

**The Mexican Electricity Sector: Economic,
Legal and Political Issues**

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This paper presents results from one of the countries studied. For other individual country studies, synthesis of results, and in-country events on electricity markets, please see the Program website at <http://pesd.stanford.edu>.

The Mexican Electricity Sector: Economic, Legal and Political Issues¹

Victor G. Carreón², Armando Jimenez³ and Juan Rosellón⁴

I. Introduction

This chapter aims to explain the motivations and strategies for reform in the Mexican electricity sector. Our focus is on the effects of politically organized interests, such as unions and parties, on the process of reform. We show how particular forms of institutions—notably, the state-owned enterprises (SOEs) within the power sector as well as the state firm that supplies most fuels for electricity generation—shape the possibilities and pace of reform. The tight integration of these SOEs with the political elite, opaque systems for cost accounting, and various schemes for siphoning state resources explain why these institutions have survived and the actual progress of reform has been so slow. Where private investors have been allowed into the market it has been only at the margin through the “independent power producer (IPP)” scheme, an oxymoron since the purchase agreements and dispatch rules that determine payment to these IPPs are dominated by the State.

In its origins in the late 19th century, the Mexican power system grew as a series of privately owned, vertically integrated regional monopolies. Investors, mainly from firms based in foreign countries, built power systems in areas where they thought they could earn a profit—mainly mining and textile industrial areas as well as the largest cities— while leaving aside most rural areas. The Mexican Revolution period (1910-1917), and the

¹ This paper was elaborated with the participation of Antonio Cervantes and Luis Carlos Ugalde. Also, we want to thank Guillermo Goveia and Gustavo Dector for their contributions. We are especially grateful to David G. Victor for his editing advice in the revision process. Finally we want to thank Mario Chocoteco for his research assistance

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political consolidation of the country (which included the assassination of President Álvaro Obregón) caused foreign private investment to trickle. By the late 1920's, two things were clear. First, electricity supply was (and still is) strongly associated with the concepts of “nationalism” and “sovereignty”⁵. Second, private investment in the sector was declining and electricity demand was rising. Therefore, there was an urge for the government to step in and assume control of the power system. During the 1930s the industry was swept up in a broader process of reorganization as the *Partido Revolucionario Institucional (PRI)* consolidated its grip on power and unified the far-flung Mexican states into an integrated federal country. As a result of this consolidation, Mexico had the *Código Nacional Eléctrico* (National Electric Code), and a newly created state-owned and state-financed enterprise —*Comisión Federal de Electricidad (CFE)*— which came to dominate all investment in new capacity. At the same time, worker unions were developed. Electricity being a key sector for the Mexican government (and mainly to the party in power), the Electricity Worker Union quickly gained political power. Since then, the strong correlation between the evolution of the electric sector and the political environment has become stronger. Through the 1940s and 1950s installed power-generating capacity continued to rise as the government and a few private generators invested heavily in the sector.

In 1960, a constitutional amendment to Article 27 nationalized the electricity industry, formally giving the government “exclusive responsibility” for generating, transmitting, transforming, and distributing electricity. The private participation in generation ended and new challenges emerged. Political issues, lack of credible data on the true cost of electricity, among other difficulties, raised barriers for setting economically efficient tariffs. Also in this decade, the government created the *Compañía de Luz y Fuerza del Centro* (LFC) to supply electricity to Mexico City and the neighboring states. Reinforced by these changes in the power sector, populist ideas claiming sovereignty and state autonomy as the government's primary goals became more important than efficiency and economic growth. As was the case in many countries during the 1960's and 1970's, Mexico alienated private

⁵ The Mexican modern nation was built around the idea of sovereignty as a key element to keep the country united against external forces. To understand the importance of that concept it is necessary to recall that Mexico lost half of its territory in the 19th century to the United States. Since then Mexican leaders have used the discourse of nationalism and sovereignty as persuasive and unifying elements to protect Mexico's borders and maintain the country's independence. Although territorial sovereignty is no longer in danger, several decades of indoctrination can persist even if international conditions have changed. Today, privatization and foreign private investment are rejected because some groups perceive them as new forms of colonialism.

investment and insulated the power system from market forces, allowing it to grow without much consideration for the economics of the business. Moreover, the “soft budget” of state financing allowed these enterprises, CFE and LFC, to operate (albeit inefficiently) and to wield growing political power. Nonetheless, a steady supply of new technologies (developed mainly abroad) as well as the economies of scale in building ever-larger power systems made it possible to sustain low tariffs for end users without causing these firms to become a huge drain on the state budget. Although these improvements were largely exhausted by the 1970s, the surges in oil prices at that time delivered a windfall to oil-rich Mexico, much of which was directed to subsidies for electricity generation. On the other hand, when oil prices crashed in the early 1980s, a deep financial problem created both the urgent need and a political opportunity for reforms that would make the power sector more efficient while reducing the burden on the state to supply all new capacity. Even though those reforms started slowly and cautiously, successive financing crises have created additional pressure for reform.

In the late 1980s and early 1990s, the Mexican government implemented swift market reforms in various economic sectors (like banking and pension systems) and started to open its markets to international free trade. These included foreign investment agreements allowing participation in several sectors (including electricity) and the creation of new economic institutions that were required to implement those reforms. The *Comisión Federal de Competencia* (Antitrust Federal Commission, CFC), the *Comisión Federal de Telecomunicaciones* (Telecommunications Federal Commission, COFETEL) and the *Comisión Reguladora de Energía* (Energy Regulatory Commission, CRE) were created to regulate markets in order to get the desired social outcomes. More specifically, the CRE was created in 1993 to help build an electricity market.. During the late 1990’s, former President Zedillo attempted a comprehensive reform of the electricity sector, which included amending the Mexican Constitution, but faced strong political resistance. Finally, in year 2000, for the first time in modern Mexico’s history, a candidate from the opposition -the *Partido Accion Nacional*, PAN- won the Presidential Office election. The new government made a new reform attempt; but in a divided Congress its proposal did not achieve the required majority support. At the same time, both major parties in the

opposition, PRI and *Partido de la Revolución Democrática* (PRD), presented their own proposals, which are presently being debated.

The plan of this chapter is as follows. In section II we recount the history of the electric industry in Mexico to explain the structure of the SOEs that dominated during most of the 20th century and are now the subject of reforms. We analyze the performance of the system, to the best extent possible given the limited data, by looking at patterns of investment and tariffs. We also examine the spread of electrification to the rural poor, regulation of the environmental impact of electricity generation and other social dimensions of the power system. In Section III we examine motivations and outcomes from the various attempts to reform this state-dominated system, starting with the financial crisis in the early 1980s. We analyze the changes introduced in 1992 and the reform proposed by former President Zedillo in 1999. The main political actors: consumers, parties, government, unions, etc, are also introduced as they get involved in the discussion. This is very important since the Mexican electric system (as any other system in the world) should not be seen separately from the political and economical standpoint since both have shaped the power sector. By understanding the different scenarios and conditions that prevailed in the sector, the whole story should make sense. While there has been some progress in the process of reform, fundamental issues remain unsettled because of the combination of economical, political, and legal factors: the composition of both chambers (deputies and senators), the judicial decisions about the legality of the present regulatory schemes, the role of the public opinion, especially on issues of nationalism and sovereignty, the new role of the CRE, the evolution of tariffs in the near future, etc. We summarize those in section IV, where we discuss the evolving agenda. Finally, conclusions are stated in section V.

II. History of the Mexican Power Sector

II.1. 1880-1979: Mexico's political consolidation and power sector growth

The origins of the Mexican Power System can be traced back to the late 19th century when private investors built and operated electric networks that would provide traction, lighting and machine motors for industry (mainly textile and mining) and lighting in the

major cities. The first plants deployed whatever source of primary energy was readily available—coal for thermoelectric plants and, where appropriate rivers were available, the power of running water. The first thermoelectric generation plant started operation in 1879, mainly to supply a textile mill at León in the state of Guanajuato; the first hydro plant produced electricity a decade later—for the mining industry at Batopilas in Chihuahua. In parallel, governments sold lucrative concessions for electrification of cities—the first of these, in 1881, awarded electric service for Mexico City to the privately held *Compañía Mexicana de Gas y Luz Eléctrica*.⁶ Through these vertically integrated monopolies, installed capacity grew at nearly 20% per year by the first decade of the 20th century⁷. Private investors were drawn only to the wealthiest and most industrialized areas. However, investment concentrated in the center of the country around Mexico City. Low prices and generous terms for the concessions, along with the demographic growth of Mexico in the early 1900's, attracted investors—most from firms based in Canada, France, Germany, and the United States, with only a small share from Mexican investors. This private model of electrification was followed in all five of the countries examined in this book. It included few requirements to invest in activities that the private investors themselves would not find profitable, such as “universal access” to electricity or rural electrification. Moreover, this administrative law instrument (i.e., a concession) was laden with ambiguities that, usually, were interpreted in ways that benefited the investors, and there was no authority with clearly articulated competence for setting policy and enforcing the terms of the concessions.⁸

Mindful of the increasing social, political and economic relevance of electricity, the government tried to tame the monopolistic tendencies of the electricity companies. But the task was daunting as the central government was weak and the industry itself was in the midst of a massive reorganization that would produce even larger monopolies that, by design, would not compete or even complement each other. The most important firms became holding companies by absorbing the many small retail companies—interestingly, this consolidation occurred at roughly the same time that Samuel Insull, in the United States, was creating a vast holding company by acquiring the assets of smaller isolated

⁶ Rodríguez y Rodríguez (1994).

⁷ Rodríguez y Rodríguez (1994).

⁸ Rodríguez y Rodríguez (1994).

firms. The *Mexican Light and Power Company* adopted a single 50 Hz system across its entire network, but *Impulsora de Empresas Eléctricas* operated at eight local frequencies—from 25 to 58 Hz—and did not attempt to seize the economic advantage of full interconnection. These two firms, together with a much smaller one, *Nueva Compañía Hidroeléctrica Chapala*, dominated the market. In a few jurisdictions, local government regulators had discovered their ability to wield influence and, in most cases, demanded low tariffs set without regard to costs. Wary of such pricing schedules that, in effect, expropriated monopoly profits, private firms reduced their investments in new capacity. The result, arguably, was the worst of two worlds. Monopolistic pricing flourished where regulators were weak, but in the heart of the industrializing nation—Mexico City—arbitrary tariff rules set the stage for perpetual under-investment in the power sector.

In 1926 the federal government adopted a policy strategy that would cast a long shadow over the century. The *Código Nacional Eléctrico* changed the Constitution and declared electricity a public service and conferred to Congress the attributions to legislate in related matters. In the short term, this constitutional move had little impact because the federal government remained weak—financing and regulation of local electric monopolies, for example, was controlled by state and city governments and the large industrial users of electricity. Congress adopted rules that demanded rural electrification, a politically popular mandate, but the private companies ignored new mandates that made no sense for their business plans. However, the Código did require homogenization of the frequency standards over the complete system—on that score it had large effect since it supplied the public good of coordination and required only two of the dominating firms (*Impulsora* and *Chapala*) to align their practices with the third.

As it is the case in other countries examined in this book—such as Brazil and South Africa—the Mexican government tried to circumvent the difficulties of sustaining private investment by assuming the function of supplying electricity itself. The seeds of this effort are found in the creation, in 1934, of the *Comisión Federal de Electricidad* (CFE), with a modest initial budget (50,000 pesos, about USD\$14,000 at the time), a tiny staff of 20 employees and two main objectives: 1) to operate as a regulatory agency and liaison between foreign companies and government, and 2) to supply electric service to those areas considered by private power companies as not profitable. With its loose mandate and tiny

budget it was hardly clear, at the time, that CFE would emerge as the dominant force in the entire Mexican electric power system.

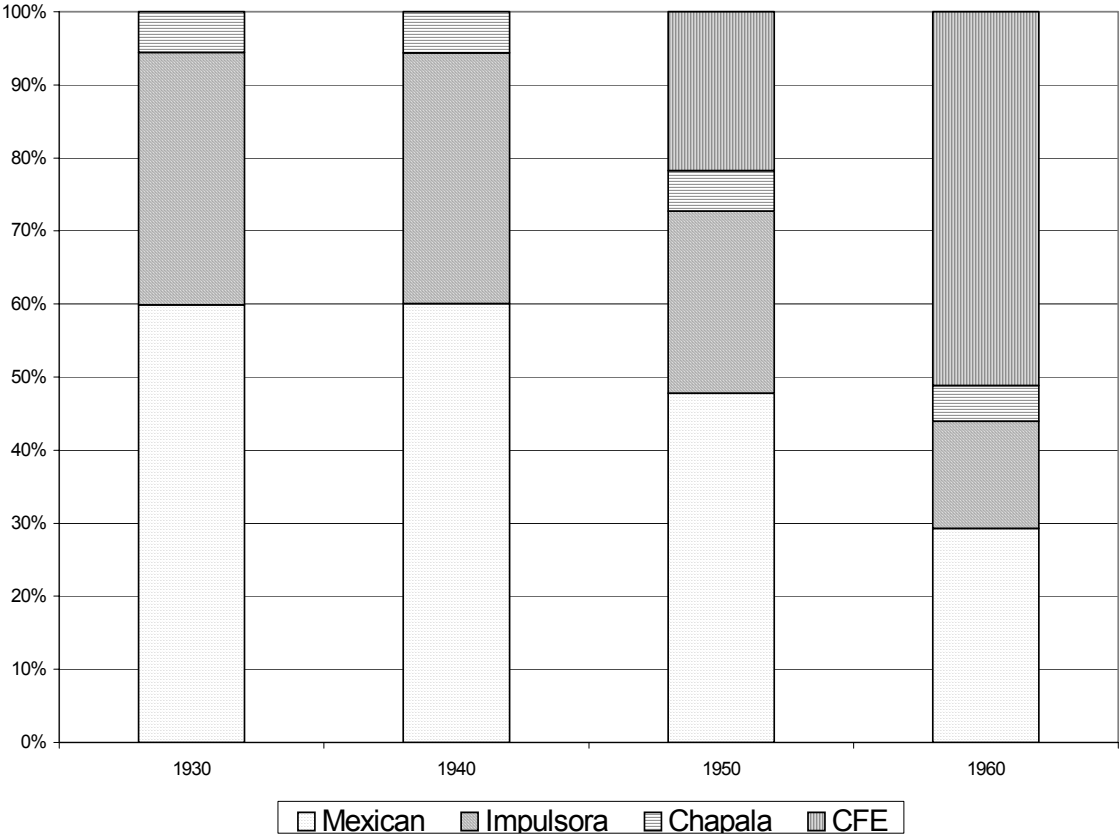
At the same time, President Lázaro Cárdenas consolidated power around PRI, his Party. Although PRI had a strong influence on peasants, its key strength rested on Unions, and the best organized ones were those in the largest industries—mining and electricity. Indicative of the growing power of these unions was the *Sindicato Mexicano de Electricistas (SME)* (Mexican Electric Workers' Union), which struck *Impulsora de Empresas Eléctricas* and its seven subsidiaries in 1936. The oldest and strongest union in México, SME, became a critical piece in President Cárdenas' policy that became known as "Mexican Corporatism" —strong central government ruling in collaboration with organized labor unions. By the late 1930s the PRI was firmly in control. Land reform and nationalization of economic resources became symbols of Mexican national sovereignty and thus key planks in PRI's policy platform. The 1938 Electricity Public Service Act, issued just as PRI was completing its consolidation of political power, required strong federal regulation of electric services, including tariffs.

Foreign firms, already finding their investments squeezed by low mandated tariffs in a few key jurisdictions, reduced their investments still further. In most cases, they maintained their existing capacity but invested little in expansion (for these firms, the Second World War was an additional discouragement to investment abroad.) From 1937 to 1943 private investment grew less than 1%. Wartime President Manuel Avila Camacho sought to nationalize the power system but feared a backlash if he simply appropriated the assets of powerful foreign investors. Rather, he launched a rolling process of nationalization—CFE was instructed to buy (at depressed prices) existing electric assets, and with state resources CFE also oversaw the construction of new generation, transmission and distribution services.

Prior to the 1940s, private firms supplied all investment in new capacity (*Mexican, Impulsora* and *Chapala*). But then private investment flagged. Nationalization began in 1944 when CFE acquired *Chapala* (the third largest of the private electric companies) and built CFE's first generating facility (Ixtapantongo). During the 1940's and 50's, CFE acquired and consolidated hundreds of regional electricity monopolies into a single firm—linking all with common technical standards and taking advantage of the ever-larger

economies of scale offered by new generation equipment. From 1939 to 1950, 52% of the total investment in the power system came from public resources and 30% from contracted credits by the government—essentially all of this within the growing CFE system. Only 18% was private investment from firms that remained outside CFE’s network.⁹ By 1959, total installed capacity had reached 8,547 MW of which CFE controlled about half (4,229 MW) and the remaining private networks accounted for smaller shares: the *Mexican Light and Power Company* with 1,821 MW and *Impulsora de Empresas Eléctricas* with 701 MW. See Figure 1 for the increase in new capacity during this process of nationalization and consolidation of the system – notice that all new capacity came from additions from CFE while the other firms kept the same installed capacity.

Figure 1: Percentage of New Capacity by Firm, 1930 to 1960.



Source: CFE and Nafinsa

⁹ Bastarrachea S. and Aguilar, J. (1994).

The consolidation largely finished in 1960 when the Federal Government bought 95% of the common shares in *Impulsora* and also acquired a majority stake in *Mexican*. These new acquisitions also allowed for a reorganization of the sector. CFE was given control over all segments and regions of the power system except for the central states of Mexico, Morelos, Puebla, Hidalgo, and Distrito Federal, which became the service area of a new state-owned enterprise, *Compañía de Luz y Fuerza del Centro* (LFC). This division of geographical responsibility between two state enterprises remains to the present. By the time nationalization reached the nation's capital a politically well-organized and (at the time) efficient power company already existed; fearful of being rolled into CFE, instead the incumbents in the center carved LFC out of the remnants of *Mexican* and implored the Mexican President to establish their service as a separate enterprise.

Having largely completed its nationalization already, in 1960 the government formalized the arrangement with a constitutional amendment (Article 27, paragraph 6) declaring: “*It is the exclusive responsibility of the Nation to generate, transmit, transform, distribute and supply electricity that is intended for public service use.*”¹⁰ As in most Latin American countries in the 1960s and 1970s, nationalization along with an import substitution strategy were part of the government's effort to control economic development—to accelerate the rate of growth and to spread the benefits widely. Over the decades that followed, the government controlled power system connected millions to the grid, achieving nearly universal coverage, which is one of the reasons why the population at large—especially those from adverse social backgrounds—support state control of utilities in Mexico. Along the way, the notion of social justice was expanded to include a wide array of subsidies for urban and agricultural consumers—as in many countries (e.g., India) electricity tariffs were constructed with an eye to political benefits rather than economic cost, and over time they led to a system characterized by mounting losses.

Under this new legal framework, CFE continued its growth by acquiring the few regional companies that remained in private hands, buying the last, *Compañía de Servicios Públicos de Nogales*, in 1972. New functions accreted to the national electricity system built around these two state-owned enterprises. In 1974 President Luis Echeverría Álvarez sponsored yet another amendment to Article 27 —this time to grant the State the exclusive

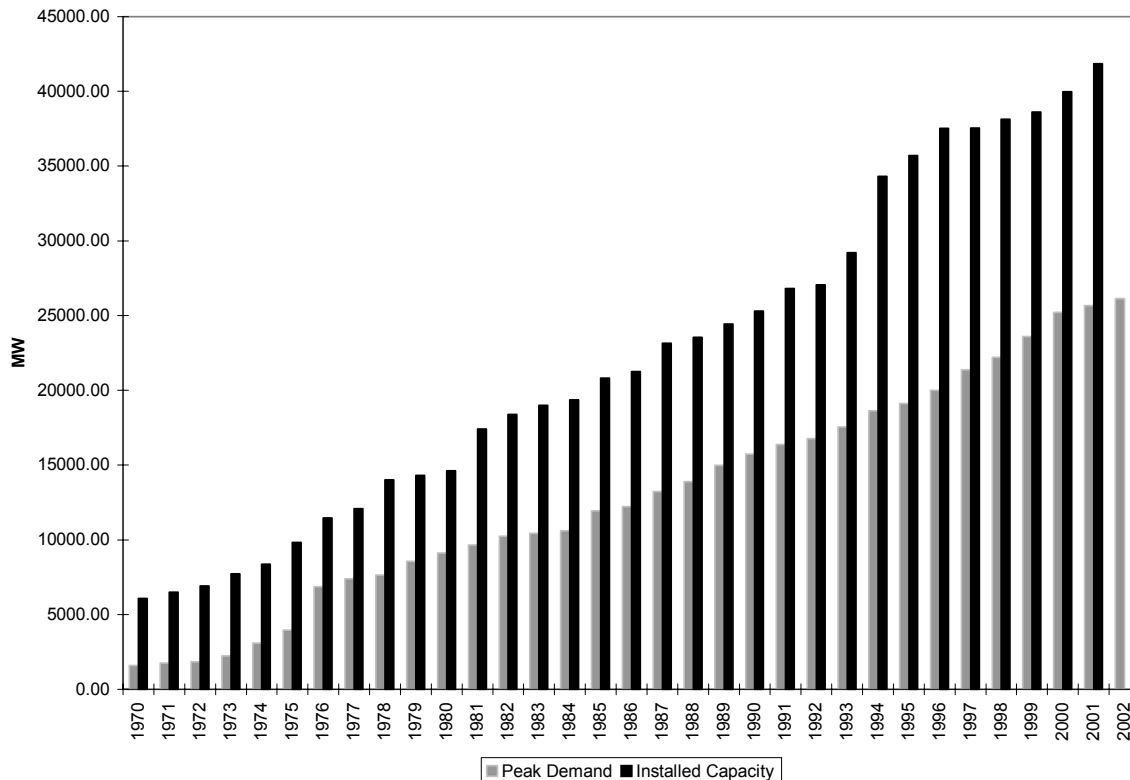
¹⁰ Breceda, M (2000)

right to use radioactive materials and nuclear fuel for generation of energy—as well as Article 73 that reserved for Congress the right to legislate on nuclear energy matters. The process of nationalization and consolidation of control into the hands of the state was finalized legally in 1975 with the *Ley del Servicio Público de Energía Eléctrica* (LSPEE) which declared CFE and LFC as public suppliers of electricity. State-controlled monopoly, it was thought, was essential for ensuring the real-time management of electric power. Only a state enterprise could be trusted with a technology that had large economies of scale—and thus natural tendencies to monopoly. Furthermore, private generators sought only profitable markets, leaving a large part of the population without electricity, and it was assumed that only a state-owned enterprise could deliver electric service more equitably

As in most of the SOEs studied in this book—possibly with the exception of Eskom in South Africa—CFE and LFC were managed like government offices rather than private, competitive firms. Relying heavily on the public budget for financing, they were (and still are) a source of political patronage for senior appointments. These enterprises also host among the strongest of the nation’s unions—key elements of the PRI power base. In addition to these generic features of state-owned enterprises, management of these firms has been complicated by frequent changes in policy as well as by the difficulty of drawing a line between State and enterprise. We now turn to the task of evaluating the system that emerged from this historical context, with particular attention to factors that have affected the choice of fuels, the setting of tariffs and the financial performance of the State-dominated system. We also examine the system’s performance on several politically important dimensions (beyond financial)—notably, its ability to connect people to the grid. The analysis of successes and failures sets the context for the goals that reform efforts, begun in the wake of a financial crisis in the early 1980s, sought to achieve.

This system, controlled and financed completely by the State, appears to have performed adequately during the 1970s. Demand grew rapidly, but so did installed capacity. There was no boom and bust cycle of investment that is often evident in private-investor dominated merchant power systems. However, as in many State-dominated systems, over-building appears to have been commonplace—reserve margins were greater than 30% throughout the period from 1970 to 2002, as shown in Figure 2.

Figure 2: Demand and Generation Capacity Growth



Source: Secretaria de Energia and Comision Federal de Electricidad

As the power system expanded over the 20th century the need for primary fuel quickly outstripped the availability of high quality coal, so generators turned to other locally available options: oil and hydroelectricity (see Table 1). Rivers were tapped from the earliest decades of electrification, but Mexico’s water resources in the north are scarce and the load factors on hydroelectric plant factors rarely exceed 30%. That left fuel oil from petroleum as the main fuel, particularly as Mexico became one of the top ten world oil producers in the 1970s and growing concerns about environmental pollution favored oil over coal. Since the 1980s, with the availability of cost-effective gas turbines, fuel oil fell out of favor as more costly than gas alternatives—much of the history of reform in the power sector, to which we turn to in the next section, is intertwined with efforts to secure a larger share for gas in the power sector.

Table 1: Total Installed Capacity by Type of Generation

	<i>Hydro</i>	<i>Steam</i>	<i>Combined Cycle</i>	<i>Turbo Gas</i>	<i>Internal Combustion</i>	<i>Geothermal</i>	<i>Dual</i>	<i>Coal</i>	<i>Nuclear</i>	<i>Wind</i>	TOTAL
1879		1.8									1.8
1900	14	4									18
1910	99	0									99
1920	192	0									192
1930											475
1940	355	40			72			12			680
1950	559	171			174			12			1234
1960	1249	839			205	3		12			3021
1970	3228	2353			271			37			7414
1980	5992	6616	540	1190	137	150					16862
1990	7805	11367	1687	1779	86	700		1200	675		26267
2000	9619	14282	2914	2360	116	855	2100	2600	1365	2	36213

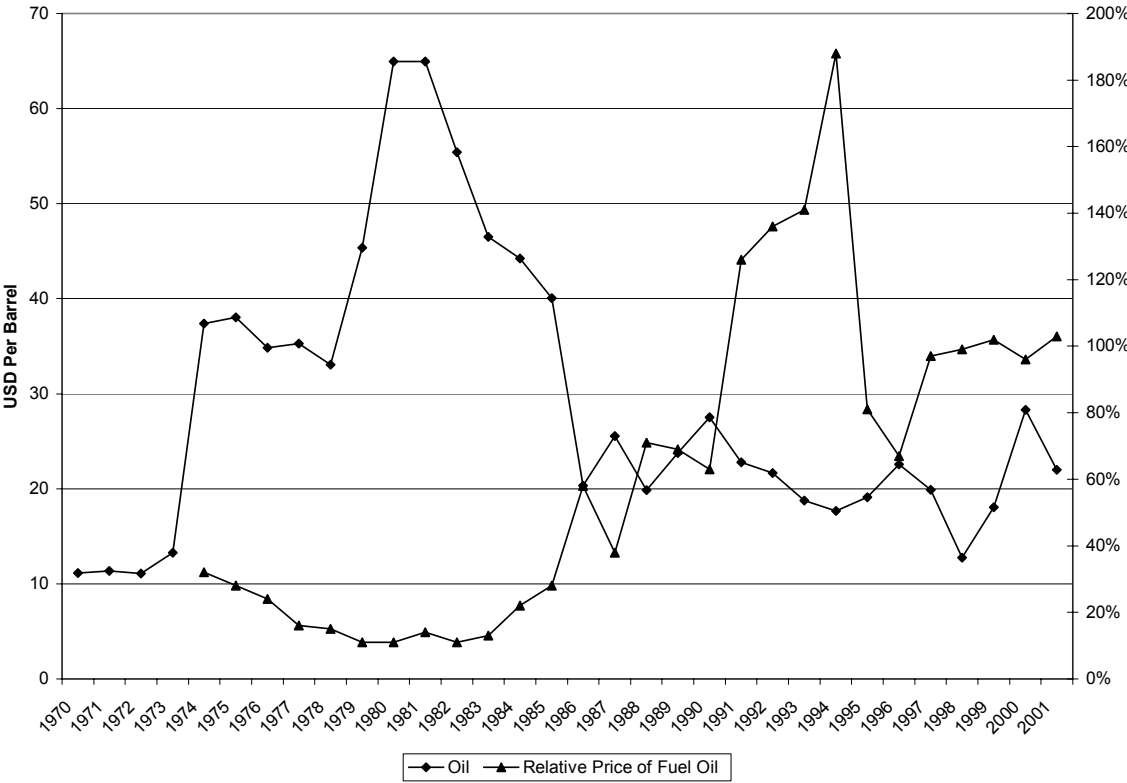
Source: SENER-CFE. This refers to generating plants in operation

Within the political and organizational calculus of CFE and LFC, the preference for fuel oil is easy to understand. First, even though Mexico is rich in natural gas, the state-owned *Petróleos Mexicanos* (PEMEX) that is responsible for hydrocarbon production did not consider gas as part of its core business throughout most of this period and thus could not guarantee a gas supply to the power sector. Even today, gas is a poor second cousin to oil extraction at PEMEX. Second, Mexico does not have coal with the quality needed to generate electricity. Third, the logic of “dependency” and the strategy of import substitution animated a self-sufficiency policy under which imports of technology and fuels would be minimized. Coal and gas plants typically require greater purchases of equipment overseas, whereas oil-fired facilities would be relatively easy to construct and supply with fuel from an oil-rich nation. Crucially for CFE and LFC in their internal decision-making, during the 1970’s and 1980’s PEMEX sold fuel oil to the power sector at around 30% of its opportunity cost (see Figure 3). From the perspective of managers within CFE and LFC, allocation of investment towards oil was actually efficient. Viewed from the vantage of the country as a whole, this strategy was extremely costly—the under-pricing of fuel oil amounted to a massive implicit subsidy to the power sector that averaged about USD \$1.5 billion dollars a year.¹¹ When world oil prices soared so did the subsidy; ironically, however, the subsidy proved easiest to sustain when oil was dear and thus large windfalls

¹¹ For the period 1974 – 1989 at 2001 constant dollars.

flowed to the State budget from Pemex oil sales overseas. Even when oil prices plummeted in the late 1980s the price charged to CFE and LFC for fuel oil was only 70% of its true opportunity cost. The philosophy of import substitution and “Mexican sovereignty” had been built into every aspect of the Mexican power system; even today, a reliable political strategy for opposing reform of state-dominated enterprises is to hype the threat to Mexican sovereignty.

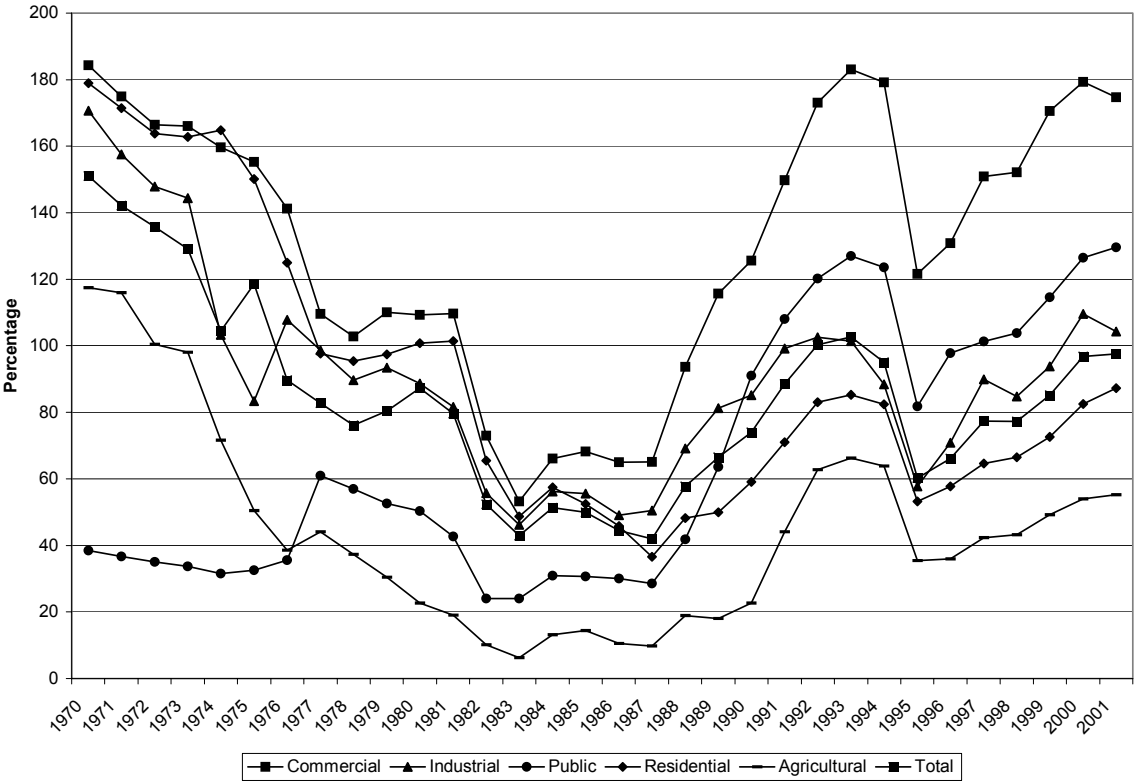
Figure 3: World Oil Price and Relative Price for Fuel Oil in Mexico. Until the early 1990s fuel oil prices were regulated in Mexico at a level far below the true opportunity cost. World oil prices (left scale) is the average cost of acquisition of Mexican heavy crude by U.S. refiners; the relative price of fuel oil (right scale) is the ratio of price charged for fuel oil in Mexico (available only since 1974) vs. a similar product in the U.S. (residual fuel oil #6, 3% sulfur, Gulf Coast average).



Low fuel prices allowed for tariffs that were also set far below their opportunity cost. However, the exact relationship between tariffs and costs is difficult to assess because, even today, there are no credible statistics on the true cost of electricity production in Mexico. We attempt to compare tariffs with costs by comparing Mexican tariffs with those in the

U.S. (see Figure 4). Mindful that there are many differences between the systems, such a comparison is nonetheless a useful place to begin in assessing Mexican tariffs.

Figure 4: Mexican Electricity Tariffs as a % of US Tariffs



Source: CFE – SENER.

In most jurisdictions in the U.S. tariffs were set “in the public interest” by independent regulators and implemented by privately owned utilities whose stockholders demanded that the enterprise cover its cost and make a predictable profit. In Mexico, the function of regulating tariffs was (and still is) played by the *Secretaría de Hacienda* (Ministry of Finance) and is an extension of the development strategy that the government pursues at any given moment. Often, the agenda at *Hacienda* has not been compatible with the needs of a financially self-sustaining power sector—as in all the other countries examined in this book, such mismatches would not necessarily cause turmoil in the sector so long as the government was also willing to cover the difference (usually indirectly through its financing of new projects). *Hacienda* consistently set tariffs for public purposes

(e.g., street lighting) for agriculture and for residential service at levels below those of the U.S.—a reflection of the importance of rural agricultural and low/middle income class voters to the construction of PRI, and also the tendency not to draw a strong line between core public functions and the full cost of services supplied by state-owned enterprises. In many respects, the integrated state budget was like a gigantic shell game.

In general, tariffs for the other classes remained well above U.S. levels, which we conjecture is the result of at least two forces. One was that the state-owned power system in Mexico was less efficient than the U.S. power system—payrolls were larger, the aversion to outside equipment meant that technical losses (although not known) were probably larger, and quality of service was lower.¹² The other factor was the ability of *Hacienda* to extract higher rents from commercial and industrial consumers, which are not a power base for PRI.

Overall, the Mexican power sector's tariff policy seems to have been broadly reflecting costs until 1973. Electricity prices were a bit higher than in the US but it was probably due to the oil-intensive and somewhat inefficient Mexican system. After 1973, there is a clear shift in the tariff policy that appears to mirror the shift in the country's general economic policy—an inward policy that allowed Hacienda to lower tariffs with the help of oil money. Lower tariffs were used as an inflation control policy followed by the government during that time. The late 1970s through the 1980s marked a peak period for state control and budgetary shell games, thanks to the lubrication of oil revenues. This is evident in figure 4 which reveals that the Mexican tariff level has followed the availability of oil subsidies, with a delay of about two years for the normal cycle of state budgets. Tariffs declined sharply in 1981 (after the oil price windfall created by 1979 Iranian revolution) and then climbed in the late 1980s as the cost of subsidy mounted and oil prices softened.

¹² Efficiency measures are against CFE and LFC. First, the energy sold per worker it is only about 1.85 Gwh/worker in CFE and 1.6 Gwh/worker in LFC, compared to about 4.5 Gwh/worker in Australia. Second, the power interruption per user is 230 and 331 minutes, in CFE and LFC, respectively. In France and the United States, it is 115 and 120 minutes, respectively. Moreover, LFC is more inefficient than CFE.

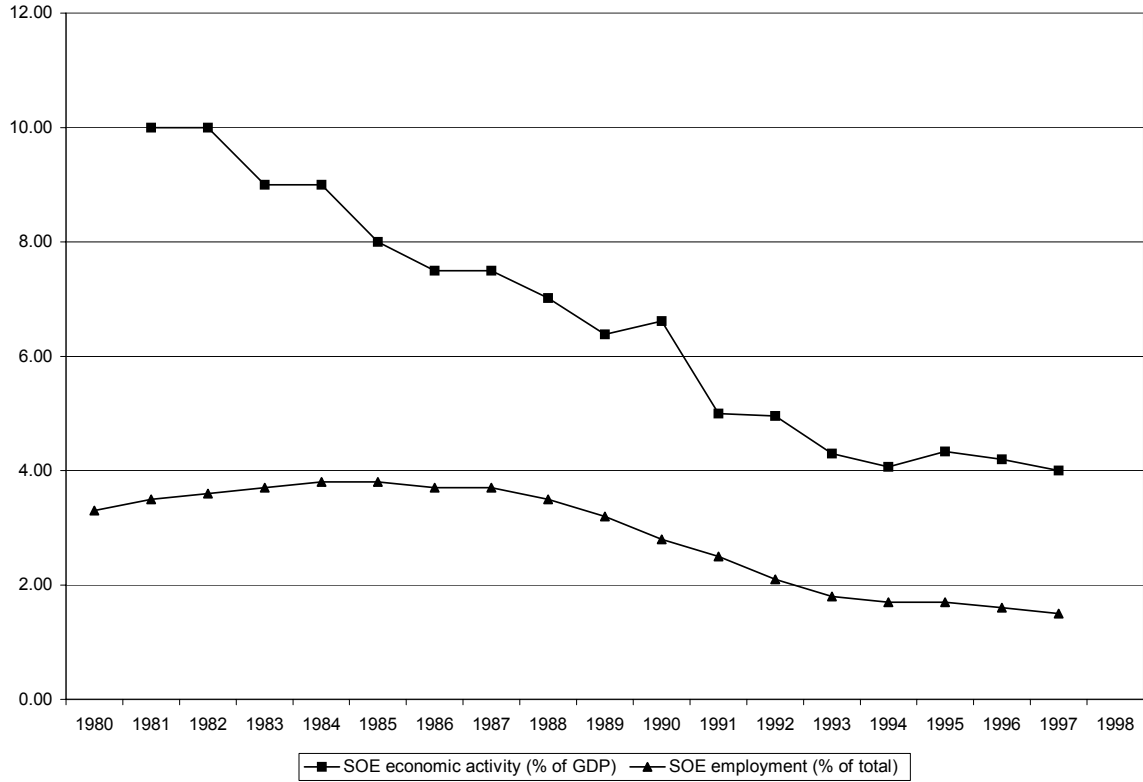
III. Shifting the State-Dominated Economy: 1982 to 2003

III.1. 1980 to 1989: The lack of resources to increase infrastructure

Starting in the early 1980s the Mexican government's framework shifted from a situation in which, in the words of former President José Lopez Portillo (who ruled from 1976 to 1982), "Mexico was managing its oil wealth" to a scenario with spiraling public debt and hyperinflation. By 1980 the Mexican Government was operating with a total deficit of 7.5% of GDP, and the electricity sector alone ran a deficit at almost 2.4% of GDP—all financed by extraordinary oil revenues. Despite oil prices that remained high in the early 1980s, shortly after Miguel de la Madrid assumed the presidency in 1982 Mexico defaulted on its external debt. The shock of this financial crisis created a window of opportunities for reformers who imposed tight fiscal controls, dismantled the import substitution strategy, integrated Mexico into the world economy, and reduced the role of the state in the local economy; ever since, the role of state-owned enterprises in the economy has declined steadily—first as a fraction of GDP and then, after delays, in the aggregate workforce (Figure 5). Among the few industries that escaped privatization in the two decades of reform that followed were the two areas with the greatest implications for the state budget—electricity as a drain, and oil as a source of revenue. The failure to disengage the electric sector is evidence of key political and constitutional factors at work—to those factors we now turn.

One of *Hacienda's* immediate responses to the crisis was to adjust prices with the twin (often incompatible) goals of reducing financial losses caused by low tariffs while at the same time taming hyper-inflation. *Hacienda* increased the price of fuel oil burned for electricity and also reformed commercial and industrial tariffs, which in 1983 had reached a historical low while keeping flat the more politically sensitive residential and agricultural tariffs (Figure 4). On the assumption that industry could pay a stiffer rate, the cross-subsidy from industrial and commercial users to the others grew over the following years. These modest reforms on fuel prices and tariffs bought time, but they did not fix the structural problems within the state-owned power sector.

Figure 5: Role of State-Owned Enterprises in the Mexican Economy



III.2. 1990-2000: Structural reforms towards building a new market architecture

During the 1990s, Mexico shifted from a country that avoided foreign direct investment to one that actively sought it—especially in export-oriented industries. Through expanded access to markets offered through trade agreements—notably NAFTA (1992) and the World Trade Organization (1994)—the value of Mexico’s exports almost quadrupled from 1990 to 2000. These investor- and trade-friendly reforms also created buffers for the Mexican economy that, in contrast with the 1982 crisis, have made it easier for Mexico to weather subsequent macroeconomic shocks. Nonetheless, each financial crisis since 1982 has brought stern limits on public debt, which in turn has limited the ability of CFE, a public company, to raise the capital needed to build new plants at the pace of rising demand. In contrast with the 1970s (see Figure 2), during the era of crises—from 1982 through the 1990s (and perhaps the present)—the growth in supply and demand were more

unpredictable; reserve margins varied widely because of lack of investment in capacity as demand was steadily growing.

A new financial crisis in 1994-1995 proved a breaking point. Politically, this crisis induced a strong change in the electorate preferences that allowed for a new composition of the Mexican Congress after the midterm elections in 1997. After more than 65 years of control, the ruling party (PRI) lost its majority in Congress (see Table 2). PRI's absolute majority in both houses of Congress had long been a crucial asset for the PRI-controlled presidency. Any policy that the President (and PRI) sought to implement—such as import substitution in the earlier era, and shifting from the state dominated economy along with free trade agreements during the era of reforms—could be assured a working majority. Any significant opposition came from within the establishment itself and could be addressed within the PRI apparatus.

Table 2. Political Control of Congress: The Percentage of Deputies and Senators

	<i>Deputies (lower house)</i>				<i>Senators (upper house)</i>			
	<i>PRI</i>	<i>PAN</i>	<i>PRD</i>	<i>Others</i>	<i>PRI</i>	<i>PAN</i>	<i>PRD</i>	<i>Others</i>
1964	83	10	0	7	100	0	0	0
1967	83	9	0	8	100	0	0	0
1970	84	9	0	7	100	0	0	0
1973	82	11	0	7	100	0	0	0
1976	82	8	0	10	100	0	0	0
1979	74	11	0	15	100	0	0	0
1982	75	13	0	12	100	0	0	0
1985	72	10	0	18	100	0	0	0
1988	52	20	0	38	94	0	6	0
1991	64	18	8	10	95	2	3	0
1994	60	24	14	2	74	20	6	0
1997	48	24	25	3	60	26	12	2
2000	42	42	10	6	47	36	12	5
2003	45	31	19	5	47	36	12	5

Economically, this crisis also had seismic effects because the government's negotiated settlement with its creditors included a prohibition against state-owned enterprises incurring additional debt. For the power sector, this did not seem a substantial concession—the economy was expected to tip into recession and thus demand for power would be sluggish, and a considerable excess capacity was available from the years of over-

building. Reality proved to be quite different—integration with the U.S. fueled a rapid growth in Mexico and led to power demand that rose at a much higher rate than expected. The government found relief in Amendments to Mexico’s *Ley del Servicio Publico de Energía Eléctrica* (LSPEE), which was altered in 1992 to allow private participation under different schemes such as Independent Power Production (IPP), Cogeneration and Self Supply (see Table 3). These legal reforms had been undertaken to comply with the energy chapter of NAFTA, which was artfully constructed to permit continued state control of oil and electricity sectors (as enshrined in Articles 27 and 28 of the Mexican Constitution) while at the same time allowing for private participation in the power sector. As shown in Figure 6, an interlocking array of constitutional, international and national laws then applied in the power sector, and as we will see the interaction between these laws has strongly shaped the outcomes.

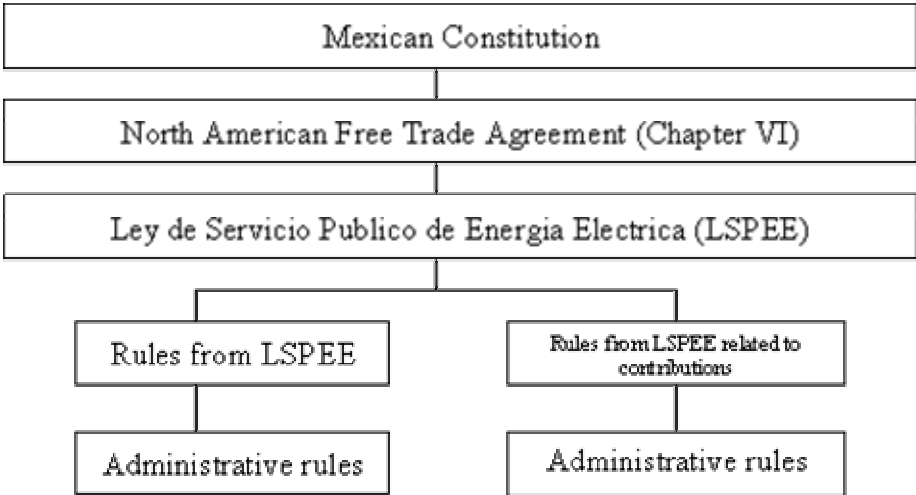
Table 3. Activities considered for private participation

<i>Scheme</i>	<i>Description</i>
Self supply	Generation of electricity to meet an industrial facility’s own energy needs. Refers to power plants owned and operated by private companies
Cogeneration	Refers to electricity generated simultaneously with steam or other types of secondary thermal energy to be used in an industrial process, or the generation of electricity from the surplus of thermal energy of an industrial process
Independent Power Production	Refers to power plants with installed capacity larger than 30 MW, built and operated by private companies. All generated power must be sold to CFE under a power purchase agreement
Imports and Exports	Exports refer to electricity produced under cogeneration, IPP or small scale generation categories. Imports refer to electricity exclusively used for self-supply purposes.
Small-scale generation	Refers to power plants with an installed capacity no larger than 30 MW built and operated by private companies. This electricity is to be sold solely to CFE.

With the LSPEE already on the books, though not yet implemented, the government jumpstarted the IPP program to alleviate the looming crisis in power supply caused by CFE’s inability to contract debt. The first tender (Merida III, a combined cycle gas-fired plant) was awarded in January 1997. In practice, IPPs on their own were not a miracle

solution because generators still had to sell their power through one of the state-owned distributors—LFC or CFE—and the power purchase agreements (PPAs) that underpinned IPP investments were, in essence, a form of long-term debt-like commitment that the post-1995 settlement would seem to have forbidden.

Figure 6. Legal Framework for the Mexican Power Sector

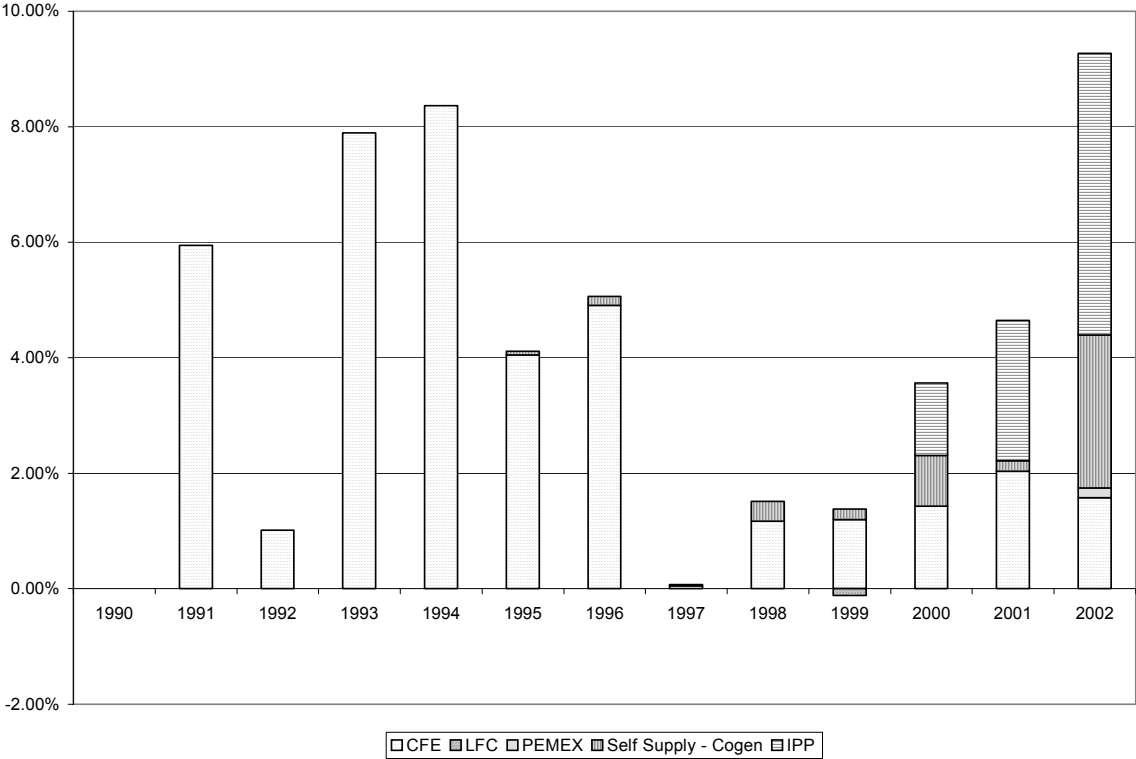


The proposed solution was a shell game established in December 21st, 1995 when the Mexican Congress approved reforms to the Public Debt and the Budget Laws that created a new scheme for the development of long-term infrastructure projects, currently known as PIDIREGAS. This scheme is tailor-made for IPPs.¹³ Under this scheme, only the capacity payments of a Power Purchase Agreement (PPA) of the starting and the following year are accounted for as liabilities. Future payments are considered as contingent liabilities but are not included in the government’s yearly budget. Since IPPs work under long-term PPA contracts, it would seem normal that the capacity payments were not considered as liabilities. However, since the Mexican power sector is operated as a vertically integrated publicly owned monopoly, every single IPP project that is operating, or under construction, has sought and received explicit government guarantees. These guarantees are in essence contingent liabilities, which must be handled more like normal liabilities. As of June 2003, PIDIREGAS debt for CFE alone amounts to USD \$4.3 billion,

¹³ Similar schemes were designed to hide and shift accruing debts in other areas such as airlines and PEMEX.

with payments distributed over the following 10 years. So far, there has never been a default on any of the PIDIREGAS liabilities; even as investors in power plants have lost vast sums in many other developing countries, all of the contracted IPPs are rewarding investors more or less as expected. For investors and government managers the scheme is attractive; however, since PIDIREGAS backs PPAs denominated in 2003 dollars there remains a substantial devaluation risk—a constant feature of Mexican financing for the last three decades that might prove to be a major problem for power sector investors.

Figure 7: Growth in New Generating Capacity



Source: Secretaria de Energia and CFE

Merida III entered into service in 2000; since then, 3,495 MW of capacity have been added through IPPs, which has contributed considerably to restoring the sector’s reserve margin. As shown in Figure 7, from 2000 to 2002 about half the new capacity came from IPPs. In 2002, one-third of the new capacity came from self-generation and cogeneration facilities—that is, power plants that are located at industrial sites outside the direct control

of CFE and LFC. Barely one-third of the new capacity from 2000 to 2002 came from the traditional CFE and LFC-dominated model of power plant construction. Despite this new surge in investment, IPPs alone were not enough to meet all the growth in demand, and there are several indicators of the chronic underinvestment due to the continuing severe restrictions on public debt. First, reserve margins have slipped—to just 1% in summer 2002—and have been maintained in part by delaying the retirement of old plants, especially plants that burn high cost fuel oil. Second, the government has slashed the authorized budgets for maintenance and repair—typically, as shown in Table 4, to levels on average 30% lower than the level that CFE executives think is required. These short-term measures helped to preserve resources for capital investment and helped to avert crisis in the power sector, but they were merely stopgap measures.

Table 4: Solicited and Authorized Budgets for Maintenance and Repair at CFE

	1995	1996	1997	1998	1999	2000	2001
<i>Solicited Budget (Millions of Pesos)</i>	2924	3128	3403	2610	2514	2844	3150
<i>Authorized Budget (Millions of Pesos)</i>	1904	2011	2502	2045	2002	2045	1937
<i>Proportion</i>	65.1	64.3	73.5	78.4	79.6	71.9	61.5

Source: CFE

Even more worrisome than these problems with current investment are the inconsistencies laden in CFE’s official planning forecast for the next ten years: a 25,000 MW increase in net installed capacity through the addition of 28,000 MW of new plants; with planned retirements amounting to only around 4,100 MW, about half the level expected.¹⁴ From both the financial and technical perspectives, the power sector would appear to be in serious trouble. The Mexican State will be unable to meet these growth targets because it has no financial resources itself for investment in the required new capacity.¹⁵ IPPs can meet some of the shortfall, but the confidence of IPP investors may

¹⁴ Secretaria de Energia (2002). Considering a life plant of about 30 years (for thermal plants), and Mexico’s thermal installed capacity of around 30,000 MW (excluding cogeneration and self supply) one would expect in the period from 2002 to 2011 retirements of around 8,300 MW —suggesting the need for constructing about 32,000 MW in new power plants, which is almost 15% higher than official figures.

¹⁵ As of June 2003, total debt -excluding contingent debt like social security debt, highway and sugar industries debt- was around USD \$236 billion (around 36% of GDP). Moreover, the debt service in the first

wane as the latest scheme to defer crisis—the PIDIREGAS mechanism—becomes exhausted.

Two conclusions can be drawn from the experience, so far, with the IPP program. First, it has resulted in almost no change in the market architecture of the sector. Although a leap for private investors, IPPs are a stopgap measure. By design, they exist inside the LFC & CFE-dominated system and require minimal adjustment of that structure. They solve an immediate problem—surging demand but stagnant supply and aging incumbent plants—at considerable cost that is largely not transparent in current state accounts. Second, IPPs have had a dramatic effect on the technology available in the sector in ways that are probably quite beneficial for Mexico. All of the IPP projects have been built by foreign companies using state-of-the art combined cycle gas-fired technology—with gas purchased from the U.S. or from PEMEX. Whereas in other countries examined in this book the introduction of gas has been difficult because fuel costs in a gas system are higher than the incumbent coal (China, India, South Africa) or hydro (Brazil). In Mexico, the incumbent is expensive and gas plants not only have lower capital cost but also are less costly to operate—in addition to being much cleaner.

Table 5: Mexican Electricity tariff/cost ratios

<i>Consumer Class</i>	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002*</i>
Residential	0.47	0.42	0.40	0.43	0.41	0.41	0.42	0.50
Commercial	1.31	1.16	1.13	1.21	1.19	1.07	1.07	1.05
Public Service	0.88	0.79	0.81	0.94	0.92	0.88	0.90	0.90
Agricultural	0.33	0.28	0.28	0.30	0.29	0.28	0.29	0.30
Medium Industrial	0.88	0.84	0.91	0.92	0.91	0.85	0.87	0.93
Large Industrial	0.81	0.83	0.91	0.90	0.90	0.85	0.83	0.90
Average	0.71	0.70	0.74	0.79	0.74	0.70	0.70	0.74

* Estimated

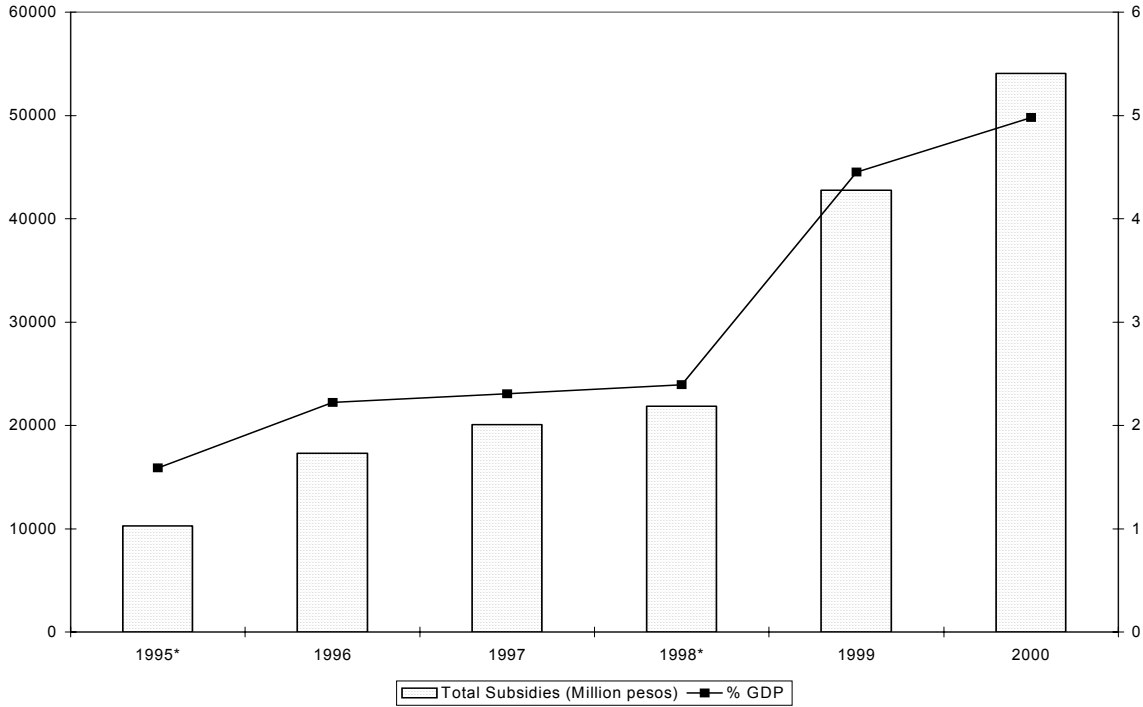
Source: Secretaria de Energia

Even as the creation of the IPP and the PIDIREGAS schemes offered new tools to avert crisis, *Hacienda* continued to reform fuel prices and tariffs with the aim of restoring some sustainability to the sector. Nonetheless, tariffs appear still to be at a level below

semester of 2003 amounted for 60% of the income and valued added taxes collected by government in the same period.

cost—especially as the cost basis of the oil-intensive Mexican power sector is much higher than in the U.S., where low-cost coal is the dominant primary energy source. According to the Ministry of Energy, Mexican electricity tariff/cost ratios are as shown in Table 5.¹⁶ Despite these increases in tariffs, the sector still loses vast sums of money.

Figure 8: Evolution of Total Subsidies to the Power Sector



Official figures estimate a net subsidy of USD \$5 billion a year (see Figure 8), principally because of residential and agricultural tariffs are set way below cost—residential tariffs alone could be as high as 3% of GDP. (The distributional effects of this subsidy are enormous; total tax collection, outside the oil sector, is only 10% of GDP.) In 2000, residential consumers received 64.1% of the total subsidy; the industrial sector, 17.9%; the agriculture sector, 11%; and the commercial sector, 5.3%. As a consequence of this policy, residential consumers face a tariff that is among the lowest in the world; but, it relies on a regressive scheme as shown by López-Calva and Rosellón (2002). A new 31-

¹⁶ We reiterate that exact costs of generation, transmission and distribution are unknown, and thus this unorthodox cost allocation makes it hard to actually sort them out. Data should be treated with caution because of the indiscriminate use of financial costs and long run marginal costs to calculate final tariffs.

category tariff scheme adopted at the end of 2000 marks a further step at rationalization; still, the residential tariffs remain below cost—implying a subsidy for 98% of users.

Politically it has proved extremely difficult, if not impossible, to raise residential and agricultural tariffs. Thus, most analysts conclude that the only practical way to make the sector financially sound is to reduce costs—yet that, too, is politically challenging as it requires confronting the powerful unions that are embedded in CFE and, especially, LFC. These unions -- *Sindicato Mexicano de Electricistas* at LFC in a cross alliance with the leftist Party PRD, the leftist wing of PRI, and some other social organizations and unions and the *Sindicato Único de Trabajadores Eléctricos de la República Mexicana* (SUTERM) at CFE (which has a mixed position on the reform issue) -- have led a broad coalition to block any attempt to allow private investment into the sector or to modify significantly the market architecture (e.g., tariff reform) in ways that could hurt their interests. Since the SME and the SUTERM are well-organized interest groups with the capacity to mobilize votes, no political Party has been willing to face the political cost of supporting a modification of the electricity subsidy policies or a substantial modification in the market architecture to allow for the implementation of competitive fares..¹⁷ If both consumers and unions oppose changes, then it becomes a risky business to pass a bill which eventually could costs votes or popular support for the involved parties.

The strongest of the referred political opposition to reform became evident in 1999 when the first profound reform of the sector was attempted by President Ernesto Zedillo. Before then, policy makers under President Carlos Salinas, mindful of the political sensitivity of the energy sector, attempted only partial reform. In 1992, amendments to the LSPEE—the basic legal architecture for the power sector that had been codified in 1975—allowed IPPs into the sector (discussed above) and also empowered a new institution: the independent regulator. The strategy was to make the true costs of generating power more transparent—through market competition—and to empower independent regulators who would be able to scrutinize costs. In addition to promising the delivery of electric service at lower cost, a shift to competitive electricity markets would make it possible to remove key

¹⁷ As a recent example we should remember that President Fox implemented some changes in the subsidy policy (reduction of subsidy for some classes of residential consumers) and must overturned it in the northern states because it faced very strong opposition from those consumers.

operational decisions in the sector from the grip of the unions. Markets built around transparent rules as well as tariffs set at levels that ensured recovery of costs would attract private investment into new generating capacity and would also allow CFE and LFC to direct their scarce resources towards dire needs such as repair and maintenance of their existing assets. Moreover, they could implement better management of the system to reduce theft of electricity, which is a rising problem that threatens to undermine further the financial soundness of the system. Indeed, the experience in telecommunications, highways, the pension system, and the banking system, seemed to confirm, at the time, that privatization and the introduction of market forces would lead to an influx of private capital that could constrain the government's ability to torque tariffs to its macroeconomic and political agendas.¹⁸ Today, the political case for privatization and market reforms is thus extremely difficult to make—indeed, policy makers often engage in verbal and legal contortions to argue that the proposed reforms do not involve privatization and unfettered markets.

III.3. The regulator in the power sector

The 1992 Amendments to the LSPEE did not alter the Mexican Constitution, and thus the State still held the exclusive right to generate, transport, and supply electricity for public service. Reforms in this context—as we have seen with the emergence of IPPs—required careful balance to preserve the constitutionally-assured role for the central government. The creation of an independent regulator presented a new frontier in this balancing act—although formally part of the government, the regulator would have an arm's length relationship with the traditional entities of government precisely to preserve the political control of electricity that was originally envisioned in Article 27 of the

¹⁸ In the years since, sober assessments of the privatization process have revealed a more subtle story. In highways and banking, privatization spawned corruption that required reassertion of control by the government; in telecommunications, the process of privatization was not accompanied by the creation of an adequate regulatory authority, with the result that competition and tariffs have delivered only a fraction of the potential benefits from privatization. A private monopoly, *Telefonos de Mexico* (TELMEX), has become the focal point for claims that privatization and liberalization yield changes that benefit only a few. McKinsey and Mookherjee (2003) analyze the distributive impact of privatizations in several Latin American countries, including Mexico. They find positive welfare effects that do not support the generalized bad public opinion towards privatization that exists in the region.

Constitution. In 1993 the government created by decree the CRE as an advisory body on gas and electricity issues. In October 1995, the *Ley de la Comisión Reguladora de Energía* (Energy Regulatory Commission Act, LCRE) transformed CRE into an autonomous agency in charge of regulating the natural gas and electricity industries. The CRE has its own budget (which is allocated via the Energy Ministry with few strings attached) and has technical and operational autonomy. It consolidates functions that had previously been scattered among several agencies, and pursuant to its enabling Act, in the electric sector CRE is empowered to perform several key tasks¹⁹:

- (a) Participation in the setting of tariffs for wholesale and final sale of electricity,
- (b) Issuance of permits to generate electricity under the schemes allowed by the LSPEE,
- (c) Review and approval of the criteria for determining fees related to public electricity service,
- (d) Verification that entities responsible for the public electricity service purchase electricity at the lowest cost and also offer optimum stability, quality, and safety of electric service.
- (e) Approval of the methodologies for calculating payments for the purchase of electricity used in public service, and
- (f) Approval of the methodologies for calculating payments for electricity transmission, transformation and delivery services.

In addition to these functions, CRE also performs similar functions in the gas sector, including the issuance of building and operating permits for gas infrastructures. By 2003 CRE had granted 218 permits in all schemes accounting for investment commitments over USD \$12.2 billion for the construction and operation of nearly 20,000 MW of capacity. Nonetheless, CRE's authority and power are not clearly specified in many areas, and CRE influence is hobbled in key areas—such as in tariffs, where the operations of LFC and CFE are far from transparent and thus rational tariff-setting is essentially impossible. CRE approves the methodologies for calculating payments for electricity transmission and distribution, but CRE does not have the authority to actually establish tariffs.

Despite reforms to create an independent regulator and allow the entry of IPPs, the fundamental barrier to competition and private participation remained—Articles 27 and 28

¹⁹ See www.cre.gob

of the Constitution. In February 1999, near the end of his tenure, President Zedillo proposed structural reforms that would have modified the Constitution, but these never passed the Congress. Many fractions inside PRI opposed reform that could erode a traditional power base—the unions in CFE and LFC—and they relied on a public that remembered the failed promises of earlier privatizations.²⁰ In addition to opposition within his own party, Zedillo’s earlier political reforms meant that he didn’t have a working majority in the Congress (see Table 4), which required him to negotiate with many different parties to achieve the support needed for passage of his proposals. In order to amend the Constitution a majority vote of 2/3 of each House and 51% of Local Congresses are needed. February 1999 proved to be a difficult time for such negotiations as few were willing to compromise with the July 2000 Presidential elections on the doorstep. These political factors combined with the lack of general awareness about the problems in the sector. To the casual observer, everything appeared to be working well—costs and quality were not out of line with the experience of most Mexicans.

Zedillo’s plan sought a comprehensive reform that would introduce competition in generation, distribution, and marketing of electricity. The proposal followed closely the UK model, although studies have shown that alternative systems—such as the Australian system with a regulated market for capacity reserves—would be more appropriate in the Mexican context (Carreón and Rosellón, 2002b). Under the Zedillo plan, nuclear generation, some hydro generation (mainly in the south of the country), and the system operator would remain in the hands of the State—nuclear for reasons of security, and large hydro because the State manages the nation’s water supplies for multiple purposes including agriculture. The independent regulator, CRE, would also oversee the aspects of the system that were prone to monopoly, such as transmission and distribution. Regulators would also ensure that generation and marketing would remain contestable activities, through monitoring of market power, barriers to entry and other factors that would undermine a competitive market.

²⁰ Using evidence from other Latin American countries, McKinsey and Mookherjee (2003) show that this public perception contrast with actual empirical evidence. There is no clear pattern in prices—in half the cases, reform brings lower prices—and the impact on payrolls is not large, while the fiscal effects of reform are favorable.

The Zedillo plan envisioned three stages of effort. First, the government would implement basic organizational changes. CFE and LFC would be partially unbundled into several generation, transmission, and distribution companies kept at arm's length; a government-controlled system operator would be created. Separate state enterprises would be created to hold nuclear and hydro assets. And basic rules for a competitive electricity market (and its regulatory framework) would be debated. Despite the failure to implement the Zedillo plan, some progress on this first stage was already accomplished when CFE created a "shadow market" in which generators compete for service at 1400 nodes through the use of a power flow model. Since September 2000, CFE's "shadow market" has sought to emulate a truly open, competitive market; it uses a merit order rule for dispatching generators and includes a one-day-ahead market as well as a "real-time" balancing market. In the one-day-ahead market, bids for hourly slots are submitted to CFE's system operator by thermal plants that are administratively separated so that they plan their strategy, to some degree, as different power producers.²¹ Payments to generators include a "capacity" payment intended to foster the development of generation capacity reserves. In this shadow market, distribution companies are also divided into several units; a MW-Mile method is used to set transmission tariffs.²²

The second stage of Zedillo's proposal envisioned opening the sector to private investment and the creation of a wholesale electricity market that included both short-term and long-term markets as well as competition for contracts with distributors and large users. In the third, final, stage the arm's-length entities would be separated fully and privatized.

In addition to political obstacles, the Zedillo plan had some technical problems. It sought to balance state-of-the-art economic theory with the practical realities in the context of the Mexican power sector. One of the main omissions was the lack of a mechanism for creating incentives to expand transmission capacity. The plan envisioned that the State would not bear risks nor provide guarantees to private investors; yet it vested transmission

²¹ Non "programmable" generators are small producers that only supply power according to a previously set energy delivery schedule. Hydro generators also make available all their generation capacity, and face production constraints in the one-day-ahead market. Both types of generators then have zero variable costs.

²² Through this method, charges for transmission services for 69Kv and higher tension lines are calculated as the higher of "fixed plus variable costs" and "operation and maintenance costs". To this amount, fixed administrative costs are added. Fixed costs are set at the long-run incremental cost of the transmission network and allocated among consumers of the current grid and consumers of the future expanded grid according to the impact that each has on congestion in the complete network.

planning solely within the Ministry of Energy and potentially created risks that most private investors would avoid unless given a state guarantee similar to the PPA that IPP generators required. Related to this problem was the lack of incentives to address problems of short-run congestion, which in turn could create bottlenecks for new generators.²³ Nor was there clarity in the incentives that would govern the system operator. Finally, it was not clear how the IPPs were incorporated into the reform—the state would retain strategic control of the sector, but it was unclear how to square that vision with investors’ requirements for predictable returns on their projects. Alas, these flaws and the many possible remedies were never given serious consideration—the upcoming election and the fragmentation of political power eviscerated the Zedillo plan before the government ever had a chance to build a political coalition for its passage.

III.4. ELECTRICITY AND THE SOCIAL CONTRACT

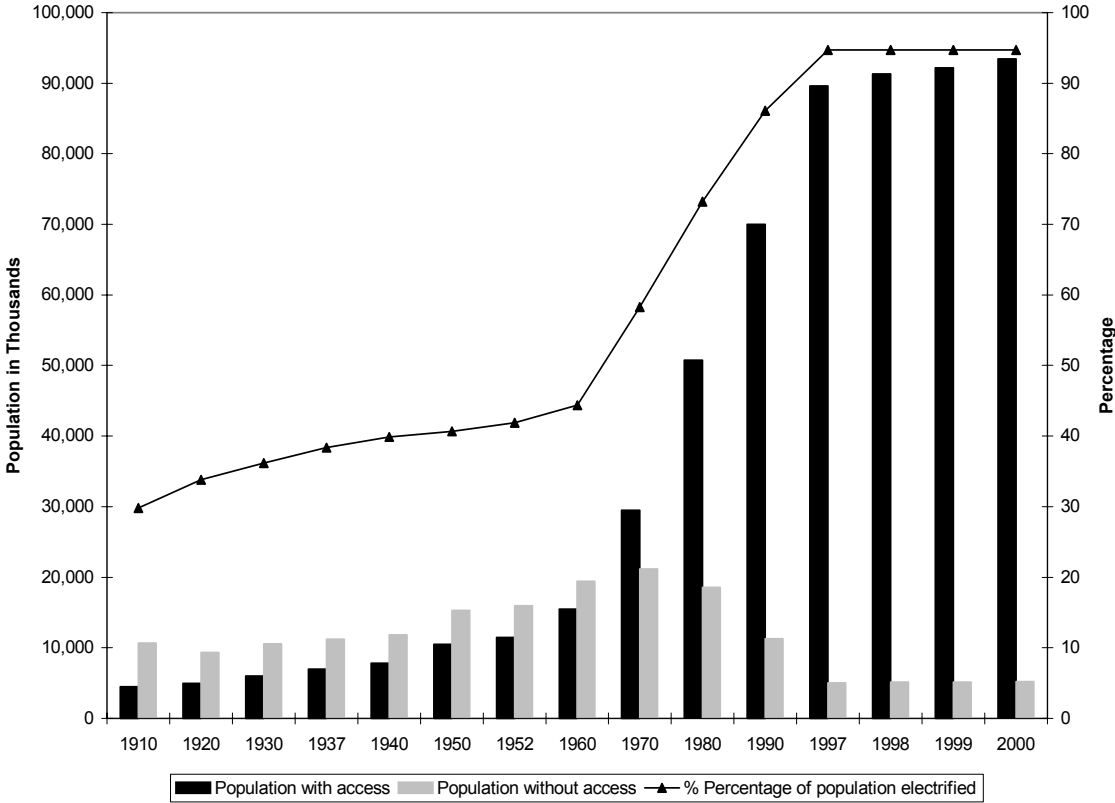
Although key choices about fuels and tariffs made during the 1970s would later undermine the financial sustainability of the power sector, that decade was a period of substantial progress in delivering benefits from electricity more widely to the society — what the editors call in the introduction to this book the “social contract.” We focus on three dimensions: electrification of rural and poor populations, protection of the environment, and investment in long-term research and development. On all three, the accomplishments rooted in the 1970s were notable, and ironically these achievements (especially that of electrification) have reinforced public support for a state-controlled power system.

The greatest success in these three dimensions of the social contract is evident with electrification. Access to electricity more than doubled from 1970 to 1990 (see Figure 9). Residential and agricultural tariffs declined in the 1970’s, which aided electrification, but the progress in electrification has continued even through the flat and rising tariffs of the 1980’s. Even as the sector has experienced enormous financial difficulties in the 1990s, electrification continued apace. By 1997, 94.7% of the Mexican population had access to electric power. At this writing (2003), penetration has reached 96%, despite the country’s

²³ For a discussion of incentive mechanisms to expand the Mexican transmission network see Rosellon (2003)

complicated geography and remoteness of small settlements in diverse rural areas. Despite this achievement in aggregate, some states have lagged markedly—notably, Oaxaca, Chiapas, and San Luis Potosi where there is a high percentage of indigenous communities living in remote rural areas where the cost of service is high.

Figure 9: Population with access to electricity



Source: CFE.

Many factors could explain the pattern of electrification. In Table 3 we report simple correlations using basic demographic and economic statistics from all states between 1970 and 2000 (one observation per state per decade). The correlation with electrification is highest for GDP ($R^2=0.81$) and urbanization ($R^2=0.99$). A multivariate regression confirms these simple results—urbanization has been the main driving force for electrification, and there is little residual value that might indicate a role for policy. Similar results are evident for water services, but in telecommunications the correlations are much less robust—suggesting that public policies promoting access have been more important for

telecommunications or, perhaps, the cost of telecommunications has declined so sharply that factors such as urban access and income have a less intense effect than in the public services where costly fixed infrastructures remain central. The story of successful electrification in Mexico is similar in many respects to that of China—factors outside the electric sector have spilled over to create dramatic progress in electrification. This history is quite unlike that of South Africa, where success in electrification in the 1990s is the direct consequence of an active government policy to promote electric connections.

Table 3: Correlations Coefficients for the Mexican Economy. Coefficients calculated with single-year estimates for 1970, 1990 and 2000 (1980 is incomplete) reported by the government.

	<i>State GDP</i>	<i>Urbanization</i>	<i>Residential Electrification</i>	<i>Water Services</i>	<i>Access to Telecommunications</i>
<i>State GDP</i>	1.00	0.81	0.81	0.80	0.68
<i>Urbanization</i>		1.00	0.99	0.98	0.42
<i>Residential Electrification</i>			1.00	0.99	0.36
<i>Water Services</i>				1.00	0.34
<i>Access to Telecommunications</i>					1.00

Second, on environment, the sector is subjected to increasingly strict regulation concerning siting and effluents. The relevant norms are under renewed consideration at the present as Mexico considers the possibility for even stricter rules based on improved state-of-the-art technology. The government is in the midst of designing a credit trading system for regulating large sources of sulfur dioxide—including power plants as well as the many facilities of PEMEX. Progress on environmental issues depends heavily on the rate of technological change in the electric sector. As in the United States, most environmental laws in Mexico “grandfather” existing facilities with weaker regulations, and thus the difficulties in the power sector that have resulted in slowing the retirement of old plants have had negative consequences for the environment. The biggest news—and good news at that—is the arrival of gas in the sector, which is mainly a function of technological improvements (gas turbines) that occurred outside Mexico as well as decisions on IPP

tenders that were taken in part because gas is cheaper than the oil alternatives. The environmental benefits are a windfall.

Third, on investment in innovation, two institutions support long run research and development in the power sector: the *Instituto de Investigaciones Electricas* (Electric Research Institute, IIE) and the *Instituto Nacional de Investigaciones Nucleares* (National Institute for Nuclear Research, ININ).²⁴ The IIE was created by Presidential Decree in December, 1975, as a public decentralized entity with legal personality and own patrimony, with scientific and technological character. The origin of the ININ goes back to 1956 when the Nuclear Energy Commission was created as the Institution in charge of research and regulation in nuclear issues. Later on, in 1979, the National Commission on Nuclear Security and the National Institute for Nuclear Research were created to separate those activities. Since then the ININ is in charge of basic and applied research and technological development on nuclear and related matters.

IV. The Evolving Agenda

Under the current legal framework for the electricity industry, private investment co-exists with the state in key areas, such as power generation. Nonetheless, the reforms implemented so far are stopgap measures—they are minor reforms in tariffs and fuel pricing implemented from 1982 to 1990, the IPP scheme created in 1992, the empowerment of CRE in the 1990s, and a new tariff schedule adopted in 2000. Each of these measures push crisis a bit further into the future; but, the sector remains financially unsustainable. Indeed, the engine for partial reforms is now running out of steam as the gap between expected demand and supply grows and the financial needs of the sector multiply. Yet the need for reform has not commanded adequate political support, and the fragmentation of political authority has made it even harder for government to assemble viable reforms. Serious reforms will require institutions such as a truly independent regulator with substantial powers and information—all conditions that are difficult to satisfy in the current context. Moreover, serious legal problems remain so long as reformers have attempted to navigate

²⁴ The *Instituto Mexicano del Petróleo* (Mexican Petroleum Institute, IMP) is in charge of research on issues related to the oil industry. In this sense it is important for the power sector because of its relationship with natural gas and fuel oil.

around the constitutional restrictions on private participation in the sector. The Mexican Supreme Court ruled in 2002 that the 1992 law—the cornerstone to the IPPs and CRE’s authority—might be unconstitutional, which has cast a shadow over investors. A myriad of proposals has induced madness in the public opinion on these topics as consumers (and some key actors) do not know with certainty what is going on in the sector and what to expect in the near future. Meanwhile, time is running and Mexico is getting closer to a critical situation in its power sector. We examine each of the referred issues in turn—the need for new investment to close the gap between demand and supply; the financial sustainability of the sector; the constitutional challenge and the role of the Supreme Court; the authority and role for CRE; tariffs; public opinion; and the main current proposals for reform.

IV.1. Demand, Supply and Gas

The government expects that from 2001-2011 electricity demand will rise 5.6% per year. At present, most of the total capacity (about 41 GW in 2002) is supplied by hydroelectric and conventional steam plants fired mainly with oil (23% and 42% of the total, respectively). Combined cycle generation accounts for only 18%, although these plants are the newest. About 44% of the generating power plants are at least 30 years old. If the power sector expands as expected, about USD \$25 billion in investment will be required through 2006; in total, from 2003-2011, the expected investment cost will exceed USD \$50 billion, with about 40% for generation, 24% for transmission, and 21% for distribution. Of this total, the Ministry of Energy envisions that various private sector investment schemes, notably IPPs, will contribute USD \$39 billion—about four-fifths of the total. Nonetheless, the (smaller) requirements in the public sector will impose extraordinary strain on the budget and could divert resources from other social priorities such as education, social security, or poverty relief.

To serve the growing demand for power and replacing the retired plants a variety of fuels is available, but one (by far) is the most attractive: gas, especially gas burned in combined cycle baseload plants. About 90% of the 18,700 MW of new capacity scheduled to open by 2006 is gas-fired combined cycle. By 2011, half of Mexico’s expected total

generating capacity of 64,000 MW will be gas fired.²⁵ Demand for gas will rise accordingly—about 7.4% per year over the next decade.²⁶ By 2010, perhaps 60% of all gas sold in Mexico will be burned for electricity generation.

This shift to gas is good news for the environment and also promises to lower tariffs. However, it is not clear how such a massive shift to gas will be achieved. Close to the end of the Zedillo's administration, The Ministry of Energy and PEMEX announced an ambitious program, *Plan Estrategico de Gas Natural* (Strategic Plan for Natural Gas, PEG) that outlines a vision for meeting this demand, calling for PEMEX to double its natural gas production from 2002 to 2006. However, actual progress at PEMEX has been lackluster—the PEMEX budget is set by *Hacienda*, and as with CFE it has not received all that it requests. In tough times, PEMEX focuses on its core business (oil) and shunts gas aside. PEMEX lacks not just the capital but also the expertise to develop new gas fields, so it has turned to *Contratos de Servicios Múltiples* (*Multiple Service Contracts, CSM*)—a scheme to allow private participation in natural gas extraction in the Burgos fields (in the northeast of Mexico) without actually conferring ownership on the fields to the non-PEMEX operators (which would contravene the Mexican Constitution, which assigns sole authority over hydrocarbons to the state). The CSMs, however, have come under a similar cloud that threatens the constitutionality of reforms in the electric sector, and most foreign operators remain wary of participation under those terms. Nonetheless, the first CSM were granted to the Spanish Oil firm Repsol-YPF during the fall of 2003

The monopoly position of PEMEX includes not just control over fields but also pricing and retailing of gas. The current regime sets gas prices on a “netback” basis to Texas markets, which made sense when most gas was imported from Texas but yields undue windfalls to gas suppliers (i.e., PEMEX) as large indigenous supplies are envisioned. It also creates difficulties for gas-on-gas competition as LNG terminals are built and will compete for contracts with local natural gas supplies. CRE has directed PEMEX not to discriminate in its pricing and marketing of gas, but the problems are structural. Gas is used in IPPs by private investors who are stuck between a monopsony (CFE) and a monopoly (PEMEX). This situation is damper for competition as, in general, fuel costs

²⁵ Secretaria de Energía (2002c).

²⁶ Demand for gas in electricity is expected to rise rapidly (10.2% per year), but that rate will be offset by sluggish growth in self-consumption of gas in the oil sector rising.

account for 60% of the total costs of gas-fired electricity. The pervasive problem of competition in the gas sector extends even to the siting of power plants which, in effect, is determined by PEMEX and its decisions about location of the gas transportation infrastructure.

IV.2. Constitutional Integrity: The Supreme Court Decision and Beyond

The keystone to sustaining investment in the power sector, in the context of the very limited reforms that have been implemented so far, is the 1992 amendment to the LSPEE, which created the framework for IPPs. In May 2001, President Vincente Fox proposed further reforms to Articles 126 and 135 of the LSPEE which would have modified the terms and limits of the self-generation and co-generation schemes to make them more attractive to private investors. Banking on success of this proposal, the Fox administration was already projecting that by the year 2011, about half of the country's generation would take place under the self-generation and co-generation schemes. However, on July 4th, 2001, the Mexican Congress filed a petition before the Supreme Court for review of the proposal and argued that the proposed articles envisioned giving the Executive Branch (which would control tendering and operation of these projects) more power than allowed under the Constitution.

The Supreme Court ruled in favor of Congress, but the Court did not restrict itself just to the immediate issue of separation of powers. It also speculated about the consistency of the entire LSPEE framework for private generators with Article 27 of the Constitution. The Court implied, in its decision, that, if asked, it would rule against the IPP scheme that had become the bedrock of efforts to expand the power system. Important investors—such as *Electricité de France*, the largest private investor in the Mexican power sector—announced that they would not participate further in the IPP scheme until further reforms that clarified their constitutional position had taken place. The Supreme Court decision illustrates that reformers must focus on just the key legislative and regulatory actions but must, finally, achieve a reform in the Constitution itself.

The Supreme Court decision has introduced yet another uncertainty into an already contentious and fractious debate. Long ago—with the Zedillo proposal of 1999—the

subject of electricity reform left the technical arena and has almost totally evolved in the political arena. Participation of the labor unions as well as the multi-dimensional negotiations between political parties are the main determinants of reform proposal success. To provide a sense of the range of options, Table A1 in the Appendix summarizes the main proposals under consideration in late 2003, they range from PAN and President Fox's vision, for a liberalization of the sector that builds on the Zedillo proposal while rectifying important flaws, to the proposals of the PRI and the PRD (the main Parties in opposition to Fox's Party), which foresee tinkering at the margins of a system that would remain vertically integrated and organized much as it is today.²⁷ According to the negotiations taking place in late 2003, the proposal that is most likely to be discussed in the Congress is the one presented in the last column. This proposal was negotiated by PAN and some fractions of PRI. However, a common factor in all these proposals is the lack of technical discussion on the specifics of the electricity sector. Even the Fox proposal seems to be totally unaware of the highly complicated task of designing an electricity market under the presence of a vertically and horizontally integrated incumbent state firm. It is not clear how under such conditions there could exist a leveled playing field for entering private generators that would have to compete with generators that belong to a state holding company that is able to deliver subsidies across its different subsidiaries.

IV.3. Evolution of Tariffs in the near future.

The direction of tariff reform remains difficult to predict; yet continued alignment of tariffs with costs is essential. We attempt to develop different scenarios for future tariffs by looking at each of the major contributors to final tariffs. At present, costs are allocated for low-voltage supply with about 35% for generation, 5% for transmission, 50% for distribution, and 10% for marketing. For residential customers, who account for 24.4% of the total load, the gains from distribution and marketing could only arrive via efficiency gains given the proposals presented in Table A1. So in order to discuss some possible scenarios we assume that this 60% of the current cost will remain unchanged.

²⁷ For a more complete discussion, see de Rosenzweig, F. and Femat, J. C. 2003.

With respect to transmission, all the current proposals under consideration envision that the government will retain control. Therefore, any reduction in this tariff will come from efficiency gains rather than outright competition. Lower tariffs from efficiency, however, will be offset with the creation of proper incentives to invest in transmission assets. Even large changes—positive or negative—will have little effect on the final.

Generation costs are likely to have a much larger impact on the total final tariff. Improved efficiency through competition should lower tariffs, although generation tariffs are already artificially low due to under-pricing of fuel oil. Gas fueled power plants should increase efficiency, but the difficulties of attracting investors for indigenous gas production, and the rising gas price trend in North America, has given rise to the need for imports of LNG. The first such facilities are slated to open soon at Ensenada, Baja California, Altamira, Tamaulipas and Lázaro Cárdenas, Michoacán, with delivered costs of perhaps 30% to 50% higher than the price of domestic gas. However, it is important to note that LNG terminals make economic sense with prices of LNG above USD \$4.00 per MMBTU. Although new plants should replace costly old oil-fired facilities, already those old plants, through CFE's "shadow market", are being dispatched only during peak periods, and the shift to a peakier load in the future—with ever-larger residential demand—may actually result in a higher cost for peak power, which reforms will attempt to pass to final users. The most likely effect of all these forces, we estimate, is a higher cost of generation.

Finally, one must consider the fate of subsidy policy in a reformed environment. While there will be pressure to maintain the current subsidies, we doubt that the high cost of this program—though offset a bit, perhaps, through efficiency improvements—will allow for continuation at current levels, which amount to around 50% of the true cost for residential consumers and 70% for agricultural users. Only in the case that investors mistakenly over-invest and produce a glut of low-cost baseload power is it likely that tariffs could be kept low while subsidies are also reduced.

IV.4. New Role of CRE

Although the creation of an independent regulatory authority in the middle 1990s was an enormous accomplishment, the powers and authority of CRE require further

clarification—especially as key functions that are performed by regulators in other countries, such as setting tariffs, are actually controlled by *Hacienda* as an extension of government policy. Indeed, the Fox proposal for continued reform includes a further specification of CRE’s role, including its role in overseeing a transparent tariff policy. A consensus is emerging that CRE should be vested with independent authority to define the rules for market operations, set tariffs, and regulate natural monopolies (see Table A1).

IV.5. The greatest challenge to Reform: Public opinion

The fragmentation of politics in Mexico has exacted a considerable toll on the process of reform. Not only has debate over reform left the technical arena and become a completely politicized issue, but the constant debate and the lack of control by any single party in the Chamber (see Table 4 above) has undercut any continuity in reform strategy and made it difficult for critical investors to anticipate outcomes.

Moreover, available data shows public opinion opposes privatization as well as even private investment in the energy sector. Mexicans who are even aware of the existence of reform proposals (who are in a small minority of the total public) believe that the essence of the most comprehensive reform—proposed by the Fox government—is a privatization that will undermine Mexico’s sovereignty. This view is the result of a carefully manufactured public opinion by interest groups such as unions that fear (probably correctly) that reform will harm their narrow interests. Detractors have found fertile soil for sowing discontent. The 1995 financial crisis, which cost Mexico 7% of GDP, has led many to believe that neoliberal reforms are the cause of economic malaise. Opposition parties to then PRI-led government, especially the PRD, have found success in bashing technocrats as the cause of social problems and injustice in Mexico. Once the PRI lost the presidency in the year 2000 and PRI as a party has fragmented, the core of “anti neoliberals” has swelled in numbers. In many other Latin American countries, the decade of liberal reforms has yielded a similar (and powerful) coalition of illiberal crusaders.²⁸ These voices have found it particularly easy to be heard in countries, such as Mexico, where the 1990s liberal reforms were ridden by corruption.

²⁸ See McKinsey and Mookherjee (2003).

These observations are illustrated in a recent poll conducted in 2002 by *Coordinacion de Estudios de Opinion* (CEO): 36% of those who know about President Fox's reform bill think it is about privatizing the power sector, while only 5% mention attracting private investment. In that same poll, 35% of the population opposed private investment—when asked—and only 17% supported a strategy of attracting new private funds in the industry. Citizens appear to fear private money almost as much as they loathe privatization. About half (49%) of Mexicans consider the country as having electricity problems, a figure far from being overwhelming—and one-third of those who think that electricity is poor cited high prices as the main problem in the sector. Of the whole sample, only 14% said that the quality of electric service was bad, while 33% who said that service quality is good.

Additionally, according to the CEO survey, only 29% believe private investment would guarantee electricity supply in the decades to come; 28% believe poor and rural communities would be electrified, while 30% do not believe that would happen; surprisingly, only 24% believe the government would channel more resources to social spending, while 36% says that promise is false. In the same vein, only 23% think service would improve as a result of private investment. Moreover, the survey suggests that the public thinks many dangers lurk in reform—among them, 60% believe worker rights would not be respected, and a majority believes that private investors will force higher tariffs.

Thus reformers face a problem of credibility with the public. Their mission of reform is viewed, by many, as unnecessary and harmful. Why should people believe this time benefits will be fairly distributed among the population? Why believe corruption will be absent this time? Why will reform yield better service and lower tariffs when similar (unfulfilled) promises were made for reform of the banking system, for example?

Thus old-fashioned popular politics, not economics or technical design, has become the most important factor explaining the failure of power reform in Mexico. One strategy for fixing this problem would be a massive campaign to alter public opinion by explaining the benefits of reform (improved service and a chance of reduced tariffs in the long run, as discussed above) and the current hidden costs to the status quo, such as subsidies that could be redirected to other social purposes. However, available data suggests that such an effort would not be very effective as citizens distrust the ability and honesty of the government to

reallocate one peso saved in electricity to other worthy goals. A second strategy would entail waiting for a more favorable composition of reformers in the Chamber of Deputies and the Senate. However, this strategy depends on political variables that are outside the control of energy reformers. Moreover, the tide is turning against reform—elections for the period 2003-2006 of the Lower House have left the PRI with a greater number of representatives, and none of the three major political parties (PRI, PAN, and PRD) have absolute domain. The Senate will face new elections only in 2006—for this strategy, a large measure of patience and luck would be needed. A third strategy might entail striking a bargain with PRI to assure that it would not pay an electoral cost for its support of a reform bill. Despite the preferences of public opinion against energy reform, this is not a main issue in the minds of the electorate—polls show that voters care much more about employment and public security. At this writing, some efforts appear to be under way on this front. Indeed, with public opinion generally focused elsewhere, PRI may be overestimating the electoral cost, which is suggested to be minor. Although PRI may be overestimating the cost for supporting reform, it is still unclear whether PRI would see a benefit from reform (especially if PAN, which would be most visibly identified with reform, were to reap most of the political gain if reforms were successful).

Creating a winning political coalition for reform will be especially important because many unions in the electric sector have amplified their political power by forming alliances with other unions to block reform. Even if PRI's leadership could be convinced to support reform, PRI's traditional relationship with many unions would strain. The only group with a strong interest in mobilizing in favor of reform is industrial users. They clearly face costs from the status quo and would enjoy substantial benefits from better service and more competitive tariffs²⁹. To date, however, industrial consumers have been ineffective at influencing members of Congress and public opinion despite some lobbying and communication efforts. Moreover, with provisions for cogeneration and self-supply

²⁹ However, industrial consumers in Mexico have had contradictory traditional positions. The price of natural gas is a clear example of this, and of the lack of credibility of the Fox government in engaging in truly efficient reforms (based on technical criterion and not on political pressures by industrial consumers). The famous story of the 4 by 3 PEMEX gas contracts is that case. Under such contracts the government offered a deal to sale one million btus for USD \$4 during three years. This contract was offered when this price was over USD \$6 to \$8. Industrial consumers accepted the deal; but, when prices went below USD \$4 they rejected the contract and asked for market prices.

already on the books (and under lesser constitutional threat than for IPPs), the largest industrial users may actually find it cost-effective to create their own power systems and exit, largely, from the public system—as is already evident in India.

V. Conclusions

Many outside analysts are surprised at how much quarrel and opposition arises from attempts to reform the power sector in Mexico. To some the rhetoric and populist claims of lost sovereignty and state autonomy—at the expense of economic efficiency and growth—are difficult to comprehend in the modern era of open economies. A close look, however, reveals that behind the rhetoric a set of powerful economic and political incentives are at work. In contrast to the late 1980s and early 1990s in which the Mexican government implemented swift market reforms in various economic sectors, today new reforms seem unlikely as many forces have emerged to shame market reforms as the cause of poverty, inequality and stagnation. For five decades the power sector has been dominated by consolidated, state-owned utilities that have entrenched themselves in the organization of the Mexican economy and the Mexican constitution—their position has, ironically, proved difficult to unravel now that reforms are implemented in the context of political fragmentation. These incumbents have also entrenched their position by touting important achievements such as 96% power access coverage—although we have shown that success on that front probably stems mainly from urbanization and economic growth. Power service appears to have improved; more importantly, the public (in general) believes that the power system is functioning well. In the last decade, niches for private investors have been created, but the broader judicial reforms have brought even these under a cloud of constitutional contention. Without any party holding a working majority in any of the chambers, further reforms have become gridlocked.

The greatest challenges that remain in the sector are complex and not visible to average citizens. They include large and inefficient subsidies in tariffs, which have made it difficult for the government to contract additional debt and have skewed government spending on a wide array of other programs. We have suggested that further power sector reform is essential as the high growth in demand for electricity is narrowing the gap with

available supply, and the various stopgap measures adopted to attract investment (and delay closure of old plants) are running out of steam. Even budgets to maintain old plants have been slashed. Although it is difficult to assess, the competitiveness of the country is probably harmed—perhaps substantially—by this continued gridlock. Yet absent massive apparent difficulties—such as widespread blackouts (themselves a possibility as reserve margins recently dipped to just 1%) the needed consensus for reform remains elusive.

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