14,282	39.44	89,891	46.96
Combine cycle	2,914	8.05	16,417	8.58
Turbo gas	2,360	6.52	5,228	2.73
Internal combustion	116	0.32	420	0.22
Geothermal	855	2.36	5,901	3.08
Dual	2,100	5.80	13,569	7.09
Carbon	2,600	7.18	18,696	9.77
Nuclear	1,365	3.77	8,221	4.29
Wind	2	0.01	8	0.00
<i>TOTAL</i>	<i>36,213</i>	<i>100.00</i>	<i>191,426</i>	<i>100.00</i>

According to the government's estimations (in 1999), Mexico needed to generate 22,248 megawatts (Mw) and to invest USD 48.7 billion in the next ten years to meet national needs on electricity generation (USD 17.4 billion), transmission (USD 9.4 billion), distribution (7.2 billion), operation and maintenance (USD 9.6 billion), capital payments (USD 5.1 billion). This figure amounted to one fourth of the 1999's total Mexican public budget and was more than the whole resources in that year devoted to education and social security. Likewise, the required increase in generation capacity was greater than the total installed capacity of the country of 35,526 Mw, which was

built in more than one century. In average, around 2 thousand megawatts would have to be invested each year which is equivalent to 10 plants of 225 Mw per year. This was an unprecedented growth in capacity generation in Mexico's history. Of the 22,248 Mw required, only around 6,444 Mw were under construction or being bid.

The structure of the Mexican electricity sector was characterized by two vertically integrated state monopolies: the Comision Federal de Electricidad, which serves most of the country, and Luz y Fuerza del Centro, which covers central states (Mexico, Morelos, Hidalgo and Puebla) and the Federal District. These two firms carry out generation, transmission, distribution and marketing activities in a monopolistic fashion. As shown in Figure 1, there is very limited private participation in self-generation, co-generation, build-lease-transfer (BLT) projects and independent power production.

Even though the State had been successful in building an important infrastructure through the vertically integrated monopolistic model, several reasons justified the restructuring of the Mexican electricity sector in order to meet the enormous growing demand for electricity. First, CFE and LFC did not have the financial and technical capacities to meet the needed increase in power generation by its own means. As an example on the financial side, in 1999, the CFE had losses of USD 4.6 billions due to credit and financing contract acquisitions. Its profits summed USD 1.1 billion but it received government subsidies of USD 3.18 billions. In Table 6, we have information for 1998 for the subsidies that CFE and LFC received from the federal government.

Figure 1. Structure of the Electricity Industry in 1999

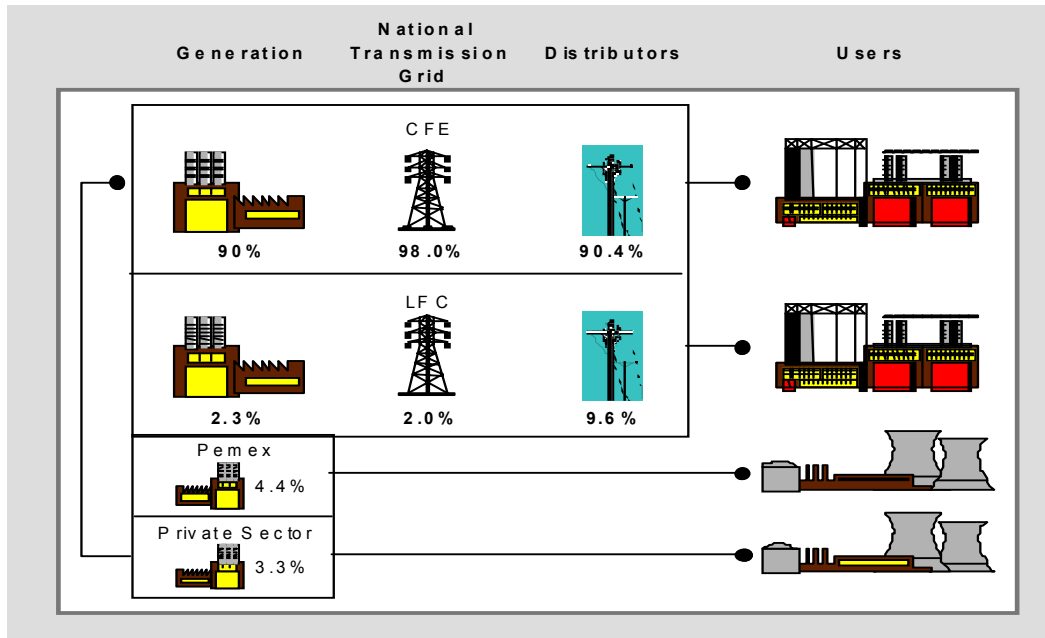
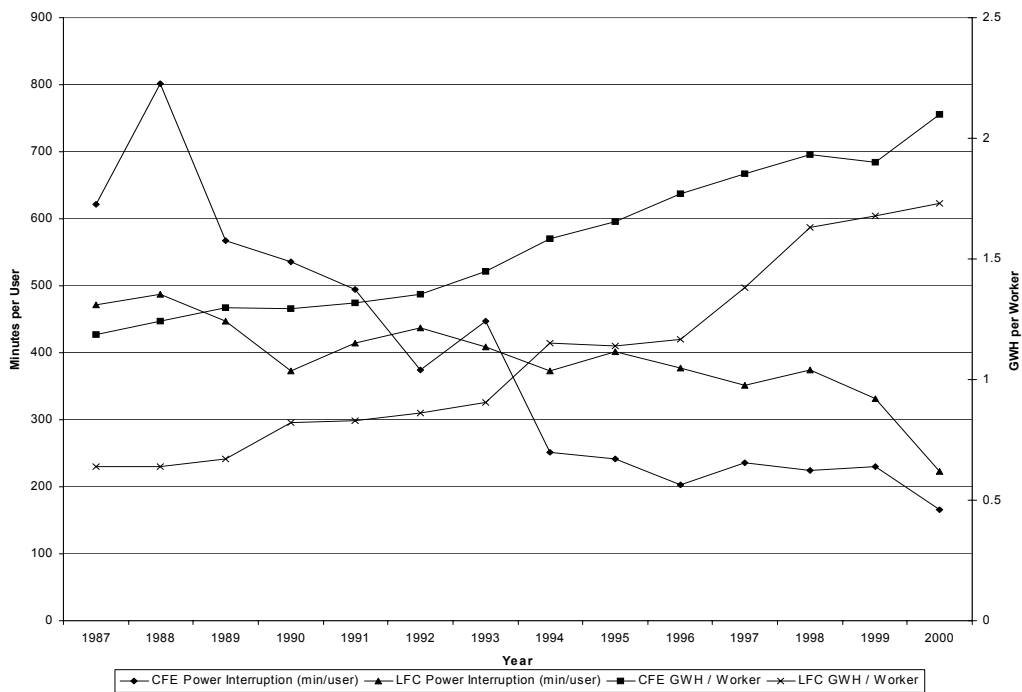


Table 6. Relationship price/cost and subsidies in 1998

Sector	Relationship price/cost			Subsidy (millions of pesos)		
	CFE	LFC	National System	CFE	LFC	National System
Residential	0.44	0.32	0.41	14,157.1	5,414.0	19,571.1
Commercial	1.21	0.59	0.91	-----	2,369.2	2,369.2
Services	0.97	0.91	0.95	92.3	121.5	213.8
Agriculture	0.31	0.22	0.31	3,847.2	76.9	3,924.1
Industrial	0.93	0.88	0.87	1,935.1	3,216.5	5,151.6
<i>TOTAL</i>	<i>0.72</i>	<i>0.55</i>	<i>0.68</i>	<i>20,031.7</i>	<i>11,198.1</i>	<i>31,229.8</i>

On the technical side, the measures of efficiency were against CFE and LFC (see Graph 4). By comparing these efficiency measures with the ones from Australia, France and United States, we have the following. In Australia, the energy sold per worker is about 4.5 Gwh/worker, while it is only about 1.85 Gwh/worker in CFE and 1.6 Gwh/worker in LFC. On the other hand, while in France and in the United States, the power interruption per user is 115 and 120 minutes, respectively; in CFE and LFC, it is 230 and 331 minutes, respectively.

Second, the long-term purchase contracts (BLT and IPP projects) with the CFE posed a huge burden on the net present value of the Mexican public budget. Given this scenario for period 2000-2010, in February 1999, Ernesto Zedillo, president of Mexico at that time, submitted a proposal to Congress to amend articles 27 and 28 of the Mexican Constitution in order to carry out a structural reform and enhance private investment in the Mexican electricity industry. This proposal never passed the Congress even though Mexican authorities argued that this reform was needed to meet a 6.1% annual demand growth for electricity supply in the 2000-2005 period, and to improve and expand the transmission and distribution network capacities.



Graph 4: Efficiency Measures for CFE and LFC

This reform asked for an ambitious structural reorganization of the electricity industry (see Figure 2) so as to increase power generation in the country. It was argued that competition and private investment would be permitted in generation, transmission, distribution, and marketing. Meanwhile, nuclear generation, some hydro generation

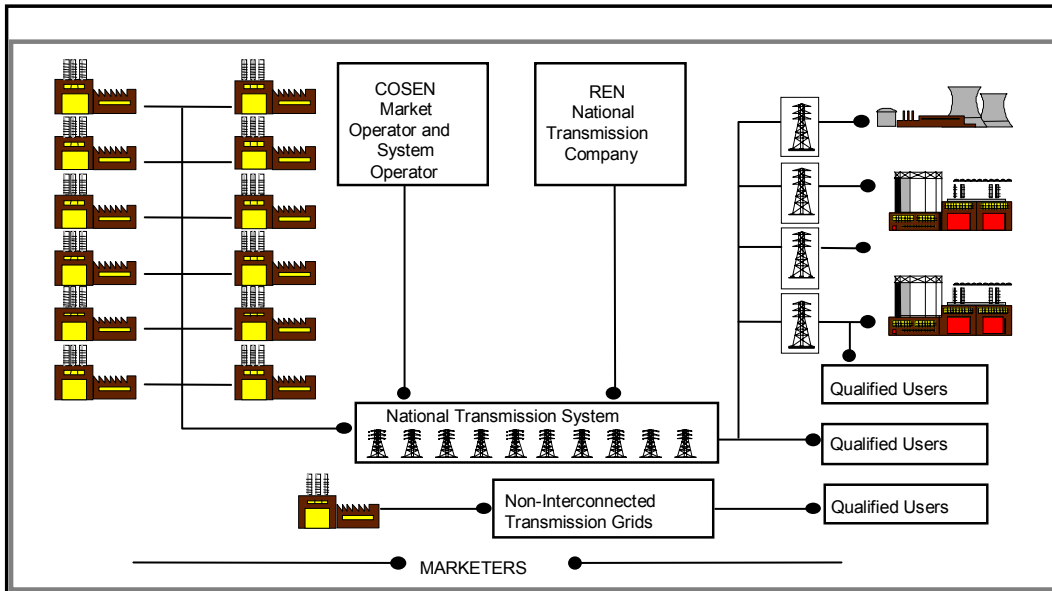
(mainly in the south of the country), and the system operator (ISO) would remain in the hands of the State. On the other hand, there would be some kind of regulations over the natural monopolies, such as transmission and distribution. Since generation and commercialization are contestable activities, regulators would make sure that competition take place without artificial entry barriers. The new organization under this restructure in the industry required important legal constitutional changes as well as the issue of a new electricity industry law and some other secondary legislation.

The Zedillos’s proposal was supposed to take place in three steps. The first one would ask for the following changes: (a) CFE and LFC are transformed into several generation, transmission, and distribution companies at arm’s length, (b) the government-run ISO is created as well as the State Company in charge of nuclear generation, and (c) the basic rules for the electricity market and the regulatory framework are designed. It is important to address that this first step has been already accomplished through what is known as a “shadow market” that started to operate in the mid of 2000.

The second step included the following actions. (a) the operation of the wholesale electricity market is implemented, (b) generation, transmission networks not interconnected to the national transmission system, and marketing are opened up to private investment, (c) markets start to work, (d) the ISO begins to operate its (physical and financial) dispatch functions, (e) private and public generators compete for contracts with distribution companies and large consumers, (f) bilateral contracts between distribution companies –and large consumers-- and private generators are allowed, (g) marketers and brokers begin their operations. Finally, in the last stage the state-owned generation, transmission and distribution companies are privatized.

Figure 2. Vision of the new electricity industry

Generation Dispatch Transmission Distributors Consumers



This proposal had some technical problems, even though, it presented a balanced combination between application of state-of-the-art economic theory and international experiences with consideration of the specific characteristics of the Mexican electricity industry. Some of these general criticisms are presented below.

First, one of the main omissions in this reform proposal was the lack of mechanisms that provide incentives for transmission expansion. It was proposed that the Secretaria de Energia would be in charge of planning the expansion of the transmission network, something that contradicts the market-oriented philosophy of the proposal.

Second, it was mentioned that the State would not bear risks nor provide guarantees to private investors. However, this did not seem true since the Secretaria de Energia would be responsible for its expansion. Moreover, there were really no coordinated incentives that solve problems of short-run congestion, recuperation of long-run fixed costs, and investment to intertemporally expand transmission network capacity. This was a critical flaw because generation development could be hindered by bottlenecks in the transmission network, which is a key element in electricity sector that are not mature enough.

Third, the structure of incentives for the ISO or COSEN was not clear. It seemed that COSEN was a non-profit dispatch entity and hence its objective function was not very clear. Additionally, COSEN functions should be clearly specified so that they do not overlap with those of the CRE and the Secretaría de Energía.

Fourth, incentives for generation capacity enhancement, in particular during peak periods, were not appropriately discussed. The proposal presented a pricing mechanism so the price paid to all generators was set equal to the offer of the last generator dispatched in each hour. However, during periods of high demand the market price rule was modified when reserve capacity margins are low. The market price was then 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 was the loss of load probability (LOLP). The terms CFALLA and K were mechanisms that artificially increased the price of electricity and produced high rents. The use of these terms, even during peak periods, promotes collusion in the generation market as can be theoretically and empirically shown. Moreover, these terms were also against the explicit purpose of the proposal to regulate market-powered segments and promote competition in contestable markets of the Mexican electricity market.

Finally, it was not clear how the IPP's were incorporated into the reform. The main problem was what to do with the long-term contracts that the State has signed to buy electricity from the IPP's.

A basic problem with this scheme was that it would contribute, together with the price factors K and CFALLA, to increase final price to consumers. Additionally, sudden increases in final prices are a common problem during transition stages of structural reform processes due to the elimination of subsidies. Therefore, the Mexican government should be careful in carrying out a selective subsidy policy to attenuate distributive negative effects of sudden price increases. For example, recuperation of the long-term contract IPP obligations could be differed as much as possible over time.

On the other hand, there were some positive aspects that could be obtained from the long-run vision of the electricity industry. First, privatization was seen as a mean and not as an end in the process. The proposal was looking for a competitive market

through the virtual restructuring of the sector, and a sound regulatory and institutional framework. After this structural and regulatory reordering, the market started to work and private investment in new generation and marketing activities was allowed. Only at the end of these processes the privatization stage was conceived. Under this process, the electricity industry would gain in productive and allocative efficiencies due to the economic and institutional reform. Second, we also can mention some other positive elements such as (a) liberalization of contestable markets (generation and commercialization) and regulation of naturally monopolistic sectors (transmission and distribution), (b) the design of incentive compatible mechanisms for the wholesale electricity market (MEM), (c) there were several price mechanisms that seek short-run and long run efficiencies: regional prices (whenever there are transmission bottlenecks), “cost-of-failure” price term (for cases of excess demand or lack of supply), real-time prices (to take care of differences between forecasted and actual generation), and hedging mechanisms, (d) long-term bilateral contracts were written as financial instruments with payments indexed to the short-term pool price, (e) both system operations and market operations were integrated in the COSEN, (f) a transparent and focused lump-sum subsidy policy was envisaged, (g) the State maintained an important strategic control of the sector (ISO functions, nuclear and hydro generation, and distribution and transmission concessions) but it did not run the risks of private IPP projects.

3. The Evolving Agenda

What are the remaining challenges?

Electricity represents a catalyst for development and progress and Mexico is a country with one of the highest growth rates in electric power demand in the world. Therefore, one of the priorities for the Mexican Government is to guarantee energy supply for all users.

In order for the Mexican Government to fulfill the energy sectors' investment needs and to adequately expand energy infrastructure, it is essential to carry out a structural reform. This will allow to introduce higher efficiency in generation and transmission and will improve the quality and security of service.

Another challenge linked directly to the other two (guarantee energy supply and carry out a structural reform) is to strengthen the regulatory and institutional framework. This would encourage the expansion of energy infrastructure, as well as clarify rules for participants.

With the introduction of private investment, the government would have more resources which could be invested in transforming PEMEX and CFE into world-class companies.

Why are these challenges still present in the system?

Most of the current power generation capacity is based on conventional steam and hydroelectric plants. The Total current Power capacity is 41,167 Mw (see Table 7). In electricity power there are nine power interconnection points between Mexico and the United States for a total transmission capacity of 1,336 Mw (see Map 1 at the end); two more with Guatemala with a 200 Mw (400 Mw more under construction) capacity and an other one with Belize with 100 Mw capacity.

On the other hand, more than a 44% of the generating power plants have 30 or more years, which implies higher generation costs. An electric reform would allow the private sector to make the needed investment to replace the obsolete plants (making the generation more profitable by lowering costs) and to build new plants in order to increase the actual capacity.

Table 7: Current Power Generation by Technology

<i>Technology</i>	<i>Capacity in Mw</i>
Wind	2
Internal combustion	144
Geothermal	843
Nuclear	1365
Dual	2,100
Coal	2,600
Combined cycle	7,563
Hydro	9,378
Steam	17,172
<i>TOTAL</i>	<i>41,167</i>

The expected average annual growth rate is 5.6% in electricity demand for the 2001-2011 period. From 2002 to 2006, 38 new power plants will be opened, with an installed total capacity of approximately 18,700 Mw. This would represent an increase of almost a 45% in the total generation system. Of these projects, about 90% will be based on combined cycle plants, which have proven to be more efficient and have lower investment and maintenance costs. With such additions, total power generation capacity in Mexico will reach 64,000 MW by the year 2011.⁷ This tendency in the used of combined cycle plants generates an increase demand for natural gas. It is expected that total demand will increase at an average expected rate of 7.4% per year for the following 10 years, increasing from 4,358 to 8,883 mmcf.⁸ If we consider the self consumption made by the oil sector, then it rises to 10.2% per year. In this way, the

⁷ Prospectiva del Sector Eléctrico 2002-2011, DGFPE, Secretaría de Energía, México 2002.

⁸ Prospectiva del Mercado de Gas Natural 2002-2011, DGFPE, Secretaría de Energía, México 2002

electricity power sector will be the main natural gas consumer, and its demand is expected to grow 12.6%, representing 60% of the total market demand.

Mexico actually has a total of eleven natural gas interconnection points with the United States with a total capacity of about 2,200 mcf/d (See Map 2). It has been this administration's priority to strengthen interconnection points. Mexico is actually a net importer of natural gas, but could become a net natural gas exporter in six or seven years.

Natural gas is a vital fuel for power generation in Mexico. Around 51.7% of total generation capacity by 1997 was hydrocarbon based. Natural gas is expected to increase its share according to the enactment in 2002 of environmental standards that will require the substitution of high-sulfur fuel oil for natural gas. Additionally, most of the IPP projects bid by the CFE are for plants that use natural gas. In fact, these projects usually include both the generation plant plus the gas pipeline connecting the plant with the gas source. This demand growth will imply a significant increase in gas penetration in the energy matrix. Between 1998-2007, the share of natural gas in energy consumption is expected to increase from around 18% to 58.1% for thermal power generation. Natural gas production is therefore crucial for the growth of the electric sector.

The Secretaria de Energia and PEMEX announced an ambitious program, Plan Estrategico de Gas Natural (PEG), in order to cope with this demand. According to the PEG, PEMEX plans to double its natural gas production from 2000-2008 passing from 131 thousand cubic meters per day to 238 thousand cubic meters per day. The analysis of the likely future evolution of domestic production, however, has to be skeptical since PEMEX's investment program in gas is typically behind schedule, and funded below the true cost. This carries to the logical conclusion of accelerating amounts of imports that, combined with the netback domestic gas methodology, could imply an increase of absolute levels of the price of gas in Mexico and possible volatility. New arrangements for risk sharing with experienced private companies should therefore be considered in the near term with associated changes in licensing, taxation and audit policies and practices.

There is also a question regarding the type of contracts that the generators will be able to arrange in order to meet their natural-gas needs. The main issue here is that PEMEX is in most of the cases the only source of gas. PEMEX has the virtual monopoly in any kind of gas (spot or futures) contracts because of its vertical integration and the existence of its marketing subsidiary. However, the CRE published the directive on first hand sales on February 2000 (see Comision Reguladora de Energía 2000) in order to regulate the marketing relations of PEMEX with its customers. This directive required that PEMEX did not unduly discriminate among consumers. This means that PEMEX would have to offer the same deals to northern generation plants that have access to more competitive contracts (because of closeness to the US market), and to southern generators that only have access to PEMEX gas. Therefore, if PEMEX makes a price discount to a generator in the north it has to offer the same discount to a similar generator in the south. The idea of the CRE with these measures was that, by having the same price of gas, competition among generators will only take place in aspects related to technical and financial issues.

Therefore, the current model of generation enhancement based on IPP generation is between a monopsony (CFE) and a monopoly (PEMEX). This does not seem to be consistent with a competitive market structure. This could affect the performance of electricity generation since, generally speaking, 60% of the total costs of a power generator is due to fuel cost.

Hence, the main policy recommendation for having a competitive natural-gas market would be that PEMEX is not permitted to discount the maximum price of domestic natural gas and the transportation rates. This is equivalent to not letting PEMEX commercialize gas. Another crucial issue is the expansion of PEMEX transportation capacity in order to satisfy gas demand from power generation. PEMEX is by far the dominant actor in transport and marketing and the interplay in both activities may continue to discourage private interest in developing gas transport infrastructure. The combined IPP/gas transport projects tendered by CFE can be seen as stopgap measures to deal with this problem.

There is another peculiarity with the structure of incentives for location of new generation plants and transmission lines. Such location will be mainly determined by

the current PEMEX natural-gas transportation system that is subsequently determined by PEMEX monopoly and vertical integration status.⁹ In other words, the location of new gas-fired producing sources in the Mexican electricity sector will be determined not by demand conditions but by closeness to the PEMEX pipeline network.

Investment Needs

Two methods are the most common to be found in Mexico to cover up power demand: the Independent Power Projects (or IPP's) and the Build, Lease and Transfer scheme. IPP's grant the government to gain access to new electricity sources by allowing CFE to buy power from the IPP's for its distribution. The other method, the BLT's allow private firms (as Mexico forbids private ownership of power stations) to build, lease, and transfer plants. In return CFE will make long-term contracts to buy the generated electricity.

According to the expected expansion of the electricity sector, the investment requirements are about 25 billion USD through 2006 and for the 2002-2011 period will be more than 55 billion USD.¹⁰ About 40% will be for generation, 24% for transmission, and 21% for distribution. The remaining 15% will be used for covering maintenance costs and other investments. The private participation through different investment schemes is expected to reach 39 billion USD by 2011. (See Graph 5 at the end for the pattern of investment).

These additional investment requirements of the electricity sector during the coming years will place an unprecedented burden on the budget and financing capacity of the public sector. This means that the government might have to divert resources away from other social priorities such as education, social security and poverty relief. According to SHCP and SENER data, the government had to meet the following budget requirements during the 2001-2006 period: USD 10 to 12 billion for poverty relief,

⁹ Since PEMEX is vertically integrated in transportation and marketing, there are little incentives for the construction of new natural-gas transportation routes that are somewhat close to the PEMEX pipeline network. PEMEX could discourage many new transportation projects through marketing and manipulation of pipeline capacity. This then implies that the shape and capacity of the current transportation network will hardly be modified according to market criteria.

¹⁰ Considering a 10 pesos per USD exchange rate

USD 20 billion for contingent debt, and USD 20 billion for basic infrastructure (highways, electricity, ports, etc.). Thus, in order to meet the increasing financial needs of the national electricity sector the government would have to allocate all the infrastructure resources to electricity for the next two and a half years, or all the poverty-relief resources for the next four years.

Supreme Court Decision

As described before, as a result of changes in the Electricity Law in 1992, an active, though limited, private investment participation has taken place within the generation of electricity. The participation of private investment through the Independent Power Producer scheme allowed by the legal reforms above described, has become the primary source of new generation capacity: the country is currently increasing its capacity in more than 10,000 megawatts generated by the IPP's¹¹.

In this context, on May 22nd, 2001, the Administration of President Fox proposed a reform to the Regulation to the Electricity Law (Ley de Servicio Publico de Energia Electrica¹²). Articles 126 and 135 of the Presidential document containing the reform modified the terms and limits for the operation of self-generation and co-generation schemes. With this, Mr. Fox's government was looking forward to increase private participation in the generation of electricity. However, On July 4th, 2001 the Mexican Congress filed a petition before the Supreme Court which involved a conflict about separation of powers with the Executive Branch. According to Congress, the referred articles violated the Law and, therefore, exceeded the power the Executive Branch is given by the Constitution.

The Supreme Court ruled in favor of the Congress. But in its ruling the Court went far beyond the constitutional question posed in the petition: this issue was not just a matter of separation of powers but also one of substantive constitutional law. In its decision, as obiter dictum, the Court questioned the constitutionality of the independent

¹¹ Cambridge Energy Research Associates (CERA), "Mexico's Supreme Court Ruling: Opening Pandora's Box?", CERA Insight, July 12, 2002.

¹² Published in the Official Gazette of the Federation on May 24, 2001

power producer (IPP) scheme, which constitutes the main source of private sector financing for generation capacity expansion in the Mexican electricity sector¹³.

This decision has generated a new source of uncertainty, additional to the present legislative and political debate about the reform of the sector. There is the possibility of a future decision against the constitutionality of the IPP mechanism.

Consequently with the Court's resolution, the model for the expansion of electricity supply in the country has been put at stake. This model is based, in the medium and long run, on the installation of private power plants under the IPP scheme, as shown in Table 8.

Table 8: Prospective Generation Capacity¹⁴

	<i>2002 – 2005</i>		<i>2002 – 2010</i>	
	<i>Mw</i>	<i>%</i>	<i>Mw</i>	<i>%</i>
CFE ¹⁵	1,590	16	6,064	22
PEMEX	–	–	750	3
Self-generation and co-generation	1,764	17	3,987	14
IPP	6,851	67	16,885	61
<i>TOTAL</i>	<i>10,205</i>	<i>100</i>	<i>27,686</i>	<i>100</i>

Power plants to be built under the IPP scheme represent 67% of the total capacity expansion between 2002 and 2005, and 61% for the period 2002 – 2010. As mentioned above, this situation has introduced uncertainty among private investors who are waiting for a clear sign of reform in the sector that reduces to zero the probability of the IPP scheme being declared unconstitutional. For the time being, important energy companies are skeptic about the present context. For example, Electricité de France, the largest private investor in the Mexican electricity sector, has announced that it won't be participating anymore under the IPP scheme unless the expected reform takes place.

¹³ Through the IPP scheme the government transfers to the private sector the risks associated to the construction and operation of the power plant.

¹⁴ As of June 2002.

¹⁵ Schemes other than IPP.

The Supreme Court's decision illustrates the imperative necessity of reforming the Constitutional text in order to thoroughly reform the Mexican electricity sector, otherwise, Constitutional issues could always be raised against any partial restructure proposal.

Restructure Proposals: Fox, PRD, and PRI

As the debate over the need of a structural reform of the Mexican Electricity Sector has grown, most political parties have submitted their points of view. The current political atmosphere has made the electricity reform debate a contentious one, and to some experts,¹⁶ the implementation of the proposed changes by Mr. Fox's government have almost no chance of going through before the 2003 mid-term elections.¹⁷

Even though it is clear from the analysis of other international restructure experiences, such as the ones which took place in Chile, the United Kingdom, and others, that a thorough restructure of the electricity sector has positive effects in the industry, the debate as to whether it is necessary to implement a structural reform in the electricity sector in Mexico, has unfortunately left the technical arena and has almost totally evolved in the political agenda. Factors such as the growing participation of labor unions, political negotiations between parties, just to name a few, are playing the most important role in this debate.

In the next section, the most relevant structural reform proposals will be described. They include the actual administration's proposal and the proposals which look forward to preserving the vertically integrated state-owned monopoly, such as the ones made by "Partido Revolucionario Institucional" (PRI) and "Partido de la Revolucion Democractica" (PRD).

¹⁶ International Energy Agency, "México Energy Outlook", Paris, 2002.

¹⁷ In the 2003 elections, the low chamber of Congress will be renewed, as well as some State Governors and City Majors will be elected

The PAN / Fox's proposal.

President Vicente Fox's political party "Partido Accion Nacional" (PAN), submitted their electricity reform proposal on December 4, 2001. The need to satisfy the growing short and long term energy demands of the country pushed the current administration to consider Constitutional reforms which allow the participation of private investment in generation.

Contrary to the former administration, the PAN's proposal does not include the privatization of CFE and LFC, it considers their financial strengthening to fund their needed expansions and therefore increase their autonomy. It also considers the corporate separation between the generation and the distribution segments of each corporation.¹⁸

Constitutional changes to articles 27 and 28, which reserve the generation, distribution and transmission to the state, are an essential part of the PAN's proposal. The proposal seeks to open up the generation and distribution to private investment, leaving the transmission to the exclusivity of the state.

The necessity of private funding to meet the needed capacity increase in order to satisfy the growing demand, is the main idea behind the proposed Constitutional changes. As developed elsewhere in this essay, without Constitutional changes, in order to meet infrastructure investment needs, the federal government would have to disburse huge sums, which would distract funds for much-needed social programs.

Another crucial characteristic of this proposal is the strengthening of the regulator, "Comision Reguladora de Energia" (CRE). Under this proposal, the CRE would have new and increased responsibilities, making it an independent regulator with important similarities with those in competitive markets, since it would have enough power to fix electricity prices, provide technical and economical regulation and enforce anti-competitive conducts from participants (including CFE and LFC). Regarding nuclear energy, under this proposal, the state would preserve its exclusive control.

¹⁸ Merrill Lynch & Co., "Energy Reform México", Mexico, January 2002.

Maybe the main advantage of the Fox' proposal is its political viability. Traditionally, there has been a strong opposition in the Mexican congress to privatization of the energy state monopolies Pemex, CFE and LFC. Recently, the previously incumbent party PRI has included in its political strategies an alliance with the leftist party PRD in this topic. It thus seems that the only possibility for a reform in Mexico is that private investors take care of new generation, and of distribution concessions and that regulators take care of designing smart regulations that allow fair competition under the existence of vertically integrated dominant state incumbents. A similar task was also undertaken by the Mexican government in the reform to the Mexican natural gas industry.

Other positive aspect of the Fox proposal is its recognition of the inefficient current subsidy (regressive) scheme of the electricity tariffs, and the need to redefine such subsidies in a transparent way according to rational social profitability criteria.

On the other hand, the same problems of lack of incentives for generation and transmission expansion that we analyzed for the Zedillo's proposal apply to the Fox' proposal. Additionally, the Fox' proposal present other major complications that arise from the constraint of having to maintain vertically integrated State monopolies. There is not a clear definition regarding the relationship between the state generators and the state transmission company.

As in the Zedillo's proposal, incentives for expansion of the transmission network are not specified in the Fox' proposal. It is only mentioned that transmission will be subject to regulation but without any specification to any type of regulatory scheme.¹⁹ This omission could be even worse than in the 1999 proposal since in this new proposal the purpose of leaving transmission and existing generation in State hands is explicit. Under such vertically integrated scheme, CFE could find profitable the congestion of the transmission lines in certain conditions. Additionally, private investment in new transmission seems to be restricted to self-supply projects

¹⁹ Transmission subsystems that are not connected to the national transmission system are not to be controlled by COSYME. There is no definition regarding the kind of regulation that will be used for such systems.

PRD and PRI's proposal

Even though PRI's and PRD's proposals may appear different in formal and superficial issues, in essence they have very similar characteristics which clearly confront them with the PAN's proposal, as well as with Zedillos's proposal.

The PRI submitted their electricity reform proposal on March 13, 2002. More than a reform proposal, it could be addressed as a political manifesto in which the status quo is the main player: it does not propose Constitutional amendments, it does not provide for the participation of private investors in generation –only in the 1992 reform schemes. It seeks to preserve the vertically integrated state-owned monopoly, only proposing the strengthening of CFE and LFC, in regards to their participation in the energy sector's strategic planning and increasing their financial capacities through fiscal incentives. The only similarity with the PAN's proposal is in the strengthening of the responsibilities and autonomy of the CRE, but in this proposal the CRE has no exclusive authority to fix prices.

In April 11, 2002, following the PRI's proposal, the PRD submitted to the upper chamber of Congress, their proposal. As stated before, it has enormous similarities with the essential elements of the PRI's proposal. It also provides for the state to preserve the exclusive rights to generate, distribute and transmit electricity, it also pushes for the financial strengthening of CFE and LFC through fiscal benefits, it also proposes the strengthening of CRE's autonomy. One of the most important differences with the PRI's proposal, is that it transfers to CRE the responsibility to fix prices, even though prices are not market fixed.

New proposals.

Recently, in December 2002, Senator Alejandro Gutierrez, from the PRI, without the support of the PRI's hard wing (headed by Senator Manuel Bartlett), submitted individually, a new proposal to thoroughly restructure the electricity sector. In this proposal, Senator Gutierrez clearly breaks with his party's position of status quo.

He proposes Constitutional amendments in order to allow private investment participation and even though the state is kept as the main actor in the electricity market. His proposal has more in common with the current administration's one, than with his own party's. It is expected that during the next session in Congress, this proposal is brought to debate.

Relationship between restructuring of electric power markets and broader processes of reform in the economy.

Mexico has a long and successful history of implementing structural reforms in the past two decades. The power reform is one of the key structural reforms to be implemented in this administration; the government bases its expectations of high rates of economic growth on the successful implementation of such reform. However, the task of moving forward in the process of reform has proven not to be easy, especially in the face of divided and highly politicized Congress. The ability of this government to build consensus could determine the pace and potential for the country's economic growth.

In the last twenty years, the three previous federal administrations had committed and undertaken a comprehensive reform program. Such restructuring programs were largely the result of the conditions attached to loans to developing countries, in exchange of fresh resources from the International Financial Institutions, like the World Bank and the IMF. This was known as the Washington Consensus and encompassed ten fundamental structural reforms to be implemented, so developing countries, mostly in Latin America, could be brought back to growth and stability in their economies.²⁰ The reforms did not deliver what they originally promised to, both in terms of growth and investment. Nevertheless, they brought unrest and huge social cost to those societies that undertook these measures.²¹ Mexico was repeatedly hailed as one

²⁰The 10 reforms are: See John Williamson ed., Latin American Adjustment: How much has happened? (Washington, DC: Institute of International Economics, 1990).

²¹ See Armando Jiménez San Vicente, "The Social and Economic Cost of Structural Adjustments in Mexico," Masters Degree Thesis, Harvard University, 1999.

of the advanced reformers²². It had been quite successful due to a hegemonic ruling party in power for seven decades, which ensured the implementation of the reforms as well as the political stability needed for them to develop.

The energy reform is one of the key structural reforms pledged by President Fox as he arrived in power in late 2000. During his campaign he promised three major reforms, a tax reform, an energy reform and a labor reform. President Fox placed a great deal of importance in continuing the reform process, both in the National Development Plan (PND) as well as in the National Program for Financing the Development (PRONAFIDE). Both documents state this administration's commitment to the implementation of those structural reforms holding back the country's development. PRONAFIDE envisions two scenarios that clearly tie the country's prospects of growth to the implementation of the pending reforms.²³ One without structural reforms and a low average rate of economic growth for the six year Presidential term of President Fox, and an alternative one, with high growth rates as a result of the implementation of the structural reforms.

Mexico is the 12th largest economy in the world and the 8th global exporter, however it suffers from one of the lowest yields of tax collection in the world as percentage of GDP: about 16% if one takes into account oil revenues or merely 10% if only tax sources are considered.²⁴

²² See Sebastian Edwards ed., Latin America and the Caribbean: A Decade After the Debt Crisis (Washington, DC: World Bank, 1993); "IMF Approves US\$ 17.8bn Stand-by Credit for Mexico," International Monetary Fund, Press Release No. 95/10, February 1, 1995; Structural and Sectorial Adjustments: World Bank Experience, 1980-92 (Washington, DC: World Bank, 1995); Peter Kenne, "The Use of IMF Credit," in The International Monetary Fund in a Multipolar World (Washington, DC: Transactions Books, 1990); Eduardo Lora, "A Decade of Structural Reforms in Latin America: What has Been Reformed and How to Measure it?", Washington, DC: Inter-American Development Bank, 1997, Mimeo.

²³ The document contemplates two alternative scenarios, "one in which the whole lot of the structural reforms are implemented, and another one, where the structural reforms are not implemented in full. Such scenarios result in different growth paths in terms of GDP, employment and real salaries...." See "Programa Nacional de Financiamiento al Desarrollo, 2002-2006." Secretaría de Hacienda y Crédito Público: México, D.F., 2002): 82

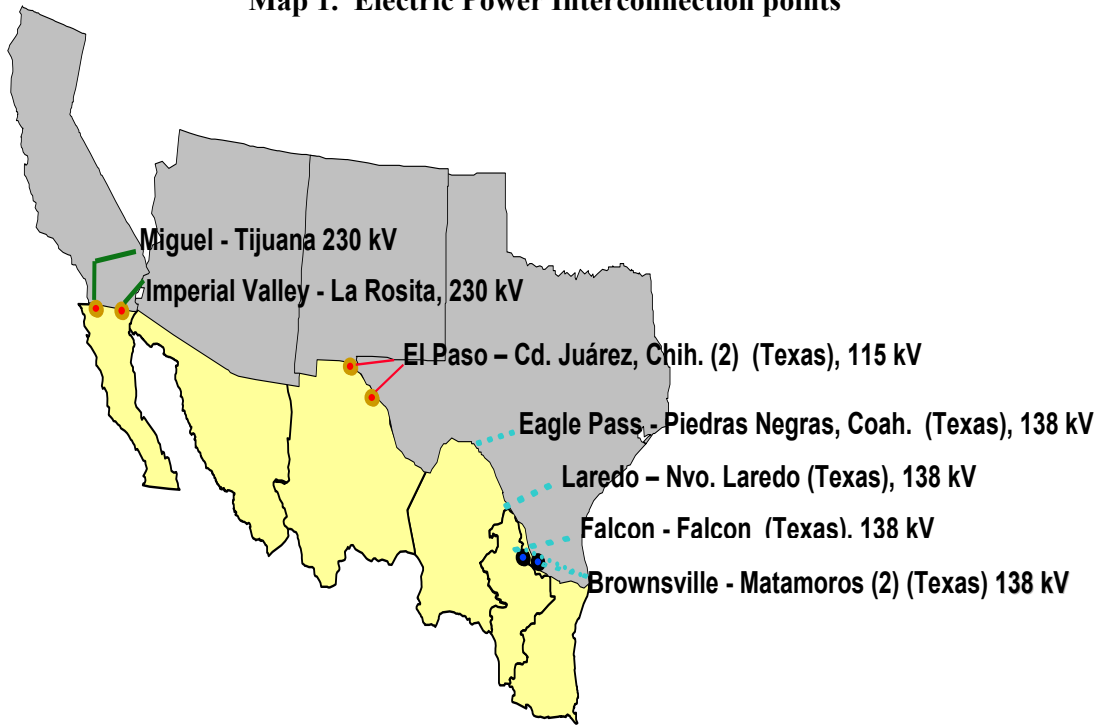
²⁴ See Armando Jiménez San Vicente, "The Political Economy of Tax Collection in Mexico, 1970-2000." PhD Thesis, London: London School of Economics, 2002. In the process of publication. By the end of the 1990s Mexico had the lowest level of tax collection among OECD countries and the third lowest in Latin America. See OECD Statistical Revenues (Paris: OECD, 1999) and The Fiscal Covenant: Strengths, Weaknesses, Challenges LC/G 204 (Santiago: ECLAC, 1998).

Facing a large budget shortage to implement his policy agenda, President Fox first attempted a comprehensive tax reform. Despite the fact that he brought into his cabinet an experienced tax man, Francisco Gil, well recognized as one of the leading figures in tax reform in Latin America and responsible for one of the most successful reforms to the tax system as Undersecretary of Income during president Salinas' term, a divided Congress and the mishandling by his team of the politics of reform, caused this policy proposal to fail. It all ended in a highly criticized incomprehensive package of tax measures.

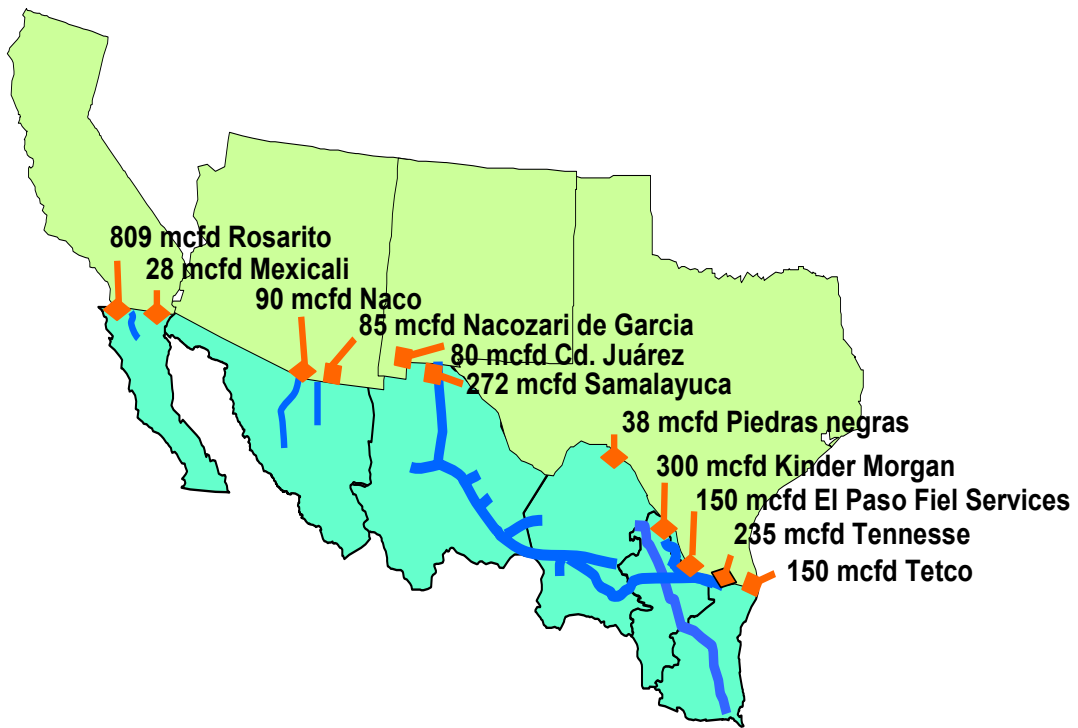
Another policy at the top of the President's agenda is the labor reform, which is still being discussed, but faces the difficulties of dealing with a corporate system used to the previous regime, where large unions were traditionally protected under the wings of an hegemonic political party (PRI) since they were considered as one of its main pillars.

The energy sector is at the core of Mexico's nationalism, sense of pride and independence. There have been few attempts to open up the Mexican energy industry, one of the last energy sectors in the world almost totally closed to private participation. President Salinas, in a time of political control over Congress, partially opened up the power sector to private investment, leaving an unfinished agenda. By the end of his term President Zedillo pushed for a comprehensive energy reform proposal, which ended up on the freezer opposed by a divided Congress, no longer controlled by the PRI.

Map 1. Electric Power Interconnection points



Map 2. Natural Gas Interconnection points



Graph 5: Total Investment in the Electric Sector

