

# Infrastructure in Latin America: Recent evolution and key challenges

(Seven Country Briefs) – C.B. 6/7: Mexico

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*Cohen & Co.*  
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## Notes

Higher middle-income countries: Argentina, Brazil, Costa Rica, Mexico  
Regional average: Argentina, Brazil, Colombia, Costa Rica, Guatemala, Jamaica, Mexico, Peru

## Weights and Measures

Metric System

## Government Fiscal Year

1 January – 31 December

## Acronyms

**APIs:** Administración Portuaria Integral

**ASA:** Aeropuertos y Servicios Auxiliares

**BANOBRAS:** Mexican National Bank of Public Works and Services

**C.A.G.R.:** Compound average growth rate

**CAPUFE:** Caminos y Puentes Federales de Ingresos y Servicios Conexos

**CENACE:** Centro Nacional de Control de Energía

**CFE:** Comisión Federal de Electricidad

**CIA:** Central Intelligence Agency

**CNA:** National Commission of Water – Comisión Nacional del Agua

**CNE:** Comisión Nacional de Energía

**COFECO:** Comisión Federal de Competencia

**COFETEL:** Comisión Federal de Telecomunicaciones

**COTAS:** Technical Groundwater Committees

**CRE:** Comisión Reguladora de Energía

**CSFB:** Credit Suisse First Boston

**DGTTFM:** Dirección General de Tarifas, Transporte Ferroviario y Multimodal

**DHS:** Demographic and Health Surveys

**ECLAC:** Economic Commission for Latin America and the Caribbean

**EIA:** Energy Information Administration

**ENAH0:** Encuesta Nacional de Hogares

**ENIGFAM:** Encuesta Nacional de Ingresos y Gastos Familiares

**ENIGH:** Encuesta Nacional de Ingresos y Gastos de los Hogares

**EPH:** Encuesta Permanente de Hogares  
**ESMAP:** Energy Sector Management Assistance Programme  
**FARAC:** Fideicomiso de Apoyo para el Rescate de Autopistas Concesionadas  
**FODEN:** Mexico's Fund for natural Disasters  
**HIMC:** Higher middle-income countries  
**IBGE.** Instituto Brasileiro de Geografia e Estatística  
**IDB:** Inter-American Development Bank  
**INDEC:** Instituto Nacional de Estadísticas y Censos  
**INE:** Instituto Nacional de Estadística  
**INEC:** Instituto Nacional de Estadística y Censos  
**INEGI:** Instituto Nacional de Estadística, Geografía e Informática  
**INEI:** Instituto Nacional de Estadística e Informática  
**IPPs:** Independent Power Producers  
**IRF:** International Road Federation  
**ITU:** International Telecommunication Union  
**JSLC:** Jamaica Survey of Living Conditions  
**LACs:** Latin American Countries  
**LDF:** Federal Duties Law  
**LFC:** Luz y Fuerza del Centro  
**NAFTA:** North American Free Trade Agreement  
**OECD:** Organization for Economic Co-operation and Development  
**OLADE:** Organización Latinoamericana de Energía  
**PEMEX:** Petróleos Mexicanos  
**PEP:** Pemex Exploración y Producción  
**PGPB:** Pemex Gas y Petroquímica Básica.  
**PHO:** Pan-American Health Organization  
**PIJ:** Planning Institute of Jamaica  
**PNAD:** Pesquisa Nacional por Amostra de Domicílios  
**PP:** Pemex Petroquímica  
**PPAs:** Power Purchase Agreements  
**PPP:** Public Private Partnerships  
**PR:** Pemex Refinación  
**PUMEX:** Puertos Mexicanos  
**SCT:** Secretaria de Comunicaciones y Transportes  
**SCT:** Secretariat of Communications

**SEDESOL:** Ministry of Social Development

**SEMARNAT:** Secretaria de Medio Ambiente y Recursos Naturales

**SENER:** Secretaría de Energía, Minas Industria Paraestatal, currently Secretaría de Energía

**SISS:** Superintendencia de Servicios Sanitarios

**UNCTAD:** United Nations Conference on Trade and Development

**UNDP:** United Nations Development Programme

**UNSTAT:** United Nations Statistical Division

**USTR:** United States Trade Representative

**WDI:** World Development Indicators

**WEF:** World Economic Forum

**WTO:** World Trade Organization

#### **Task Team**

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# 1. OVERVIEW

The Federal Republic of the United Mexican States covers a *total area* of 1,972,550<sup>1</sup> square kilometers. In July 2004, its *total population* was estimated at 104,959,594<sup>2</sup>, with an annual *population growth* rate of 1.18%<sup>3</sup>. Mexico has a young population, with a *median age*<sup>4</sup> of 24.6 years, with only a slight difference between *male* (23.7) and *female* (25.5).

Figure 1.1 – Map of Mexico



Source: *The World Factbook – Mexico 2004 - CIA*

Mexico's Chief of State and Head of Government is President Vicente Fox Quesada, who was democratically elected in July 2000. The Mexican political system is currently going through a process of renewal and democratization, shifting with President Fox towards increased political pluralism and a more effective separation of powers. However, the mid-term elections, which took place in July 2003, have modified the internal balance of the Chamber of Deputies. Now each of the three major political parties stands a reasonable chance of winning the next presidential election. This could resolve the previous gridlock and there could be a window of opportunity for building consensus in order to pass reforms, although an attempt to pass much-needed fiscal reforms failed in December 2003.

The government's agenda includes structural reforms relevant to our study, such as reform of the energy sector allowing private sector participation in meeting future demand, or the introduction of telecommunications regulations that will help foster a competitive environment

<sup>1</sup> Source: *The World Factbook – Mexico 2004 (Estimates) – CIA*.

<sup>2</sup> *Ibidem*.

<sup>3</sup> *Ibidem*.

<sup>4</sup> *Ibidem*.

so as to increase coverage, improve quality and reduce costs. The government has also initiated extensive reforms in key infrastructure and service sectors, focusing on sector restructuring, competition and regulation to increase performance and investment.

Mexico's 2001-2006 National Development Plan defined some important basic objectives, classified into four groups:

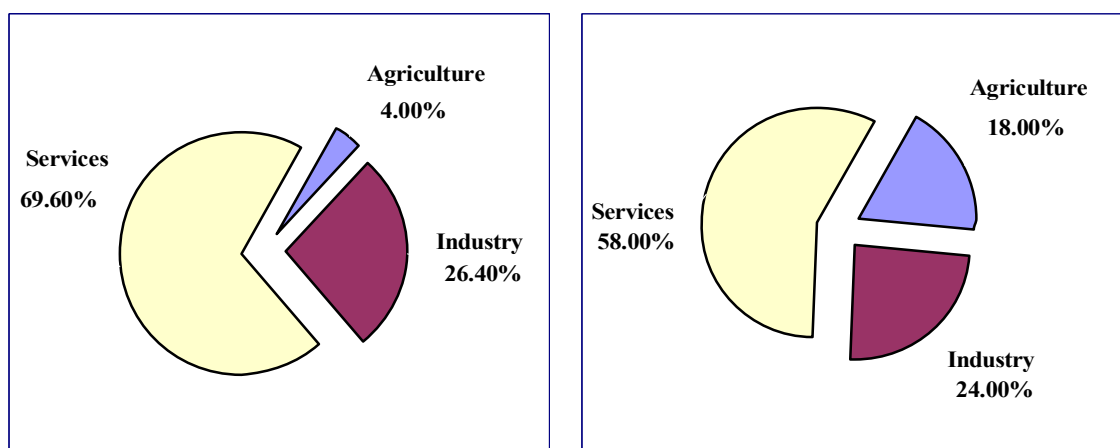
- (i) reducing poverty and inequality;
- (ii) increasing competitiveness;
- (iii) strengthening institutions; and
- (iv) promoting environmental sustainability.

Mexico has a free market *economy*, composed of a mixture of modern and outdated industry as well as agriculture. The main natural resources of the country are petroleum, silver, copper, gold, lead, zinc, natural gas and timber.

In 2002, Mexican *GDP Purchasing Power Parity* amounted to international \$818.830<sup>5</sup> billion, while the *per capita GDP PPP*<sup>6</sup>, having decreased by 0.54%, amounted to international \$7,946.80, one quarter of the U.S. citizen's indicator. In 2003, the real growth rate was 1.3%<sup>7</sup>.

In regards to *GDP composition*<sup>8</sup>, in 2003, agriculture accounted for 4.0% of GDP, industry 26.4% and services 69.6%. In the same year, the composition of the *labor force*<sup>9</sup> by occupation was 18% in agriculture, 24% in industry and 58% in services.

Figure 1.2 – GDP and Labor Force by Sector – 2003



Source: *The World Factbook – Mexico 2004 – CIA*

<sup>5</sup> Source: World Development Indicators 2004 – The World Bank. Values in constant 1995 international \$.

<sup>6</sup> Ibidem.

<sup>7</sup> Source: *The World Factbook – Mexico 2003 (Estimates) – CIA*.

<sup>8</sup> Ibidem.

<sup>9</sup> Ibidem.

Mexico is still a poor country whose income distribution has remained highly unequal: in 2000, 53% of the population was affected by *income-poverty*<sup>10</sup> and almost 24% was extremely poor<sup>11</sup>. In the same year, it was estimated that 12.6% of the urban population and 42.4% of the rural population was extremely poor.

As for *development indicators*, in 2002, the *infant mortality* rate stood at 24 deaths per 1,000 live births; and in 1999, *weight malnutrition* touched 7.5% of children under 5 years of age. In addition, the *female labor force* in 2002 was only 33.8% of the total labor force<sup>12</sup>.

Moreover, Mexico has a relatively high incidence of diseases that may be correlated with environmental risks including limited access to safe water supply, limited access to basic sanitation, and exposure to air pollutants, hazardous substances and indoor air pollution in rural areas where wood-burning stoves are used.

With regard to educational issues, the *literacy rate* in Mexico is fairly high. In fact, 90.5%<sup>13</sup> of people aged 15 and above were able to read and write in 2000, with the *adult female literacy rate* estimated at 88.68%<sup>14</sup> and the *adult male literacy rate* at 92.56%<sup>15</sup>.

In 2003, the *Human Development Index* (HDI) ranked Mexico 53<sup>rd</sup>; however, from 1975 to 2002, it increased constantly and reached the maximum value of 0.802. Referring to the *Human Poverty Index* (HPI-1), Mexico ranked 12<sup>th</sup> among developing countries.<sup>16</sup> The Human Development Index measures average achievement, while the Human Poverty Index measures shortages in the three basic dimensions of human development included in the HDI: a long and healthy life, knowledge and a decent standard of living.

Access to basic infrastructure services (transportation, water, sanitation and energy) is relatively high in Mexico; however, the high infrastructure indicators disguise the fact that there are a large number of households without services. Transport is lacking, particularly in rural areas, and especially hampers the poor. In addition, services are often of low quality, particularly those available to the lower income population. Incomplete coverage and poor-quality infrastructure services persist despite a substantial inflow of public resources.

More than 40% of Mexico's population lives in temporary housing, characterized by provisional construction materials, lack of services and insecurity of tenure; in many cases, dwellings are located in areas at risk of natural disasters (68% of people affected by natural disasters are poor).

Since the 1980s, Mexico has been undergoing a far-reaching privatization program, aimed at maintaining a limited state interest in the main infrastructure sectors of the country and attracting private investments. Telmex, the state-owned telecom carrier, was privatized in the 1990s and since then competition has gradually been introduced into every telecom segment. Telmex has retained market leadership; however, competitors have consistently complained about the anticompétitive behavior of the incumbent. In 2001, Telmex was still the market

<sup>10</sup> Defined as having a level of per capita consumption below that necessary to meet basic food and non-food needs.

<sup>11</sup> Below requirements to meet basic food needs for adequate nutrition.

<sup>12</sup> Source: World Development Indicators 2004 – The World Bank.

<sup>13</sup> Ibidem.

<sup>14</sup> Ibidem.

<sup>15</sup> Ibidem.

<sup>16</sup> Source: Human Development Report 2004 – UNDP.

leader, with a 96% market share in local telephony, 78% in mobile services and 55% in Internet service provision.

In the water and sanitation sector, privatization is still far from being effective as not only have municipalities failed to attract private investments, but also the low tariffs in the sector do not enable the appropriate remuneration of private investments. The system is therefore highly dependent on public subsidies.

Privatization in the transport sector, however, has been successful, and the government has succeeded in raising a significant amount of private financial resources for the railroad, toll roads, airports and port segments. Nevertheless, even after some years of private management, some of the privatized projects have failed to perform. These were specifically in the road sector and stemmed from an over-optimistic traffic-demand forecast which in several cases subsequently necessitated government-led rescue initiatives for private companies in financial difficulty. Ever since, new concession tenders have been looked upon with suspicion by the private sector.

In the energy sector, a monopoly situation persists and the government retains control. In order to meet future challenges, the energy and water sectors will need to raise more than US \$100 billion in the next decade: this is one of the main objectives for the current Mexican government in the coming years. To achieve this goal, more steps need to be taken to foster institutions able to raise money for infrastructure development, such as the state-owned *Banobras* (*Banco Nacional de Obras y Servicios*) and pension-fund companies, whose combined assets under management are in excess of US \$31 billion. As in other modern developed countries, a public financial institution acting as a development bank and a pension-fund system would be the best solutions for infrastructure financing; only investors who have a long-term outlook (e.g. pension funds) and a less profit-oriented strategy (such as a government-backed development bank) would be interested in a sector that pays dividends only after many years from project implementation and in which significant capital expenditures are required.

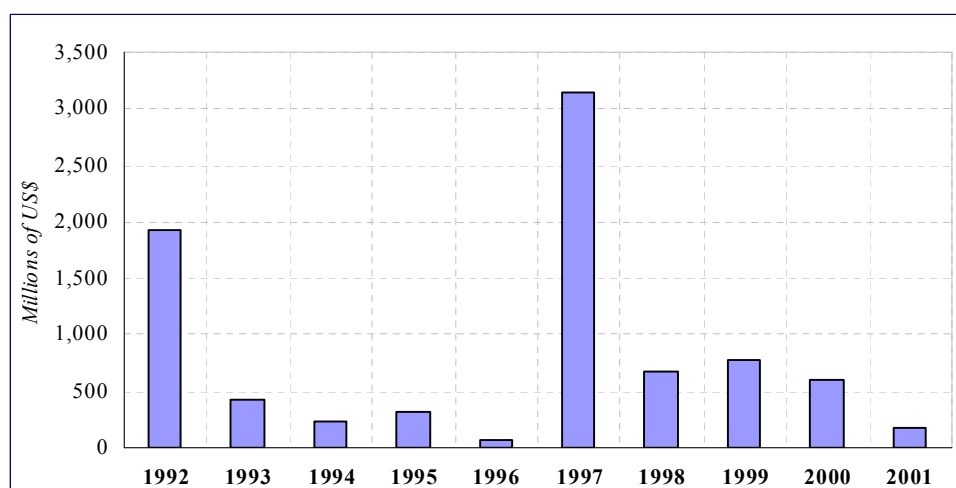
## 2. TRANSPORT

### 2.1. OVERVIEW

During the 1980s, investments in the Mexican transport system decreased substantially due to the economic recession and the fiscal deficit. Consequently, following the external debt crisis, infrastructure facilities rapidly deteriorated and became an obstacle to Mexico's development. On account of the process of economic integration with North America in the 1990s, the maintenance, modernization and expansion of transport facilities have become more important, and are necessary to enable growth in international trade, to guarantee competitiveness in national output and to attract investments.

Accordingly, Mexico has initiated changes in the transport system and, to date, it has accomplished service decentralization management and facilitated the participation of private investors in many of its transport sectors - roads, railways and ports - with mixed results. The port and airport privatizations led to improved performances in both sectors, while the road privatization program, which took place in the early 1990s, was a failure due to lower than expected traffic volumes. Consequently, the government had to repurchase most of these concessions at significant cost. These experiences indicate the importance of reliable forecasts and the need for specific projects designed by the *Secretaría de Comunicaciones y Transporte* (SCT). In the light of poor performance in road privatization, there is a high perception of risk associated with investment in highways in Mexico; this is mainly due to the government's failure to deliver on guarantees and contractually obligated adjustments during the toll roads debacle, owing to political constraints. Besides, SCT has not yet modified its role from operator to watchdog.

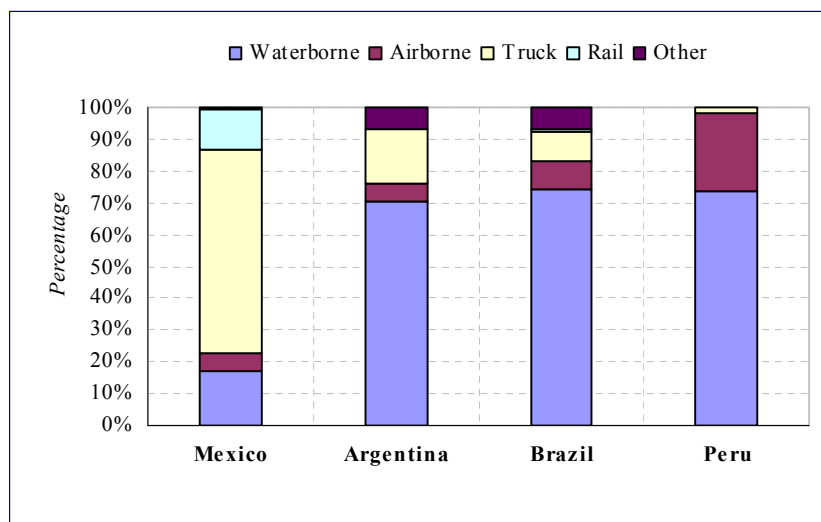
Figure 2.1 – Private Investment in Transport



Source: World Development Indicators 2004 – The World Bank

Figure 2.1 describes the private investment in transport occurring between 1992 and 2001. As shown, after the peak in 1997 (US\$ 3.14 billion), when most of the road privatization program took place, this value fell sharply to US\$ 170 million as a consequence of the aforementioned toll road privatization debacle.

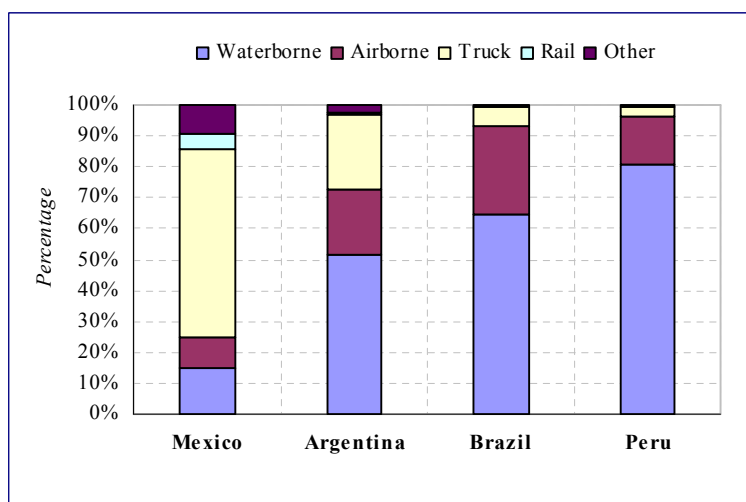
Figure 2.2 – Exports by Mode of Transport – 2000 - Value FOB



Source: Economic Commission for Latin America and the Caribbean (ECLAC)

A higher degree of economic openness contributed to the above-mentioned changes in the government’s transportation policy. The internationalization of the Mexican economy increased largely in the 1990s when Mexico joined NAFTA (North American Free Trade Agreement). On account of this agreement, trade flows with the United States and Canada increased, and land transportation (the use of trucks) became the predominant mode of transport within Mexico and for cross-border trade, while marine transportation became more limited. Figures 2.2 and 2.3 compare the modes of transportation used in Mexico with those in other Latin American countries, on both the import and export sides. The outcome of the railway privatization program, which was better than expected, has brought fresh interest in multi-modality, since new players are competing for market share through better services and lower tariffs. Certainly, logistical problems still exist: in fact, major improvements are required in road and rail access to port facilities and distribution centers. Moreover, one of the major obstacles to achieving inter-modal competition is the lack of coordination between multi-modal agents and authorities, leading to a lack of inter-modal facilities.

Figure 2.3. – Imports by Mode of Transport - 2000 - Value FOB



Source: Economic Commission for Latin America and the Caribbean (ECLAC)

## 2.2. ASSESSMENT OF THE KEY POLICY AREAS

### 2.2.1. ANALYSIS OF THE TECHNICAL DIMENSIONS OF THE SECTOR

In order to assess the technical dimension of the transport sector in Mexico, the following sub-sectors have been analyzed:

- road system;
- rail system;
- ports; and
- airports.

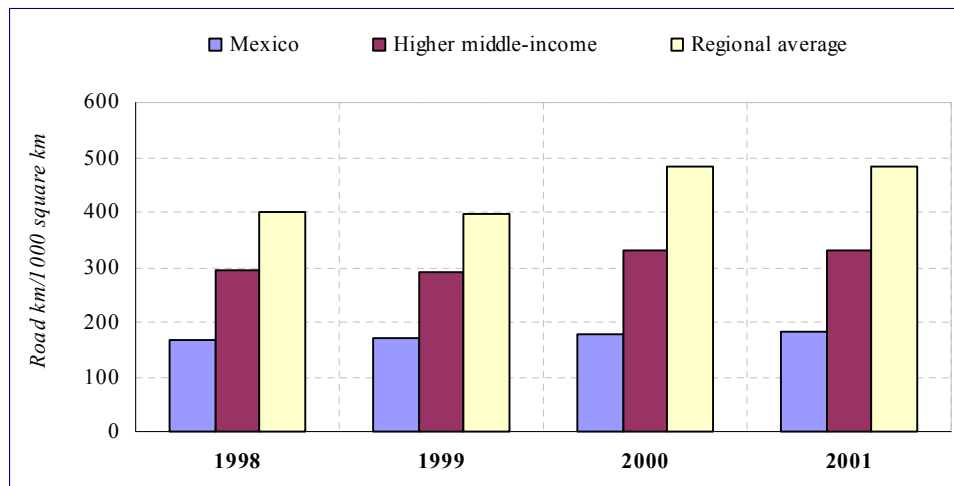
**Roads.** With regard to the road transportation sector, in 2002 Mexico had 337,168 km of roads, a road density of 177 km/1,000 km<sup>2</sup>. Then, as indicated in Figure 2.4, in the period between 1998 and 2001 Mexico lagged behind both the higher middle-income countries and the regional sample, mainly as a result of the toll roads debacle occurring in the early 1990s. In detail, compared to its main benchmarks, the Mexican performance was much lower than Costa Rica's (703 km/1,000 km<sup>2</sup>), slightly lower than Brazil's (204 km/1,000 km<sup>2</sup>) and higher than Argentina's (84 km/1,000 km<sup>2</sup>), as shown in Table 2.1 below.

Table 2.1 – Road Indicators – 2000

	Mexico	Brazil	Argentina	Costa Rica
Road Density (Road km/1000 sq km)	177.51	203.97	84.12	702.94
Paved/Total (%)	32.49%	9.56%	27.60%	22.01%

Source: IRF, CIA, WDI 2004

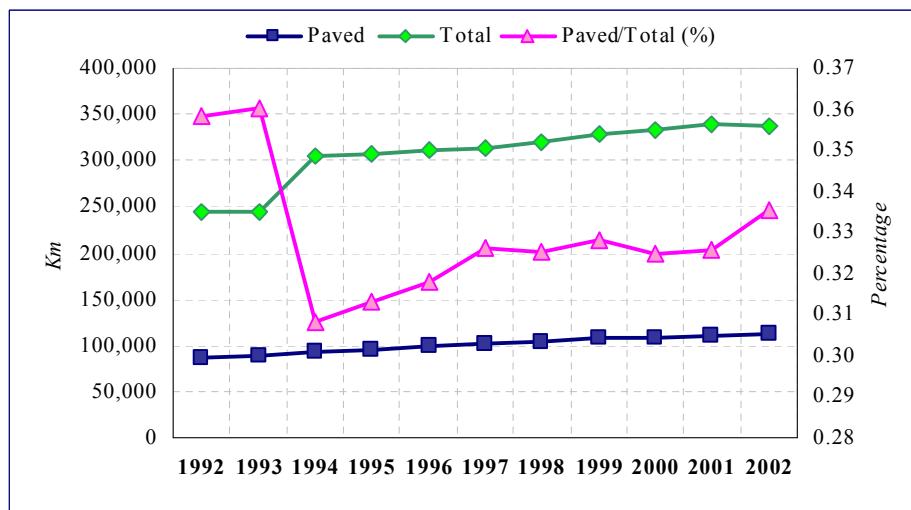
Figure 2.4 – Road Density Benchmark



Source: Ernst & Young Italy and Cohen&Co. elaborations on ECLAC data (Anuario Estadístico America Latina y el Caribe 2003)

Figure 2.5 shows the progress of Mexican road-building. It should be noted that from 1980 to 1992, road lengths remained stable, but with the initiation of the highway concessions program the lengths increased, and the highway network grew by 38% between 1992 and 2002. Paved roads, however, grew only by 30% for the same period, and in 2002 represented a third of the entire highway system (113,125 km in 2002). However, it is worth mentioning that, as indicated in Table 2.1, Mexico performed well in terms of paved roads (32.49%) compared with its main benchmark countries: Argentina (27.60%), Costa Rica (22.01%) and Brazil (9.56%).

Figure 2.5 – Road Length

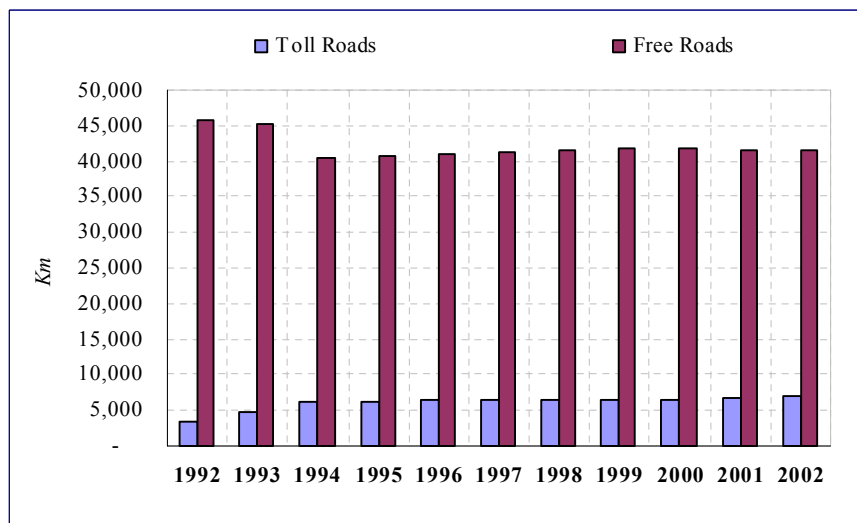


Source: Dirección General de Evaluación and Subsecretaría de infraestructura

With regard to the federal network, it should be noted that in 2002 it included 48,524 km of paved roads. As shown in Figure 2.6, some of them are toll roads (6,987 km), while the remainder is made up of toll-free roads (41,537 km) – meaning that 14% of the total system is funded through toll charges from the road concessions program, compared with 7% in 1992.

The increase in toll collections also explains the favorable development of Mexican roads. In 1994, only 43% of federal highways were in good or acceptable condition, but by 2002 that percentage had grown to 70%. The comparison with other countries shows that the Mexican system enjoys sound health: for instance, in 2002 only 37% of Brazil’s roads were in good condition. Moreover, while toll roads mainly consist of four traffic lanes (75% of the total), only 8% of toll-free roads consist of four-lane highways.

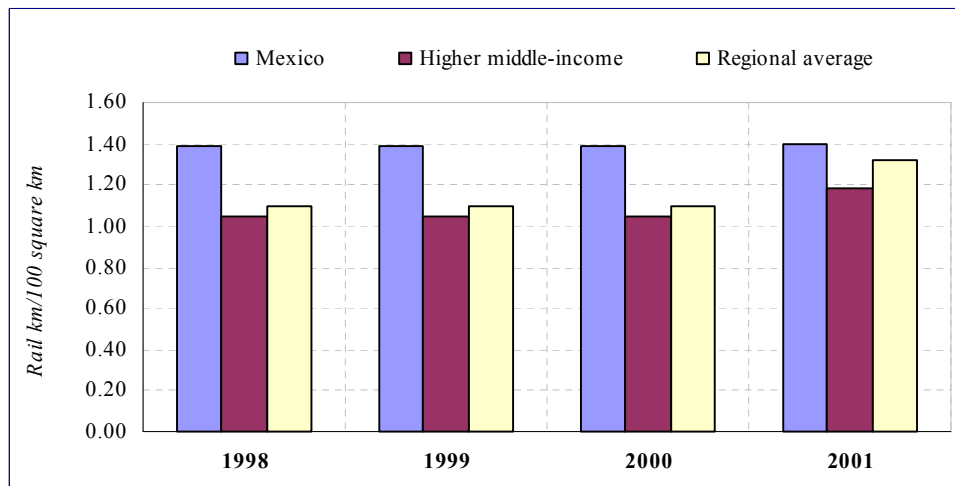
Figure 2.6 – Length of Federal Roads



Source: Subsecretaria de Infraestructura

**Rail system.** In spite of the fact that during the 1990s network lines remained practically unchanged - since 1992 only 210 km have been added to the railway system - the Mexican railway network, with a length in 2002 of 26,655 km, was one of the most developed in Latin America and, as Figure 2.7 below confirms, Mexico’s performance in terms of rail density in the period 1998-2001 was much higher than that of the regional sample or the peer group. In particular, in 2001, with a density of 1.4 km/100 km<sup>2</sup>, the indicator for Mexico was notably better than that of the Brazilian network (0.36 km/100 km<sup>2</sup>), and very similar to Argentina’s (1.31 km/100 km<sup>2</sup>), while Costa Rica recorded a better indicator (1.66 km/100 km<sup>2</sup>).

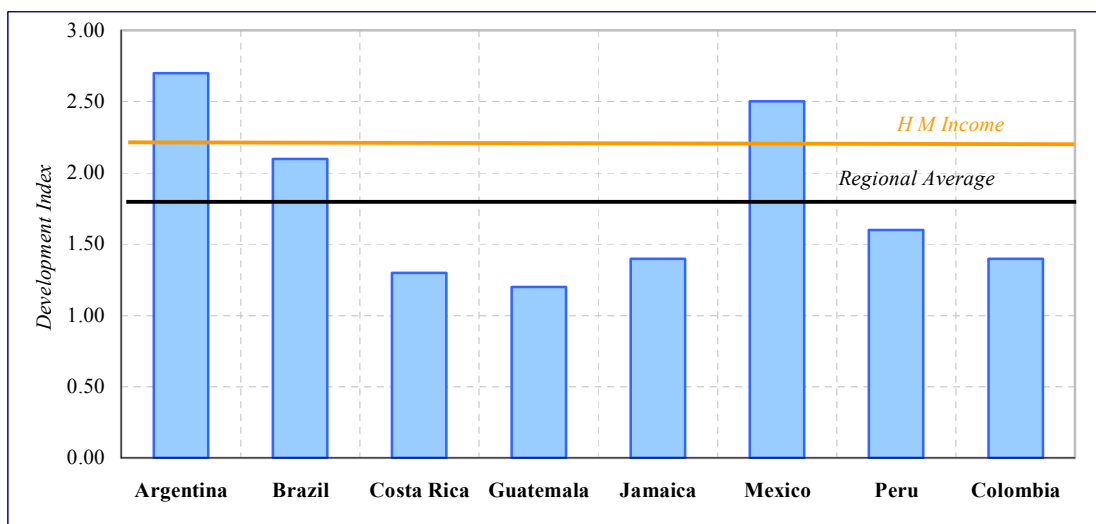
Figure 2.7 – Rail Density Benchmark



Source: Ernst & Young Italy and Cohen&Co. elaborations on ECLAC data (Anuario Estadístico America Latina y el Caribe 2003)

Figure 2.8 confirms the previous analysis regarding the Mexican railway network also in terms of the quality of the infrastructure; indeed, aside from Argentina, Mexico scores best among the Latin American countries under consideration.

Figure 2.8 – Railroad Infrastructure Quality - 2004<sup>1</sup>



Source: World Economic Forum 2004 Executive Opinion Survey

<sup>1</sup>Scoring: 1= underdeveloped and 7= as extensive and efficient, the world's best

**Ports.** Mexico’s coasts look out to both oceans, Atlantic and Pacific, a key vantage point for the ports sector. There are 108 ports and registered terminals distributed equally between the two coasts. The port sector has undergone major changes in recent years and many concessions have been granted (64 to 2003). Up to 1993, *Puertos Mexicanos* (PUMEX) was the sole port operator in Mexico, and until then it wielded monopoly power over building and use of port infrastructures. Eventually PUMEX’s low productivity led to its dissolution and to the passing of the Port Law. The key points of the Port Law are:

- (i) the decentralization of port management; that is, decentralization of each port or group of ports through the constitution of the *Administración Portuaria Integral* (APIs), which are state-owned commercial companies managing ports. These companies are open to the participation of state and local entities as well as to private sector representatives; in fact, one of their main objectives is the attraction of private investment; and
- (ii) the introduction of competition between operators and the simplification of regulatory issues. The government has maintained ownership of port infrastructure, but services have been privatized.

This port reform significantly improved performance in the sector. Indeed, it is worth mentioning that, following the reform, investments increased. For instance, terminals and storage capacity increased and, importantly, performance indicators improved.

Due also to the aforementioned improvements in the performance of ports, the total turnover of Mexican ports, expressed in tons, increased by 7.6% between 2000 and 2003 and nearly 28% in container flows, making the trade flow indicators for Mexican ports similar or slightly lower than those of the other Latin American countries. For instance, as indicated in Table 2.3, the freight bulk turnover in Mexican ports in 2002 was a little over 2.5 ton/inhabitant, while in Brazil – the best-performing country among Mexico’s main benchmarks - the flow was almost 2.9 ton/inhabitant in the same year, which shows that by comparison Mexico depended less heavily on the port system. Information on port movements is summarized in detail in Tables 2.2, 2.3, 2.4 and 2.5.

**Table 2.2 – Ports: Freight Tons**

Year	Mexico	Brazil	Argentina	Costa Rica
2000	244,252,372	477,405,631	62,410,910	6,738,474
2001	243,123,478	489,176,266	70,281,785	6,731,124
2002	254,612,510	502,829,439	75,079,606	9,574,325
2003	262,820,215	552,086,910	81,130,763	10,362,240
2003/2000	7.60%	15.64%	29.99%	53.78%

Source: ECLAC – *Perfiles Marítimos*

Table 2.3 – Ports: Freight Tons per 1,000 People

Year	México	Brazil	Argentina	Costa Rica
2000	2,493	2,807	1,741	1,769
2001	2,446	2,838	1,943	1,738
2002	2,525	2,882	2,058	2,429

Source: Ernst & Young Italy and Cohen&Co. elaborations on ECLAC - Perfiles Marítimos data

Table 2.4 – Ports: TEU

Year	Mexico	Brazil	Argentina	Costa Rica
2000	1,315,903	2,470,417	1,192,630	585,427
2001	1,358,178	2,793,245	1,321,329	577,621
2002	1,564,544	3,522,765	1,102,950	602,568
2003	1,683,400	4,255,598	1,333,840	669,259
2003/2000	27.93%	72.26%	11.84%	14.32%

Source: ECLAC - Perfiles Marítimos

Table 2.5 – Ports: TEU per 1,000 people

Year	México	Brazil	Argentina	Costa Rica
2000	13.43	14.52	33.27	153.66
2001	13.67	16.20	36.54	149.14
2002	15.52	20.19	30.23	152.86

Source: Ernst & Young Italy and Cohen&Co. elaborations on ECLAC - Perfiles Marítimos data

Mexico's main ports are *Altamira, Lazaro Cardenas, Manzanillo, Progreso, Tampico* and *Vera Cruz*, which represent 75% of cargo turnover, excluding ore and petroleum shipments. In 2002, petroleum accounted for 62% of ports' turnover, ore represented 20%, and general cargo accounted for the remaining 18%. Table 2.6 shows the freight loads in the main ports.

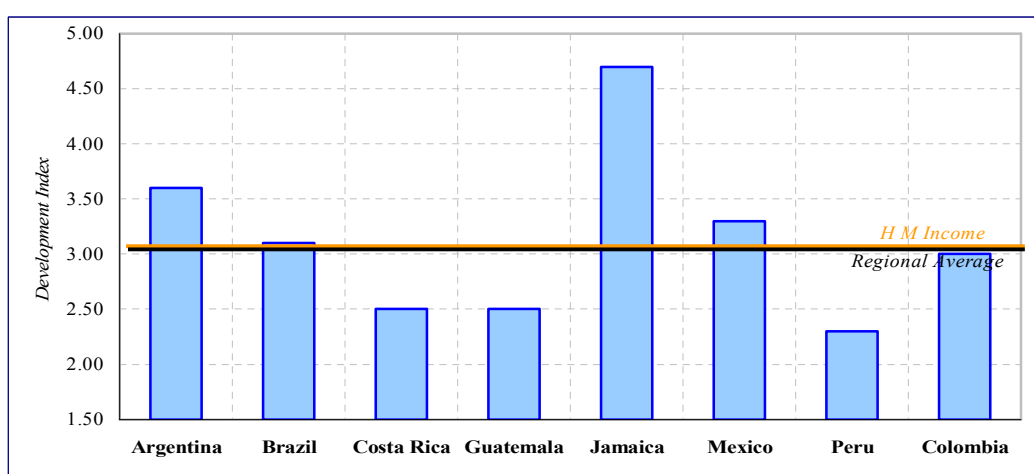
Table 2.6 – Main Ports

Main Ports\Year	2000	2001	2002	2003
<b>Freight Tons</b>				
<b>Cayo Arcas</b>	42,134,011	46,775,358	49,293,588	55,860,154
<b>Pajaritos</b>	33,686,724	30,135,832	31,820,944	31,547,505
<b>Dos Bocas</b>	23,110,287	28,523,434	31,000,237	32,392,805
<b>Salina Cruz</b>	16,828,835	16,575,545	17,177,580	16,330,129
<b>Lazaro Cardenas</b>	18,084,113	14,706,378	14,454,325	15,939,334
<b>Vera Cruz</b>	14,051,439	14,068,613	14,731,281	15,295,067
<b>Mexico - Total</b>	244,252,372	243,123,478	254,612,510	262,820,215
<b>TEU</b>				
<b>Vera Cruz</b>	540,014	543,327	548,422	571,765
<b>Manzanillo</b>	426,717	457,946	638,597	707,404
<b>Altamira</b>	182,545	206,864	225,937	256,417
<b>Progreso</b>	59,199	65,353	59,140	60,369
<b>TOTAL</b>	1,315,903	1,358,178	1,564,544	1,683,400

Source: ECLAC - Perfiles Maritimos

Finally, it should be noted that the results of the World Economic Forum’s 2004 Executive Opinion Survey are positive with regard to users’ opinions on the port infrastructure. In fact, as illustrated in Figure 2.9, the quality of infrastructure in Mexican ports is adequate (3.3), higher than both the regional average and that of the higher middle-income countries of the region, which both score 3.1. Moreover, in 2004 Mexico recorded the best performance in the region, with the exception of Jamaica and Argentina.

Figure 2.9 –Port Infrastructure Quality – 2004<sup>1</sup>



Source: World Economic Forum 2004 Executive Opinion Survey

<sup>1</sup>Scoring: 1= underdeveloped and 7= as extensive and efficient, the world’s best

**Airports.** Mexico has numerous *airports*: 233 with paved runways, which are all linked to domestic and international airlines. The country also has the greatest number of large airports, namely 12 that are over 3,047 meters, as compared with the other higher middle-income countries (see Table 2.7). Between these 12, the six major airports are in Cancun, Guadalajara, Mexico City, Monterrey, Puerto Vallarta and Tijuana, all located in the main commercial cities or tourist centers.

**Table 2.7. – Airports with Paved Runways: Benchmarks**

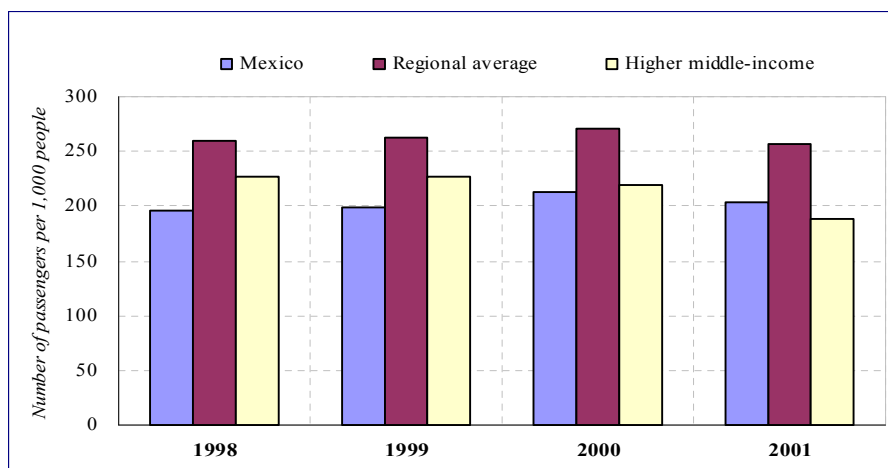
	Mexico	Argentina	Brazil	Costa Rica
<b>Total</b>	233	144	698	30
<b>over 3,047 m</b>	12	4	7	-
<b>2,438 – 3,047 m</b>	28	26	23	2
<b>1,524 – 2,437 m</b>	84	42	158	2
<b>914 – 1,523 m</b>	80	64	461	18
<b>under 914 m</b>	29	8	49	8
<b>Population – million</b>	104.96	39.14	184.10	3.957
<b>Land - sq Km – thousand</b>	1,923.04	2,736.69	8,456.51	50.66
<b>Airports (with p.r.) /1000 sq Km</b>	0.12	0.05	0.08	0.59
<b>Airports (with p. r.) /million people</b>	2.22	3.68	3.79	7.58

Source: *The World Factbook – 2004 – CIA*

The number of passengers in Mexican airports has risen significantly in the last decade: in 1990 this figure was 14.34 million, while in 2001 it reached 20.17 million (implying a C.A.G.R. of 3.15%)<sup>17</sup>. In spite of this performance, as indicated in Figure 2.10, the *number of passengers per 1,000 people* in Mexico in the period 1998-2001 was significantly lower than the average of all the Latin American countries under consideration. However, in 2001 the value for Mexico was higher than the average of the higher income group, due to the lower than average indicators recorded by Argentina and Costa Rica in 2001 (see Table 2.8). Moreover, it should be recognized that the overall trend in Mexico in the years under consideration has been positive, unlike that of the benchmark.

<sup>17</sup> Source: ECLAC Anuario estadístico de America Latina y el Caribe.

Figure 2.10 – Passengers Carried per 1,000 People<sup>1</sup>



Source: Ernst & Young Italy and Cohen&Co. elaborations on ECLAC data - Anuario Estadístico de America Latina y al Caribe 2003

<sup>1</sup>Guatemala excluded

Table 2.8 – Passengers per 1,000 People – Higher Middle-Income Countries

Year	1998	1999	2000	2001
Mexico	196.17	199.44	213.28	202.99
Argentina	244.99	258.70	248.37	160.62
Brazil	175.60	168.26	187.06	198.88
Costa Rica	293.18	282.92	230.39	190.52

Source: Ernst & Young Italy and Cohen&Co. elaborations on ECLAC data - Anuario Estadístico de America Latina y el Caribe 2003

Considering the *ton-kilometers of freight per 1,000 people* in Table 2.9, the values for Mexico are relatively low compared with the figures of the two other benchmarks, but the differences are reducing, mainly due to decreasing benchmark values; however Mexico’s progress has been steady.

**Table 2.9 – Ton – Kilometers of Freight per 1,000 People**

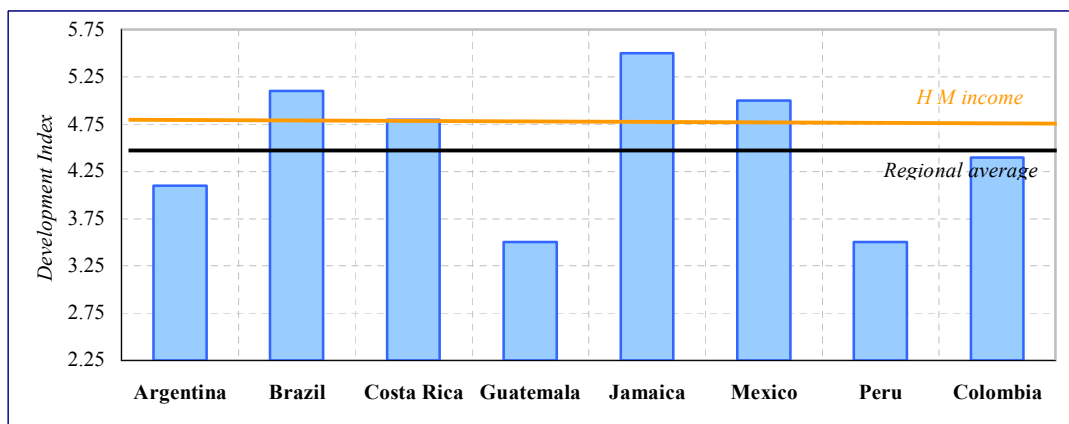
Country/Year	1998	1999	2000	2001
Mexico	2,992.09	3,194.11	3,163.34	2,978.55
Higher middle-income <sup>1</sup>	11,220.87	10,335.08	10,297.50	5,210.54
Regional average <sup>1</sup>	10,568.47	9,767.95	9,825.28	7,090.11

Source: Ernst & Young Italy and Cohen&Co. elaborations on ECLAC data - Anuario Estadístico de América Latina y al Caribe 2003

<sup>1</sup>Guatemala excluded

Finally, with regard to air transport infrastructure quality, data from the World Economic Forum of 2004, concerning user perceptions of quality, gave Mexico had a rating of 5, which is higher than both the regional average of 4.5 and that of the higher middle-income countries, at 4.8.

**Figure 2.11 – Air Transport Infrastructure Quality – 2004<sup>1</sup>**



Source: World Economic Forum 2004 Executive Opinion Survey

<sup>1</sup>Scoring: 1= underdeveloped and 7= as extensive and efficient, the world's best

### 2.2.2. ECONOMIC EFFICIENCY AND PRIVATE SECTOR FINANCING

Following the economic crisis of the 1980s, during the 1990s the transport infrastructure system recovered completely from the decentralization of infrastructure management, the increased role of private investments and the new legal framework regarding concessions. Profitability rose substantially and the country was able to fill the gap in international trade created during the previous decade.

The *road network* concessions process began in 1989 with a 4,000 km highway construction project involving private capital. The *Secretaria de Comunicaciones y Transportes* (SCT) was responsible for setting a maximum toll, and estimating traffic, investment costs and other parameters, and investments were to be funded entirely through private resources. Following a wave of optimism regarding Mexico's future economic performance, which showed impressive growth in the early 1990s, 5,500 km of highways were awarded (52 concessions, 31 allocated to the private sector alone). The length of concessions was relatively short; on average, 12 years. Unfortunately, misestimated traffic flows and high tariffs caused serious financial problems to some concessionaires and the government was compelled to reorganize the sector by creating the *Fideicomiso de Apoyo para el Rescate de Autopistas Concesionadas* (FARAC). It rescued the concessionaires in financial trouble and put 21 concessions under public control.

In 2002, the concessions' process was re-launched, this time trying to avoid previous errors, and allocating project risks more appropriately between the public sector, private sector and financial institutions.

Nowadays, the greater part of the Mexican highway system, 4,800 km, is managed by *Caminos y Puentes Federales de Ingresos y Servicios Conexos* (CAPUFE), a minor stake of 800 km is under private concessions, and the rest is managed by the state. CAPUFE also operates the FARAC network, composed of a stake of highways rescued by the federal government in 1997 due to the financial trouble they experienced.

The *railway system* also experienced major reforms in the last decade, especially in 1995 when a large part of the network was awarded to the private sector in order to stimulate the recovery of investments and to ease the fiscal burden related to the railway system. The results of the reforms may be summarized as follows:

- (i) concessions have generated a significant cash flow to the federal government;
- (ii) the government does not grant subsidies either to the operations or investment activities;
- (iii) a regulatory agency, *Dirección General de Tarifas, Transporte Ferroviario y Multimodal* (DGTTFM), is responsible for preventing or settling conflicts between concessionaires as well as for monitoring concessions and tariffs;
- (iv) the main trunk concessions last for a 50 year term, while secondary concessions last for between 25 and 30 years;
- (v) concessionaires must pay a concession fee to the government based on invoiced revenues (0.5% in the first 15 years and 1.25% from the 16<sup>th</sup> year);
- (vi) contracts did not provide for inversion limits; and

- (vii) tariffs must cover all costs under a cap registered with the Secretariat of Communications and Transportations (SCT).

The **port sector** has basically followed the same path as the other transport sectors. The key points of the reform were the dismantling of the monopolist port operator *Puertos Mexicanos*, and the creation of APIs, which would have been decentralized and would have become responsible for managing single ports or groups of ports, with the authority to concede/transfer port services to the private sector. Also, the Ports Law created the major authority in this sector, the Secretariat of Communications and Transportations (SCT), which guarantees concessions under this law. The investments were significantly higher, leading to increased facilities and improvements in productivity, which are reflected, for instance, in the reduced time spent in operations and the lowered costs for cargo handling. Moreover, according to Sanchez (2003), on account of these improvements ports began to contribute to the government budget (due to the dividends on profits) instead of receiving government subsidies for their activities. Indeed, between 1990 and 1994, state fiscal transfers to ports had reached US\$ 67 million; while, between 1996 and 2002, APIs paid up to US\$ 35 million to the federal government.

In the **airports sector** the privatization program launched in 1998 is practically complete, having allowed private participation only with regard to airport management, while ownership is mainly in public hands, managed by *Aeropuertos y Servicios Auxiliares* (ASA). The concessions awarded were for a duration of 50 years and involved 35 airports, with four controlling entities – Mexico City Group, Northern Central Group, Pacific Group and South-Eastern Group. Specifically, in 1998, the South-Eastern license was sold to Azur, a consortium of Mexican and European investors. In 1999, the Pacific Group was also sold to a consortium with Spanish and Mexican capital, and in 2000 the North Central Group license was awarded to a consortium with Mexican and French capital.

Each of the transport sectors has been reorganized in a similar way: the state has stepped down from infrastructure management, but has maintained the ownership of infrastructure. The objective is to make transport self-financed by using internal resources. Although privatization has failed in some projects due to misguided and overoptimistic expectations, a generally positive result has been achieved overall.

### 2.2.3. REGULATORY FRAMEWORK AND INSTITUTIONAL DEVELOPMENT

**Roads.** The Law of Roads (*Ley de Caminos, Puentes y Autotransporte Federal*) regulates the construction, operation, conservation and maintenance of roads and bridges, which constitute the routes of communication, and federal transportation services, which operate along these routes. The Law of General Ways of Communication and the Commercial, Civil and Federal Codes complement this Law in relation to the aspects it does not cover. State roads and transportation within states are regulated at the lower level.

The Secretariat of Communications and Transportations (*Secretaría de Comunicaciones y Transportes*, SCT) is the institution responsible for planning policy and programs, building and conserving roads and bridges, granting and supervising concessions and permits, defining the characteristics and technical specifications of roads and bridges, issuing norms regarding the infrastructure and services covered by the Law, and setting charges.

The building, operation, use, conservation and maintenance of federal roads and bridges can be awarded to private domestic companies through concession, which last up to 30 years and are renewable. The concession procedure is based on public auction. When there are alternative

roads, the SCT ensures that one of them is toll-free. This auction procedure can be carried out successfully if the SCT awards the concession to public or semi-public institutions.

The SCT grants permits for the operation of transportation services for loads, passengers and tourism at the federal level, the construction and operation of load terminals, verification units and passenger terminals, the rendering of towing and storage services, the rendering of mail and package services, and others. Permit holders are subject to this Law, regulations and international agreements, and treaties.

If the SCT finds that the service of transportation of passengers cannot be rendered competitively (upon the Antitrust Agency's opinion), it will regulate such charges. The SCT may regulate charges for verification units, towing and storage of vehicles. As a general rule, charges are regulated by a cap with an adjustment mechanism, and must allow rendering of services under satisfactory quality and competitiveness conditions.

The Law sets a series of conditions and requirements applicable to vehicles and drivers, in relation to issues such as safety, liability, insurance, sanctions, and so on. It also releases small operators from legal requirements, unless they transport dangerous waste.

According to the SCT, there are several challenges for improving road and transportation infrastructure and services. The first challenge is the expansion of coverage and access to road infrastructure (including rural areas), as well as the improvement of road quality. The second is the improvement of road operation, reducing the conditions that restrict their use (such as bottlenecks and poor quality roads in strategic regions). The third challenge is to improve the safety, efficiency and competitiveness of transportation services. The fourth is to increase transportation service coverage at national and regional levels. The fifth is to improve the international competitiveness of transportation services. The sixth is to harmonize the legal framework throughout the national territory, specifically by homogenizing state legislation in order to avoid the use of discretion, to provide legal security to investors and to render better and more efficient services. The final challenge is to improve the supervision of concessions.

The public auction procedure has been applied in several Latin American countries (e.g. Argentina and Chile), to grant concession contracts for the construction and operation of roads and highways. In meeting these challenges, the government should consider its past and international experiences, particularly when seeking to foster efficiency, to allocate market and regulatory risks appropriately, and to avoid the renegotiation of concession contracts.

**Rail system.** The Law of Railway Services (*Ley Reglamentaria del Servicio Ferroviario*) regulates the building, operation, conservation and maintenance of railways and the service of railroad transportation. The state is responsible for fostering the development of the sector, as well as protecting the safety and sovereignty of the nation, under conditions that ensure free competition among transportation modes. The Law covers all national railway communication routes, thus excluding local communication routes (and leaving them under state regulation). The Laws of General Ways of Communication and the Commercial, National Goods, Administrative Procedures and the Civil and Federal Codes complement this Law in the aspects otherwise uncovered.

The SCT is the institution responsible for planning policy and programs, the granting and supervision of concessions and permits, defining the characteristics and technical specifications of railways and railroad transportation services, issuing norms regarding the infrastructure and services covered by the Law, applying sanctions and setting charges.

A concession is required to build, operate and exploit railroads, on the one hand, and for rendering transportation services, on the other hand. The concession is granted only to Mexican companies, although foreign investors are permitted (up to 49% of shares). Concessionaires may sub-contract part of works, but they are ultimately liable for all commitments in the concession contracts. Concessions are awarded by a public auction procedure, have a duration of 50 years and are renewable. This procedure can be bypassed if the SCT grants a concession to public or semi-public institutions. Otherwise, permits are required to render ancillary services, build access and marginal facilities for right of way, advertise on the right of way, and to build and operate bridges over railways. When there are two or more interested parties, the SCT holds an auction. Permits are granted to Mexican companies.

Concessionaires of railway services have to render such services to all users, without interruption, under uniform and equitable conditions with respect to opportunity, quality and price.

Concessionaires and permit holders set charges freely, subject to conditions of quality, safety and competitiveness. The SCT regulates charges in the absence of competition (upon intervention by the Antitrust Agency).

The Law also establishes a series of conditions for interconnection, terminal services, requirements regarding vehicles and drivers, safety, liability, guarantees, sanctions, and so on.

Improvements in the railway system (SCT awarded six railway concessions) offer the opportunity to diversify domestic transport services (with air, road and water services). Concessions have improved the productivity, safety and quality of rail services.

However, in order to achieve optimal performance in the provision of infrastructure and services it is necessary to overcome several challenges, such as the strengthening of interaction between concessionaires (interconnection and terminal services, right of way), which must be regulated by clear norms, increasing the urban and interurban passenger services, and consolidating the supervisory and regulatory role of the agency in order to promote efficient, safe, high-quality services.

**Ports.** The Law of Ports (*Ley de Puertos*) regulates ports, terminals, marinas, port facilities (with the exception of military ones), their construction, use, operation, management and also port services rendered in such facilities. The Law of Maritime Navigation and Trade, the Law of General Ways of Communication, The Law of National Goods, the Law of Administrative Procedures and the Commerce Code complement this Law in the uncovered aspects.

The Government authorizes the construction of new ports through concessions. SCT authorizes the construction of personal-use terminals and marinas. SCT and the Secretariat of Social Development determine the public domain areas in which ports may be built.

The concession mechanism is the default procedure for granting goods of public domain for integral management or for the construction, operation and use of facilities. A permit is needed to render port services. Only Mexican commercial companies may participate in concessions, and Mexican companies and individuals may be granted permits. Concessions are awarded through an auction procedure, last for up to 50 years, and may be renewed for a similar term. The Law details the basic structure of a concession contract, which must include the reason for granting the contract; the basis of tariff regulation; the building, expansion and modernization programs, and the fee to be paid to the federal government (which may be based on potential profitability in the case of integral port management). Port-service permits do not confer exclusivity.

The responsibilities of the Port Authority include planning policy and programs, fostering social and private participation, awarding and supervising concessions and permits, determining the areas and facilities for public use, building and operating outside a concession framework according to public interest, authorizing public works, establishing the basis for price regulation, issuing sector norms, and applying sanctions. A port master's office is located in each port, carrying out the duties of the maritime authority (authorizing traffic and dispatch, supervising navigation, the docking and staying of ships, supervision of navigation ways, and so on).<sup>18</sup>

The SCT determines the cases in which it is possible for third parties to render services in public terminals, facilities and common areas on the basis of technical, efficiency and safety considerations. Users may freely choose a provider.

The Law of Ports states that the Antitrust Agency shall determine when to establish tariff and price regulations. If the commission deems the existing competition to be inadequate, the SCT may stipulate price caps and adjustment mechanisms. Port managers may determine the basis for prices and charges to be applied to service providers and the operators of terminals, marinas and facilities.

When regulated, rates may be set on the basis of benchmarks from comparable ports in more competitive situations or a synthesis of rates from cost data (Kessides, 2004). Both methods are difficult to implement and depend on information from the regulator, which is not as complete as that of operators.

Mexico started a decentralization program in the mid-1990s, which included the concession of the major ports to private operators. According to Kessides (2004), the result was a reduction in tariffs, and an improvement in the efficiency, productivity and self-sustainability of the sector (since the port system started to cover costs). Given the improvement in the system's financial health, port authorities and concessionaires were able to undertake new investment to expand and modernize the system.

The key challenges of the sector lie in the substantial growth of maritime foreign trade and tourism, which makes ports a strategic facility, especially if one takes into account Mexico's advantage of location enabling it to connect trade between East Asia, America and Europe. However, services must be kept competitive in price and quality. In order to do that, it is important, first, to achieve more efficient transportation of goods and passengers in the port system, and second, to promote the development of the maritime transport industry (expanding competitive facilities and services).

**Airports.** The Law of Airports (*Ley de Aeropuertos*) regulates the building, operation and conservation of civil airports, which form part of the general communication routes, and the Law of Civil Aviation (*Ley de Aviación Civil*) regulates the transportation of passengers, loads and mail. The Laws of General Ways of Communication, National Goods, Administrative Procedures, Metrology and Normalization, and the Commercial, Civil and Federal Codes complement these Laws in the aspects otherwise uncovered.

The SCT, as the Airport and Civil Aviation Authority, is the institution responsible for planning policy and programs, fostering social and private participation, granting and supervising concessions, permits and authorizations, building and operating not under a concession facility according to public interest, establishing transit and safety rules, establishing a basis for

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<sup>18</sup> Currently, the Port Authority, the Maritime Authority and the Port Master's Offices are under the Port and Maritime Authority (*Coordinación General de Puertos y Marina Mercante*) at SCT.

efficient, competitive and non-discriminatory rendering of services, issuing sector norms, applying sanctions, keeping an Aeronautic Registry, and so on.

A concession granted by the SCT is necessary for the construction, operation and management of airports. Commercial companies constituted under Mexican law can participate in concessions, and foreign investment is admitted up to 49% of shares (or require an approval by the National Bureau of Foreign Investment if the foreign investor's shares exceed such limits). Concessions are awarded by an auction procedure (some exceptions are considered for expansions or for awarding concessions to federal agencies), last for up to 50 years, and can be prorogued for a similar term. A permit is needed to run aerodromes other than airports, and may be granted only to Mexican companies. A concession to render the regular service of domestic transportation is only available to Mexican companies, lasts for 30 years, and can be renewed for a similar term. The SCT grants indefinite-length permits for the rendering of irregular domestic transportation services, and regular or irregular international transportation services, to domestic or foreign companies, depending on the nature of the service.

The Law of Airports states that the SCT may establish the basis for tariff and price regulation for airport services, leasing and other services if competition is inadequate (according to the criteria set forth by the Antitrust Agency). The SCT establishes price caps for individual services or bundles of services, and the adjustment mechanism to ensure the provision of services under satisfactory conditions of quality and competitiveness.

Airport and complementary services must be rendered in a regularly, uniformly and permanently, under non-discriminatory conditions in terms of quality, price and opportunities. Concessionaires and transportation service permit holders may set prices freely, and are subject to competitive controls (predatory or monopoly pricing, etc.) by the SCT. The Secretariat may determine maximum and minimum prices if it deems it necessary. Several kinds of price discrimination are permitted (quality, ticket restrictions, etc.). If the SCT deems competition inadequate (on the basis of an opinion from the Antitrust Agency) it will establish the basis for price regulation.

The Laws set forth a series of conditions and requirements regarding safety, liability, environmental protection, insurance, and sanctions, and so on.

As in the case of ports, airports are also a strategic facility, and air transportation is a strategic service, due to the substantial growth of foreign trade and tourism in Mexico. SCT recognizes that to face such competitive conditions, it is necessary to consolidate the financial health of airlines and to achieve efficiency, quality and safety of services, in part by fostering access and competition and by strengthening the regulatory and supervisory role of the airport authority.

With respect to the legal framework, it should be noted that the regulatory agency is a public institution. The normative reforms should better define the responsibilities assigned to the airport authority in order to provide more certain rules for investments. Finally, the need to improve the development of competition in air transport services is recognized.

## 2.3. POLICY OPTIONS AND IMPLICATIONS

The above analysis shows that Mexico has made major efforts in recent years to overcome its transport infrastructure problems. During the 1980s, the fiscal crisis of the state caused a sharp decrease in investments, thereby contributing to Mexico's economic slowdown. Reductions in expenditure (especially for maintenance) and lack of competition in the transport sector caused a decrease in productivity, leading to a reduction in competitiveness for the country as a whole. In the 1990s, the government undertook a reform initiative aimed at increasing economic competitiveness through the improvement of the infrastructure sectors.

The reforms approved recently in Mexico are focused on attracting private investments, increasing competition, and decentralizing management and strengthening the public sector's regulatory power. The involvement of the private sector would enable the transport sector to reduce its dependence on public investments and to establish better management techniques. The enhancement of competition would allow an improvement in productivity given the cost reduction linked to new investments and better management techniques. The strengthening of the regulatory framework is necessary to guarantee that, where competition is not sufficient for obtaining the desired results, final consumers can take advantage of increased operational efficiency, avoiding monopoly distortion.

The concession model considered for transport infrastructure in order to encourage private participation is as follows: the private operator is responsible for the management, maintenance and realization of new investments. The remuneration for the private sector comes from users' fees. This model has been applied to all transport infrastructure sectors: highways, railways, ports and airports. Concessions have been adapted according to the different sector features, in particular, taking into consideration the following variables: type of projects, time horizon, tariffs and investment obligations. As a consequence, most targets have been achieved; in fact, not only have investments increased, but productivity has also improved. However, not all sectors have demonstrated the same performance.

In the *road sector*, the network has been expanded and the quality of roads has been improved to some extent; however, sector development as a whole has recently been lagging behind other comparable Latin American countries. The main problem is lack of experience in managing and awarding concessions; in addition, excessive optimism at the time concessions were awarded led to overestimated cash flows and revenues from the concessions. The lower than expected traffic flow, alongside high toll fees, caused a cash flow shortage, in spite of the extension of the concession time horizon. Therefore, contracts needed to be renegotiated and tariffs reduced in order to stimulate traffic flow. It should be noted that most concessionaires were aided by the public sector, which took control, creating a "contingent liability" for the government in connection with these highways.

To make concessions more attractive and to achieve the expected targets, adequate risk-sharing between state and private operators should be established in order to avoid all risks being run by either the private or public sector. Taking past results into consideration, concessions not able to reach financial equilibrium should be reshaped to avoid new contingent liabilities. With regard to other sectors, in general maintenance should be enhanced, alongside the expansion of services and productivity.

In the *railway sector*, investments can be encouraged through the revision of resource allocation to the public sector. An important point worth stressing is the regulatory issue regarding intermodality in transport, which is still not very developed in the Mexican economy.

*Ports* and *airports* should receive greater attention as an improvement in these infrastructures is a fundamental element in strengthening Mexico's competitiveness. These sectors are becoming even more important in the light of Mexico's increasing trade integration. Finally, another goal to be pursued is the development of a broad information system regarding service quality and tariffs; the regulator must be provided with the information and skills necessary to both preserve the interests of the consumer and to ensure profitability in concessions.

## 2.4. PRIORITIES FOR FUTURE REFORMS

The reform process undertaken recently has enabled significant improvements in quality and access to transport infrastructure in Mexico. Services are now quite widespread and productivity has been improved in all sectors: roads, ports, railways and airports. Nevertheless, it is important to note that there are still problems related to access; for instance, although there are good quality indicators related to the federal road network, road coverage in Mexico is relatively poor due to network integration problems and some problems remain despite recent improvements. Moreover, the quality of national and local roads is still inadequate.

Overall, recent reforms were focused on:

- (i) making the sector more attractive for private operators;
- (ii) management decentralization; and
- (iii) limited direct public participation in order to squeeze the public investment in these sectors.

One of the main problems experienced in the *road sector* has been the lack of expertise in handling concessions, especially concerning financial issues. Under the new concession framework, the risk mitigation must be spread among the several agents, making each responsible for the risk it runs. The ring-fencing structure must be appropriate both for guaranteeing investment payback and, in particular, for stimulating efficiency, productivity and service quality. In fact, all payments are conditioned by certain criteria which must be achieved. The tariff structure must be established in order to offset the actual costs borne by concessionaires and to lower the need for cross-subsidies among different kinds of vehicles. The tariffs should take into account service quality and productivity, along with the inflation rate. Public guarantees, which, if not structured in accordance with some quality standards, do not stimulate private sector efficiency, must be reconsidered also in order to avoid the risk of contingent liabilities that risk worsening the government's fiscal situation.

With respect to the *railway sector*, the concessions framework did not take into account the financial viability of the new investments, which, indeed, were not carried out by the concessionaires. Therefore, this issue should be addressed by changing the concession structure, so as to increase this kind of investment, which is focused primarily on increasing service and enhancing integration with other modes of transportation.

As far as *ports* are concerned, major improvements in productivity linked to cost reductions have been achieved (due to the disappearance of public monopolies, which previously managed all ports, and owing also to the decentralization of port management and its concession to the private sector).

The same results have been accomplished in the *airport sector*, by awarding concessions to the private sector and enhancing competition in tariff-setting. The state is in charge of the supervision and regulation of performance; in other words, it defends consumers' rights, establishing service quality patterns, security and tariff caps, particularly in cases of no or little competition. The legal framework should first of all aim to maintain the efficiency and quality of the system and, secondly, to control private or public transport behavior in order to regulate the market and to foster further investments.

Finally, private sector involvement in transport services should not be pursued only in the light of the national budget deficit, but also in order to improve access to and the quality of basic services, also considering affordability. The good performance of concessions clearly depends on many factors, such as the appropriate model framework, regulation and surveillance of concessions. Thus, special attention must be paid on how concessions will be reshaped, avoiding problems similar to those experienced in the initial phase and allowing the state to concentrate its efforts toward services which are less attractive to private operators.

## 3. ENERGY

### 3.1. OVERVIEW

Mexico's electricity system is principally state owned. Two public companies, *Comisión Federal de Electricidad* (CFE) and *Luz y Fuerza del Centro* (LFC) have exclusive rights to the generation, dispatch, transmission, distribution and commercialization of electricity as a public service. More specifically, the CFE and the LFC are responsible for around 85% of generation and own 100% of transmission and 100% of distribution (independent power producers generate approximately 6%; cogeneration and self-dealing account for the other 9%). CFE's distribution area covers all of Mexico's territory, except for the Federal District (where the capital, Mexico City, is located) and the states of México, Morelos, Hidalgo and Puebla, which are served by LFC.

Mexico's energy sector is currently in a gridlock, with reforms only partially implemented, and the achievement of further advances looking unlikely due to strong opposition from important political players interested in maintaining the status quo. The first reform took place in 1992, when an amendment to Mexico's "*Ley del Servicio Público de Energía Eléctrica*" (Law of Public Electricity Service) allowed private participation in the electricity sector under different schemes, such as the Independent Power Producers (IPPs), cogeneration and self-supply. In 1993, the *Comisión Reguladora de Energía* (CRE), an advisory body relating to gas and electricity, was created by government decree. In October 1995, the "*Ley de la Comisión Reguladora de Energía*" (Energy Regulatory Commission Act) turned the CRE into an autonomous agency with its own budget. However, price setting remained under the control of the Ministry of Finance. There were no privatizations in the transmission and distribution segments of the electricity sector.

The gridlock mentioned above constitutes a serious threat to the entire Mexican economy as the CFE and LFC are highly leveraged and have no financial capacity to increase supply. This situation of indebtedness is mainly due to labor pensions and reforms of the Public Debt and Budget Laws passed by the Mexican Congress, which created a new scheme for the financing of long-term infrastructure projects, known as PIDIREGAS, which ended up increasing the companies' liabilities.

The electricity sector in Mexico is heavily dependent on oil (44%) and natural gas (24%), which in combination account for almost 70% of production. The sector also has important contributions from hydroelectric plants (14%) and coal (11%); a less important contribution is made by nuclear energy (4%). Many of the hydroelectric plants are more than 30 years old and should be phased out and replaced with more modern, presumably combined-cycle gas-fired plants. The evolution of the production of electricity by source in Mexico is shown in Table 3.1.

**Table 3.1 – Electricity Production by Source**

Source of electricity production (% of total)	1998	1999	2000	2001
Coal	9.81%	9.74%	9.34%	11.06%
Hydropower	13.55%	17.05%	16.21%	13.59%
Natural Gas	16.87%	17.74%	19.76%	24.02%
Nuclear	5.10%	5.20%	4.02%	4.16%
Oil	51.39%	47.06%	47.54%	44.25%

Source: World Development Indicators 2004 – The World Bank

Mexico's electricity production profile can be better assessed by comparing it to the profiles of the other Latin American countries analyzed in this country brief. Table 3.2 below shows the average profile of electricity generation of a sample of Latin American countries, including Argentina, Brazil, Colombia, Costa Rica, Guatemala, Jamaica, Mexico and Peru.

**Table 3.2 – Electricity Production by Source – Regional Averages**

Source of electricity production (% of total)	1998	1999	2000	2001
Coal <sup>1</sup>	5.80%	4.69%	5.00%	5.44%
Hydropower	50.00%	51.15%	51.46%	51.30%
Natural Gas <sup>2</sup>	22.36%	18.73%	19.56%	19.03%
Nuclear <sup>3</sup>	5.39%	5.06%	4.23%	5.45%
Oil	29.30%	27.24%	25.89%	25.47%

Source: World Development Indicators 2004 – The World Bank

<sup>1</sup> Averages calculated using data from Argentina, Brazil, Colombia, Guatemala, Mexico and Peru (2000-2001), Argentina, Brazil, Colombia, Guatemala and Mexico (1999) and Argentina, Brazil, Colombia and Mexico (1998)

<sup>2</sup> Averages calculated using data from Argentina, Brazil, Colombia, Mexico and Peru (1999-2001) and Argentina, Colombia, Mexico and Peru (1998)

<sup>3</sup> Averages calculated using data from Argentina, Brazil and Mexico

The first finding that can be drawn from Table 3.1 is that Mexico does not rely on hydropower as much as its Latin American counterparts. Hydroelectric generation in Mexico remained below 20% of the total generation throughout the period considered, whereas the regional average was above 50%. On the other hand, its percentage use of oil to produce electricity is almost twice the regional average. Coal is a more important source of electricity in Mexico than

in the average Latin American country, whereas the share of total electricity production from natural gas and nuclear materials in Mexico is similar to the regional average.

Table 3.3 draws another comparison with the average profile of higher middle-income countries in the region (namely Mexico, Argentina, Brazil and Costa Rica). The main differences between the average regional profile and the average higher middle-income profile are that in the latter the use of natural gas as a source of electricity generation is significantly higher, whereas the average use of oil is significantly lower in the latter. This means that, compared with the higher middle-income profile, Mexico’s electricity production is even more oil intensive.

**Table 3.3 – Electricity Production by Source – Higher Middle-Income Averages**

Source of electricity production (% of total)	1998	1999	2000	2001
<b>Coal<sup>1</sup></b>	4.63%	4.95%	4.66%	5.27%
<b>Hydropower</b>	55.18%	53.64%	54.50%	54.46%
<b>Natural Gas<sup>2</sup></b>	31.73%	24.99%	25.14%	24.44%
<b>Nuclear<sup>1</sup></b>	5.39%	5.06%	4.23%	5.45%
<b>Oil</b>	1.90%	14.91%	14.22%	13.26%

Source: World Development Indicators 2004 – The World Bank.

<sup>1</sup> Averages calculated using data from Argentina, Brazil and Mexico

<sup>2</sup> Averages calculated using data from Argentina, Brazil and Mexico (1999-2001) and Argentina and Mexico (1998)

## 3.2. ASSESSMENT OF THE KEY POLICY AREAS

### 3.2.1. ANALYSIS OF THE TECHNICAL DIMENSIONS OF THE SECTOR

In order to assess the technical dimension of the energy sector in Mexico, the following sub-sectors have been analyzed:

- (i) Access;
- (ii) Affordability;
- (iii) Quality of service; and
- (iv) Technical dimension and efficiency.

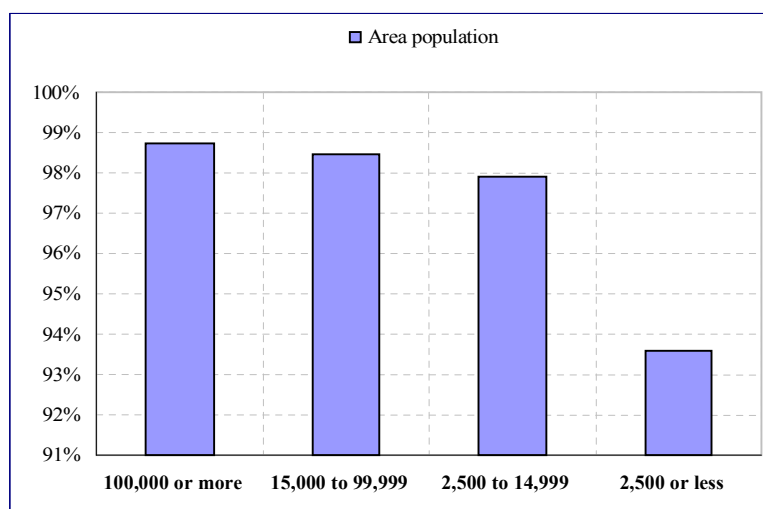
Mexican households' *access* to electricity in 2000 was slightly over 97% according to the *Encuesta Nacional de Ingresos y Gastos de los Hogares* (ENIGH) 2000, published by the *Instituto Nacional de Estadística, Geografía e Informática* (INEGI). This is to be considered good coverage for Latin America, as confirmed by Table 3.4. It should be noted that Mexico's overall household access rate is lower only than that of Costa Rica. Although there are no data available that enabling a direct analysis of coverage in urban and rural areas, the survey mentioned above, ENIGH 2000, reports that coverage is reasonably uniform across different population sizes.

**Table 3.4 – Access to Electricity – Latin American Countries**

Country	Households reporting access to electricity		
	Total	Urban	Rural
<b>Argentina (2002)</b>	n.a	99.57%	n.a.
<b>Brazil (2002)</b>	96.25%	99.42%	79.48%
<b>Costa Rica (2002)</b>	98.41%	99.81%	96.30%
<b>Guatemala (2000)</b>	73.11%	95.34%	56.20%
<b>Jamaica (2000)</b>	86.88%	92.04%	79.49%
<b>Mexico (2000)</b>	97.18%	n.a.	n.a.
<b>Peru (2002)</b>	71.90%	93.70%	30.80%

Sources: Argentina – Instituto Nacional de Estadísticas y Censos (INDEC), *Encuesta Permanente de Hogares (EPH) 2002*; Brazil – Instituto Brasileiro de Geografia e Estatística (IBGE), *Pesquisa Nacional por Amostra de Domicílios (PNAD) several issues, and Brazilian Census (2000)*; Costa Rica – Instituto Nacional de Estadística y Censos (INEC), *Encuesta de Hogares de Propósitos Múltiples 2002*; Guatemala – Instituto Nacional de Estadística (INE), *Encuesta Nacional de Ingresos y Gastos Familiares (ENIGFAM) 2000*; Jamaica – Planning Institute of Jamaica (PIJ), *Jamaica Survey of Living Conditions (JSLC) 2000*; Mexico – Instituto Nacional de Estadística, Geografía e Informática (INEGI), *Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH) 2000*; Peru – DHS (Demographic and Health Surveys), Instituto Nacional de Estadística e Informática (INEI), *Encuesta Nacional de Hogares (ENAHO) 1999, and Household Energy Use in Developing Countries-A Multicountry Study-2003-ESMAP-Table A.2.5*

Figure 3.1 – Access to Electricity Services by Population Density



Source: Instituto Nacional de Estadística, Geografía e Informática (INEGI), Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH) 2000

Since rural areas are less densely populated, the data in Figure 3.1 would suggest that the coverage rate in such areas is slightly lower than 94%. The available data regarding cooking fuels used by Mexican families are also limited. The only available information is from the year 2000, reproduced in Table 3.5, and includes data for the other Latin American countries.

Table 3.5 – Main Cooking Fuel Used by Households – Several LA Countries

Percentage of households using as main cooking fuel:		
	<i>Modern</i>	<i>Solid</i>
<b>Argentina (2001)</b>	95.00%	5.00%
<b>Brazil (1999)</b>	90.69%	8.15%
<b>Guatemala (1999)</b>	26.65%	72.10%
<b>Jamaica (2000)</b>	n.a.	47.00%
<b>Mexico (2000)</b>	81.05%	18.32%

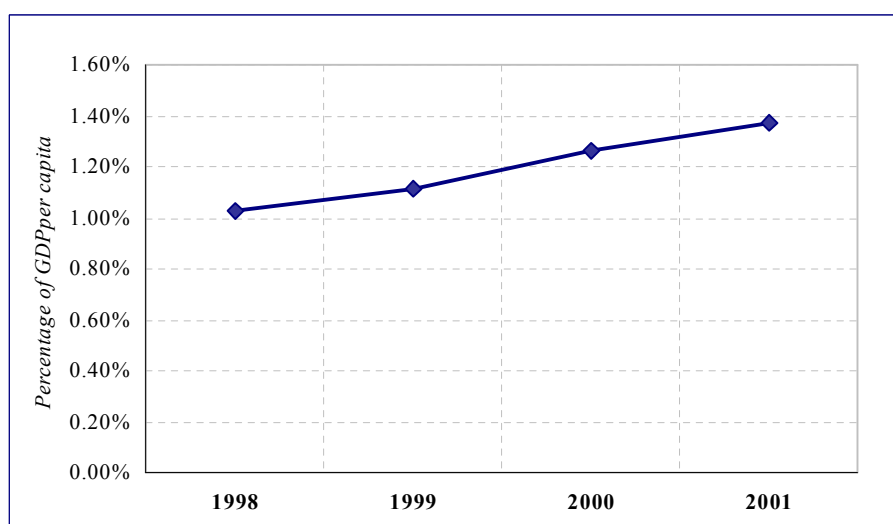
Sources: Argentina – World Health Report, Statistical Annex, and Instituto Nacional de Estadísticas y Censos (INDEC), Censo Nacional de Población, Hogares y Viviendas 2001; Brazil, Guatemala and Jamaica – World Health Report, Statistical Annex; Mexico – Instituto Nacional de Estadística, Geografía e Informática (INEGI), Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH) 2000

As shown in Table 3.5, the percentage of households using modern cooking fuels is lower in Mexico than in Argentina and Brazil, countries which are similar in terms of dimensions and level of development. The discrepancy between the percentage of households with access to electricity (97.18%) and the percentage of households that use modern fuels (including

electricity) to cook (81.05%) may be attributed to the absence of electric cooking appliances in the home or to the lack of funds to pay for electricity for cooking. Moreover, the use of solid fuels by almost 20% of households gives a signal to the Mexican government to consider the serious health consequences of exposure to fumes from burning solid fuels.

In order to have an idea of how *affordable* electricity services are in Mexico, the following exercise was carried out: using information on electricity consumption per capita, the residential price of electricity and GDP per capita, consumption per capita was multiplied by electricity price to obtain expenditure in electricity per capita. The result was then divided by GDP per capita to get the percentage of GDP per capita spent on electricity. The results of these calculations are shown in Figure 3.2 below.

**Figure 3.2 – Expenditure on Electricity**



*Source: World Development Indicators 2004, The World Bank; Organización Latinoamericana de Energía (OLADE), Energy Information Administration (EIA), U.S. government*

Considering the percentage of GDP per capita spent in Figure 3.2, electricity as a proxy for the share of a household's income spent on electricity, the conclusion is that although electricity is not a heavy component of household expenditure, its weight increased considerably from 1998 to 2001. Table 3.6 complements the analysis by showing electricity prices for residential and non-residential consumers. Energy prices are heavily subsidized in Mexico, with residential consumers paying around 50% of the real costs and agricultural consumers only 30%. On average, the subsidy amounts to 30% of the real electricity production costs. Therefore, it is not surprising that expenditure on electricity is low as a percentage of GDP.

Table 3.6 – Residential and Non-Residential Tariffs

Average electricity end-user prices (US cents/kWh)	1998	1999	2000	2001	2002
<b>Residential</b>	5.50	5.90	6.80	7.50	7.58
<b>Non-residential</b>	3.80	4.20	5.10	5.30	n.a.

Source: Organización Latinoamericana de Energía (OLADE), Energy Information Administration (EIA), U.S. government

It is important to note that the Ministry of Finance, the authority in charge of setting electricity tariffs, has been increasing electricity prices to reduce the weight of subsidies in the government budget. Moreover, Table 3.7, extracted from Carreón-Rodríguez, San Vicente and Rosellón (2003)<sup>19</sup>, reports tariffs over cost ratios for electricity services in Mexico from 1998 to 2002. There are no important changes in those ratios for different types of non-residential service tariffs in 2002.

Table 3.7 – Mexican Electricity Tariff/Cost Ratios

Consumer Class	1998	1999	2000	2001	2002
<b>Residential</b>	0.43	0.41	0.41	0.42	0.50
<b>Commercial</b>	1.21	1.19	1.07	1.07	1.05
<b>Public Service</b>	0.94	0.92	0.88	0.90	0.90
<b>Agricultural</b>	0.30	0.29	0.28	0.29	0.30
<b>Medium Industrial</b>	0.92	0.91	0.85	0.83	0.90
<b>Large Industrial</b>	0.90	0.90	0.85	0.83	0.90
<b>Average</b>	0.79	0.74	0.70	0.70	0.74

Source: Carreón-Rodríguez, San Vicente and Rosellón (2003)

The first indicator to analyze in relation to *quality of service* is the interruption time per user, measured in minutes<sup>20</sup>, and the second is connection time, which measures how many days, on average, it takes for a customer to receive service.

The data in Table 3.8 are taken from *Comisión Federal de Electricidad*, which, as discussed earlier, is one of two public companies that share a virtual monopoly of the electricity sector in Mexico.

<sup>19</sup> Carreón-Rodríguez, V.G., A. J. San Vicente and Juan Rosellón. *The Mexican Electricity Sector: Economic, Legal and Political Issues*. Working Paper 5, Program on Energy and Sustainable Development, Stanford University, 2003.

<sup>20</sup> The numbers reported in Table 3.5 are discordant with those that found in Carreón-Rodríguez, San Vicente and Rosellón [2003], page 15. They put power interruption per user at 230 for CFE, but do not specify the year (most likely 2000). The difference is due to the fact that the numbers used in Table 3.5 do not take into account interruptions due to natural phenomena, such as earthquakes, unlike those used in the paper.

Table 3.8 – CFE’s Quality Indicators

	1998	1999	2000	2001	2002
Interruption time per user (minutes)	160.00	139.00	128.76	127.97	124.42
Connection time (days)	1.40	1.29	1.30	1.22	1.18

Source: Comisión Federal de Electricidad (CFE), Informe Anual 2002

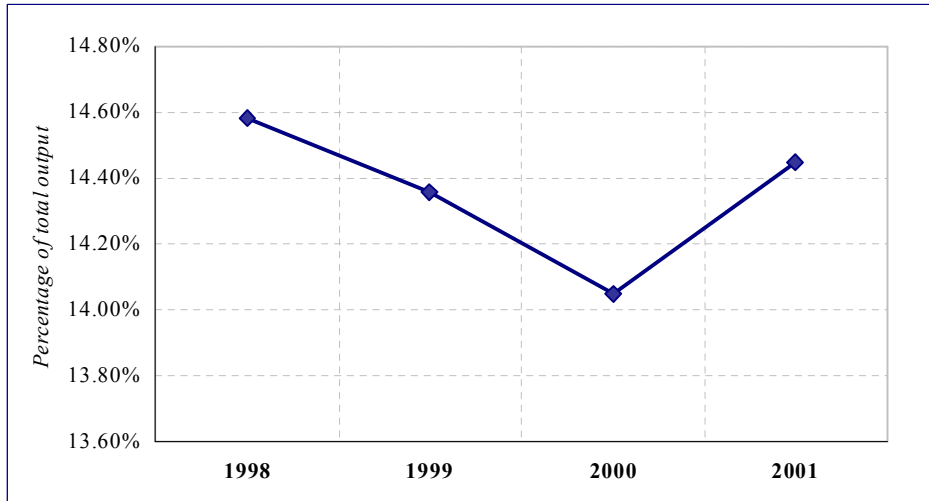
The CFE has made substantial progress, reducing interruption time by 22% from 1998 to 2002. If one compares the CFE’s numbers with those of France and the United States, at 115 and 120 minutes respectively, the company’s relative performance is reasonable. This seems to be confirmed by the data regarding connection time. There is a lapse of little more than a day from the moment consumers ask for service and the time they receive it; this connection time is line with expectations.

It is unknown, however, whether the other public company, *Luz y Fuerza del Centro* (LFC), has met the same standards as the CFE. Indications state that it has not. According to Carreón-Rodríguez, San Vicente and Rosellón (2003), the average interruption time per LFC user was 331 minutes<sup>21</sup>, but that number includes interruptions caused by natural phenomena such as earthquakes. Since the corresponding number for the CFE is 230, according to the authors, it is reasonable to conclude that the quality of the LFC’s service is considerably lower than that of the CFE.

The first indicator considered in the analysis of the sector’s *technical efficiency* is transmission and distribution losses. Figure 3.3 indicates that losses hovered around 14% of total production from 1998 to 2001. This value is in line with that of other Latin American countries: the average losses in Argentina, Brazil, Colombia, Costa Rica, Guatemala, Jamaica, Mexico and Peru in 2001, for instance, reached 13.12%. If the size of the Mexican territory is taken into account, the value seems to be reasonable, in that losses were lower than Brazil’s, a country with similar geographical dimensions.

<sup>21</sup> The authors do not specify which year the number refers to, but it is most likely 2000.

Figure 3.3 – Transmission and Distribution Losses



Source: World Development Indicators 2004 – The World Bank

Table 3.9 – Transmission and Distribution Losses – Benchmarks

	1998	1999	2000	2001
<b>Mexico</b>	14.58%	14.36%	14.05%	14.45%
<b>Regional average<sup>1</sup></b>	15.11%	14.44%	15.17%	14.62%
<b>High middle-income average<sup>2</sup></b>	13.61%	13.60%	12.97%	13.12%

Source: World Development Indicators 2004 – The World Bank

Another important measure of efficiency is the consumption of energy per unit of GDP. Table 3.10 provides information comparing Mexico’s energy consumption with that of other Latin American economies.

Table 3.10 – Energy Consumption per Unit of GDP

Country	Energy consumption per unit of GDP (Kg of oil equivalent per 1000 PPP GDP)		
	1998	1999	2000
Argentina	137.72	144.29	139.74
Brazil	160.13	157.09	148.48
Costa Rica	87.37	80.81	85.49
Guatemala	142.78	147.82	141.73
Jamaica	426.48	419.54	424.93
Mexico	204.99	197.02	182.94
Peru	110.21	113.67	105.71
Average (without Mexico)	177.45	177.20	174.35

Source: United Nations Conference on Trade and Development (UNCTAD), United Nations Statistical Division (UNSTAT)

Mexico's consumption of energy per unit of GDP, measured as kg of oil equivalent per 1,000 PPP GDP, was consistently above the average of its Latin American counterparts. Moreover, only Jamaica's performance was worse than Mexico's in terms of efficiency. It must be noted, however, that Mexico was able to cut its consumption by almost 11% from 1998 to 2000.

### 3.2.2. ECONOMIC EFFICIENCY AND PRIVATE SECTOR FINANCING

In assessing the *financial health of the main providers* of electricity in Mexico, data taken from the financial statements of the CFE (*Comisión Federal de Electricidad*) and the LFC (*Luz y Fuerza del Centro*) have been analyzed. Table 3.11 is based on that data.

Table 3.11 – Financial Indicators for CFE and LFC

Financial indicator	1998	1999	2000	2001	2002	2003
Return on equity (CFE)	2.62%	1.55%	1.55%	1.61%	-1.50%	-1.65%
Return on Assets (CFE)	1.97%	1.15%	1.15%	1.13%	-0.95%	-1.00%
Return on Assets (LFC)	n.a.	n.a.	n.a.	-13.34%	-14.23%	-1.85%
Total Equity (LFC)	n.a.	n.a.	n.a.	-2,760.881	-9,411.884	-6,226.309

Source: Comisión Federal de Electricidad (CFE), *Estados Financieros*; Luz y Fuerza del Centro (LFC), *Estado de Situación Financiera, Estado de Resultados*

There is no doubt that the financial performance of both companies is not outstanding; however, LFC is weaker financially; in fact it is facing financial problems. Its total equity had been negative since 2001, as was its return on assets, indicating losses for every period for which data are available. CFE's situation is better, but the return on equity (ROE) and return on assets (ROA) achieved within the six-year period are very low by industry standards. The fact that it suffered losses in 2002 and 2003, as confirmed by the negative values of its ROE and ROA, is also problematic.

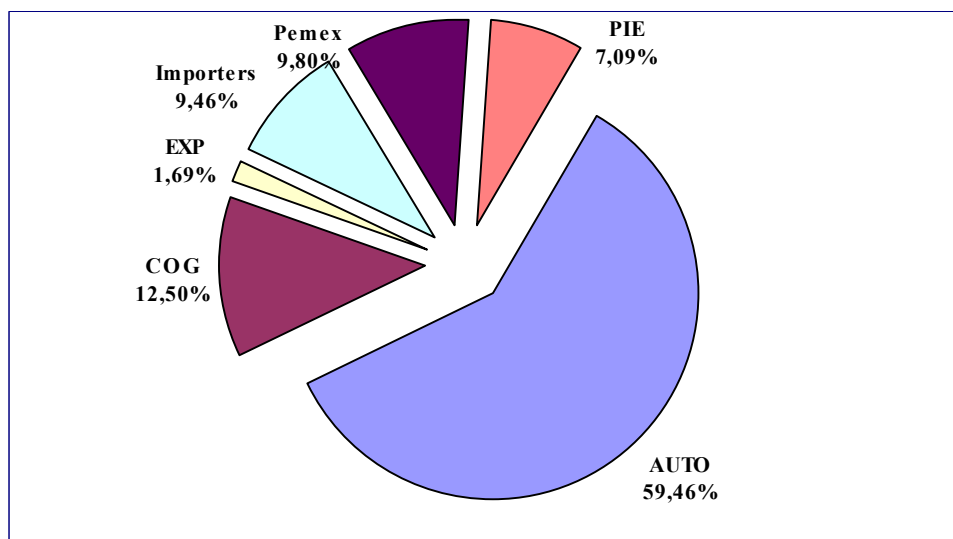
Another alarming factor is the two public companies' dependence on transfers from the federal government, which will be discussed in further detail in the next subsection. It is important to understand, however, that some of the profits reported by the CFE would have been losses had the government not made transfers, and, of course, LFC losses would have been even greater.

As mentioned earlier, the CFE and LFC account for most of the electricity industry in Mexico; however - apart from the contribution of the state oil company *Petróleos Mexicanos* (Pemex) - there is some private participation, particularly from the independent power producers (IPPs).

Indeed, as of October 2005, there are 296 "permit-holders" authorized to generate (or market, in the case of importers) electricity in Mexico in the various modes allowed by the legal framework. In 2005 the additional installed generation capacity represented by all the permit-holders is 21,479 MW. Of this capacity, 12,557 MW corresponds to independent power generators (productores independientes de energía—PIE); 4,932 to entities generating electricity for their own consumption (AUTO); 1,630 to exporters (EXP); 2,170 to cogeneration facilities (COG) and only 190 MW (less than 1%) to importers (IMP).

Of the total permits, 29 are held by the state-owned company Pemex and 28 by importers. This leaves 239 permit-holders, for which private capital plays a dominant role in the development of generation capacity, including 176 AUTO, 37 COG, 5 EXP and 21 PIE (Figure 3.4).

Figure 3.4 – Authorized private sector power generation - permits breakdown



Source: CRE Data - <http://www.cre.gob.mx/permissionarios/perelec.html>

The data presented in Figure 3.4 provides a capsule portrait of the situation in the month of October 2005. However, it should be noted that the permits are at different stages of the process and in reality, only 264 permits are operating. An additional 27 projects are under construction. The remainder consists of 4 “inactive” permits and one permit “to begin work”.

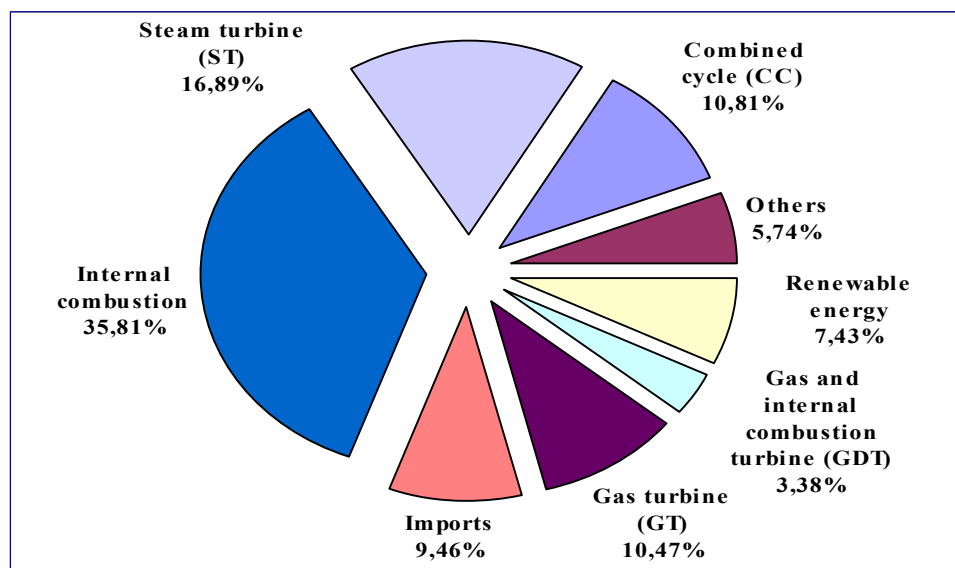
The Mexican regulatory authorities have defined 14 basic technologies among permit-holders. In the aggregate, for 106 of the 296 permit-holders, internal combustion (IC) technology is the principal source, followed by steam turbine (ST) and combined cycle (CC). Only 22 permits indicate the use of renewable energy technologies (hydro and wind power), representing only 7% of authorized permits.

**Table 3.12 – Permit-holders by generation technology**

<b>Technology</b>	<b>Number of permits</b>
<b>Combined cycle (CC)</b>	<b>32</b>
<b>Gas and internal combustion turbine (GDT)</b>	<b>10</b>
<b>Gas turbine (GT)</b>	<b>31</b>
<b>Imports</b>	<b>28</b>
<b>Internal combustion</b>	<b>106</b>
<b>Renewable energy</b>	<b>22</b>
<b>Steam turbine (ST)</b>	<b>50</b>
<b>Others</b>	<b>17</b>
<b>TOTAL</b>	<b>296</b>

Source: CRE Data - <http://www.cre.gob.mx/permisionarios/perelec.html>

Figure 3.5 – Permit-holders by generation technology (%)



Source: CRE Data - <http://www.cre.gob.mx/permissionarios/perelec.html>

It must also be mentioned that the primary fuels or energy sources indicated in the CRE permit list are the following: renewable (wind, water, sugar cane bagasse, biogas); petroleum (fuel oil, diesel, and petroleum coke); coal and coke; natural gas (NG); natural gas with other (dual plants) and other (various combinations of energy sources other than NG in dual or hybrid plants). Most of the permit-holders (92) selected diesel as their preferred fuel, followed by natural gas (76).

With regard to the investment funded by the permit-holders, it is worth mentioning that in 2002 the total investment in permits amounted to US \$10.6 billion, of which US \$1.3 billion (12%) corresponds to the 38 operating Pemex projects. The rest, or US \$9.315 billion, was the amount of private capital committed to electricity generation in Mexico in that year. The available data indicates that the greater proportion of the investment was provided by the PIEs, which generally carried out larger-capacity projects. The PIE mode accounted for 44% of non-Pemex investment with only 16 authorized permits in 2002, AUTO contributed 33% with 96 permits, EXP 14% with 6 permits, and COG 8% with 28 permits.

It must also be specified that at least 90% of the total private capital invested in electricity generation was derived from international financing sources. From an analysis of generation permits issued by the CRE, it is impossible to determine the national origin of the capital, since many of the permit-holders are legally incorporated as Mexican corporations. The CRE permits do not specify the source of the capital invested in the generation project even when the amount is indicated. The PIE and EXP modes in particular, representing together nearly 60 percent of the total authorized generation capacity, rely almost entirely on foreign capital. Domestic capital tends to be more prominent in the COG and AUTO modes (Pemex and several other domestic companies).

The question is whether or not this kind of business has been attractive to private investors, since private investments in this sector in Mexico are characterized by significant fluctuation,

mainly resulting from the dominant position exercised by publicly owned companies as well as the absence of a firmly established regulatory framework for the sector.

With regard to the *fiscal dependence of the sector*, the main points to note are that Mexico's electricity sector is largely dominated by public utility companies, tariffs are subsidized and energy markets are limited; it is therefore to be expected that the sector is quite dependent on fiscal funds. Table 3.13 shows this public expenditure.

**Table 3.13 – Public Expenditure on Electricity**

	1998	1999	2000	2001	2002	2003
<b>Capital expenditure (thousands of US\$)</b>	4,943,936	4,389,774	5,280,849	5,083,438	5,690,669	n.a.
<b>Capital expenditure/GDP</b>	1.17%	0.91%	0.91%	0.82%	0.88%	n.a.
<b>Transfers from Federal Government to CFE (thousands of US\$)</b>	3,793,218	4,399,034	4,643,663	4,991,955	4,575,540	5,354,957
<b>Transfers from Federal Government to CFE/GDP</b>	0.90%	0.91%	0.80%	0.80%	0.71%	0.86%
<b>Transfers from Federal Government to LFC (thousands of US\$)</b>	n.a.	n.a.	n.a.	1,386,336	1,355,771	1,950,380
<b>Transfers from Federal Government to LFC/GDP</b>	n.a.	n.a.	n.a.	0.22%	0.21%	0.31%

Sources: *Comisión Federal de Electricidad, Estados Financieros; Luz y Fuerza del Centro, Estado de Situación Financiera, Estado de Resultados; Instituto Nacional de Estadística, Geografía e Informática (INEGI), El Sector Energético en México*

Significantly, the amount of transfers from the federal government to the CFE and LFC is considerably large, above 1% of GDP. Without such transfers, needed to fund the large subsidies embedded in tariffs, these companies would probably not survive.

In addition, when adding the public expenditure reported in Table 3.12 for 2001 and 2002 (the two years for which there are data pertaining to all indicators), fiscal funds at around 1.8% of GDP were poured into the electricity sector<sup>22</sup> each year. The transfer amount is exceptionally high, especially when compared with the corresponding figures for Brazil and Argentina, countries with similar levels of development. In 2001, Brazil's total expenditure amounted to 0.30% of GDP, while Argentina's equaled 0.12% of GDP.

<sup>22</sup> The numbers on capital expenditure refer to the energy sector as a whole, but transfers from the federal government to the CFE and LFC evidently refer only to the electricity sector.

In conclusion, by controlling input prices (oil and kerosene), output prices (electricity tariffs) and most of the generation and the total electricity transmission and distribution, the government has created an enormous fiscal burden.

### 3.2.3. REGULATORY FRAMEWORK AND INSTITUTIONAL DEVELOPMENT

**Electric power.** Article 27 of the Political Constitution states that the generation, transmission, distribution and supply of electric power for public utility concerns the nation and that none of these activities may be awarded to the private sector.

The Electricity Law (*Ley del Servicio Público de Energía Eléctrica*) of 1975, the regulation of the Law (of 1993 and amendments), and several regulations constitute the legal framework of this sector. The Law explicitly establishes that all acts regarding electric power are of public order and that concessions will not be granted to the private sector. The nation, through the Federal Commission of Electricity (*Comisión Federal de Electricidad*, CFE) is the entity in charge of the generation, transmission, distribution and supply of electric power, with a minor role from *Luz y Fuerza del Centro* (LFC).<sup>23</sup> There is an open-access requirement, with some technical and economic exceptions.

The Secretariat of Energy, Mines and Industry (*Secretaría de Energía, Minas e Industria Paraestatal*, currently *Secretaría de Energía*, SENER) issues all dispositions regarding public service, and authorizes all programs related to (i) the planning of the electricity system, (ii) the generation, transmission, distribution and sale of electricity, and (iii) works and facilities for the planning, execution, operation and maintenance of the national electric system. The CFE is responsible for carrying out all programs.

The CFE is run by a government board, composed of representatives from several Secretariats, the CEO of Pemex and three representatives from the labor union. SENER appoints the President of the Board.

The Law also states that some services are not considered as public utilities: self-supply generation, cogeneration, small production, private generation (independent power producers, IPPs) to be sold to CFE through power purchase agreements (PPAs), exports of power generated from these sources, imports for self-supply, and generation under emergency reasons. SENER grants permits for these services. Permits are of indefinite duration, with the exception of IPPs, which last for 30 years and are renewable. SENER authorizes imports and exports of electricity, subject to domestic supply requirements.

The Secretariat of Trade and Industrial Promotion approves the contract standards for the rendering of services. The Secretariat of Finance and Public Credit, upon petition by CFE, sets, adjusts and restructures prices and charges (with the participation of the Secretariat of Trade and Industrial Promotion) in order to recognize the costs of provision, service expansion and rational consumption of energy.

The legal framework of the Federal Public Administration invests SENER with the regulation of the electricity industry. A Presidential Decree delegates the regulatory role to the Energy Regulatory Agency (*Comisión Reguladora de Energía*, CRE). In order to promote the efficient development of supply (generation, export and import), transmission and delivery of electricity, CRE is responsible for (i) approving the regulatory instruments for interaction between

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<sup>23</sup> LFC is also a public company, which in 2004 represented 1.7% of generation capacity and about 23% of domestic sales.

generators, importers and the CFE and LFC; (ii) participating in price-setting and restructuring processes and establishing fines related to infractions; (iii) granting or taking permits for regulated activities; and (iv) approving model contracts for regulated activities. The Government, upon proposal by SENER, appoints CRE's members, who serve 5-year staggered terms which may be renewed.

Changes in generation capacity (expansion or substitution) must be carried out according to a minimum long-run cost principle, and subject to minimum reliability, stability and safety conditions. SENER determines whether the projects must be performed by CFE (as in the case of nuclear projects, or when SENER considers it appropriate). If a project cannot be executed by the CFE (for budgetary reasons or because CFE does not consider that the project fulfills the minimum cost condition) it will be granted to the private sector by an auction mechanism.

The dispatch of electric power to the public services is subject to certain rules regarding the operation of the national electricity system established by the National Energy Control Center (*Centro Nacional de Control de Energía*, CENACE) under the CFE. The CFE shall accept electricity to meet demand, respecting an increasing order of costs or proposed prices.

The rules under the Law set specifications regarding the quality of services. One of these specifications determines that the service is firm unless the provider and the user sign a contract for interruptible service (e.g. predetermined hours). Several environmental norms (Norms NOM-085-ECOL-1994, NOM-CCA-001-ECOL/96, NOM-114-ECOL-1998 and others) regulate safety and environmental standards, relating to the emission of gases, sulfur dioxide, nitrogen oxide, sulfur contents in products, the disposal of wastewater and requirements for the construction of transmission lines.

By 2002, there were 44 interconnection contracts, 24 contracts for backup of energy, 43 agreements for sales of electricity surplus, 28 agreements for transmission of energy, and 275 permits for generation (cogeneration, self-supply and IPPs). About 40% of generation capacity was already available (through 230 permits).

According to official views, based on evidence that demand grew steadily over public funds in the past, and the expectation of growing demand throughout the coming years, SENER foresees a need for private sector funding to develop investment in the sector.

The participation of the private sector has been recognized and introduced since the reforms of the legal framework were implemented in 1992. However, the rules have not been clear enough to foster investment in different types of supply (other than IPPs). Most investments took the form of IPPs and supply commitments (through PPAs), giving rise to the risk of future contingent liabilities deriving from the commitments undertaken in these contracts (such as inflexible prices). In this respect, one can learn from the experiences of the East Asian countries. After the crisis in the second half of the 1990s, governments terminated, renegotiated or continued contracts. In all these cases, several costs had to be paid, either for fulfilling the contract conditions or for breaching them. Consideration should be given to this issue, especially with regard to the fact that currently about 44% of generation units have a duration of more than 30 years, and this proportion will increase to 70% by 2012.

With the introduction of private generation, the electricity model changed from a vertically integrated monopoly to a single-buyer model. The current situation is such that, for the coming decade, public funds will only be available for reposition of transmission and distribution assets, leaving aside any investment for the modernization of assets.

Therefore, a structural reform of the sector and its normative framework to include private sector participation is envisaged. The Political Constitution is the main brake to reforms, as it forbids concessions.<sup>24</sup>

There is controversy among stakeholders regarding the creation of a power market, in spite of the abundant evidence of the benefits of a fully-fledged power market, as evidenced by other Latin American countries such as Argentina and Chile. In Chile, the reforms implemented during the 1970s and 1980s involved the restructuring and privatization of enterprises, the creation of the Electricity Bureau (*Comisión Nacional de Energía – CNE*) and the enactment of the Electricity Law. There was an unbundling of the different stages (generation, transmission and distribution) and the introduction of open-access requirements. An independent operator is in charge of the dispatch and coordination of both contract and spot transactions. Margins of natural monopoly activities are regulated by price caps. Nevertheless, Chile is facing some challenges in the contract market (specifically, incentives to distribution companies to contract power), alongside the creation of more competitive conditions, the liberation of nodal prices and the application of the regulatory model for distribution margins, while Argentina is facing important challenges in the definition of future evolution of the market.

There is also controversy in relation to transmission and distribution, even though this issue has already been resolved in the natural gas sector, where private participation is permitted.

Mexico's long tradition of state participation in the sector may make it difficult to implement reforms in the proposed direction. Given the challenges mentioned here, it is important to consider whether a sector with private participation and state supervision and direction is feasible. Again, evidence abounds of a well-defined and working power market.

In a second line of analysis, if the government passes these reforms, it will need to find contract instruments that are more flexible than PPAs; it will need to move more in the direction of developing a contract market for power.

With regard to the actors involved in the sector, there has been some discussion about the efficiency of the CFE. Poor accounting makes the performance of the sector hard to evaluate. On the other hand, the labor union participates in the direction of the company. The operator's goals may therefore be drawn away from the provision of an efficient and reliable service.

With regard to prices, evidence shows that subsidies to low-income and rural users (the responsibility of the CFE) are poorly targeted, and apply to consumption rather than to access (most importantly, there is an important proportion of low-income and rural users with no access to this service).

Finally, the CFE Board demonstrates continuity in its functions, but since it works under the SENER, the extent to which its decisions are independent may be questioned. Moreover, the dispersion of regulatory decisions, such as price setting (currently under another jurisdiction) may hamper regulatory functions.

**Hydrocarbons (Crude Oil).** The Political Constitution states that the nation is the owner and exclusive producer and user of all hydrocarbons (Articles 27 and 28). The Law that regulates the sector covers exploration, production, refining, transportation and first-hand sale of

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<sup>24</sup> In October 2003, the Secretariat of Energy stated that private generators should "hire lawyers" should Articles 27 and 28 of the Political Constitution not be amended, as the sector will run into legal problems sooner or later given that IPPs are considered unconstitutional.

hydrocarbons and derivatives.<sup>25</sup> The federal government is the sole issuer of technical and regulatory dispositions.

*Petróleos Mexicanos* (Pemex) and its subsidiaries carry out these activities, subject to technical and safety requirements. Pemex may procure services (storage, distribution, and so on), but payments must be independent of the rendering of such services; otherwise it is subject to sanctions. Pemex or third parties may transport second-hand sold products.

Pemex is divided into four divisions, dealing with (i) exploration and production (*Pemex Exploración y Producción*, PEP), (ii) refining (*Pemex Refinación*, PR); (iii) gas and basic petrochemical products (*Pemex Gas y Petroquímica Básica*, PGPB); and (iv) petrochemical products (*Pemex Petroquímica*, PP). The company is run by a Management Board and a CEO. Representatives are appointed by the government and the workers' union. The CEO is appointed by the government. Each division has the same management structure, and there are eight representatives; one is the CEO of Pemex, four are appointed by the government, and three by the union of workers.

The Secretariat of Energy is responsible for enforcing the Law, assigning areas to Pemex for exploration and production, and granting permits for the superficial exploration and recognition of areas. The Energy Regulatory Commission (*Comisión Reguladora de Energía*, CRE) is responsible for regulatory matters.

The sector program 2001-2006 establishes that production, storage, transport, distribution and trade of hydrocarbons and derivatives must meet the safety and environmental standards (emission of gases, sulfur dioxide, nitrogen oxide, sulfur contents in products, and others), as defined in norms NOM-085-ECOL-1994 and NOM-086-ECOL-1994.

The government recognizes that in order to guarantee sufficient supply to meet the growing demand, it needs to promote efficiency and productivity. On the other hand, given the changes in the characteristics of the crude oil derivatives required (lighter and purer gasoline, a product of improved environmental standards), refining needs to be improved, both in terms of capacity and quality. In order to achieve the level of investment necessary to meet demand and quality, private participation is needed. A further point is that there are currently no incentives to explore on the basis of service contracts.

An alternative to overcome this incentive problem is to maintain ownership of hydrocarbons in wells, but to allow incentive contracts for extraction, which is common practice in other Latin American countries. The various modes range from several forms of sharing (exploration and production) contracts to concession contracts.

**Natural Gas.** The Political Constitution states that the nation is the owner and exclusive producer and user of all hydrocarbons (Articles 27 and 28). The nation, through Pemex and its subsidiaries, is responsible for exploring, producing, processing and first-hand selling of natural gas (and is responsible for the necessary storage interconnecting production with processing).<sup>26</sup>

Private and social companies can transport, store and distribute natural gas. Transportation and distribution of natural gas are considered public utilities. Pemex or private companies have an obligation to provide services.

<sup>25</sup> First-hand sales correspond to the first sale of the product. Second-hand sale refers to resale of the product or sale of processed products.

<sup>26</sup> Liquefied petroleum gas has similar regulations, with particular restrictions applicable to this sector (see regulation of LPG – Liquefied petroleum gas).

Besides the responsibilities detailed in the previous section (hydrocarbons), the Secretariat of Energy is also responsible for granting permits for the transportation and distribution of natural gas, and jointly with CRE, for granting permits for transportation, storage and distribution.

On the other hand, the CRE Law expands its regulatory powers to the natural gas sector. It is responsible for promoting the efficient development of first-hand sales of natural gas, and the transportation, storage and distribution of natural gas, acting as supervisor and setting fines related to infractions.

Permits for first-hand sales, transportation, storage and distribution services related to natural gas last for 30 years, and may be renewed. This activity must be the company's primary business, and it may hold several permits, although (regional) vertical integration is prohibited. Nevertheless, the CRE may authorize exceptions if there are efficiency gains (in which case the company should not hold a dominant position) or if there is no other operator to enter the area. In the case of transportation, permits do not confer exclusivity. In the case of distribution of natural gas, the permits shall include a period of exclusivity for the geographical zone to be covered (12 years) and minimum coverage, but do not confer exclusivity on commercialization. All operators are obliged to provide open and non-discriminatory access, interconnection, unbundled services and system expansion (if required by users in the latter case). Cross-subsidies are barred. A Directive on Accounting details the guidelines for accounting, so CRE can verify the existence or otherwise of cross-subsidies as well as the performance of companies. Renewals do not confer exclusivity. The regulation defines a procedure for awarding permits through auctions.

If the Antitrust Agency considers that there are competitive conditions (which may be assessed upon request by permit holders), the price of natural gas for first-hand sales and storage, transport or distribution charges may be freely set. Otherwise, the CRE must stipulate a cap subject to the principle of reasonable profitability under efficient use, but does not have to guarantee revenues, costs or expected profitability. Charges must be divided into the following components: access to the system, capacity and use. The cap for the price of natural gas must take into account opportunity cost conditions and competitiveness of the product in an open market (according to Pemex statements, they take reference prices from Texas, United States). Consumers have the option of purchasing gas at the wellhead or at a delivery point (transportation and storage services constituting the difference between those prices). Parties may negotiate a lower price. Also, charges are adjusted periodically, taking into account changes in input prices and efficiency in rendering services. Adjustments apply after the first five years. Also, every five years, CRE and the permit holder perform a global revision. The government may grant subsidies, provided the revenues of permit holders remain unaffected. End-user prices include the price of gas, and transportation, storage and distribution charges. The transition from the price of gas to the final price is subject to verification by the CRE.

Natural gas may be imported or exported according to the foreign trade Laws. The regulation regards as discriminatory all practices that do not respect the principle of equal treatment under the same conditions, with the exception of some kinds of price discrimination (category of user) or differentiation (distance and mode of service). Anticompetitive practices are explicitly controlled by the Antitrust Agency.

The main changes in the sector began in the mid-1990s. Before 1995, PEP was responsible for exploration, production and processing (to which it still has exclusive rights), and PGPB was responsible for transportation, storage, and commercialization (which it now shares with private companies) and distribution (which is now managed only by private companies). The development of the private activities allows consumers to purchase gas at the delivery point or at the wellhead under competitive conditions. The directive on first-hand sale of natural gas

introduces transparency, non-discriminatory and equitable treatment in the contract relationship between Pemex and users. A transition in transmission charges, from a regime of cap charges on interruptible services to a firm and interruptible charges system, is under way. The regime determines a differential treatment of IPPs and power generators, on the one hand, and first-hand purchasers, on the other hand, to guarantee sale and transport conditions. 123 permits were issued for the transportation and distribution of natural gas by the end of 2003, 16 for public-utility transport, 86 for self-use transport and 21 for distribution, significantly expanding the network grid.

Demand for natural gas is growing and the sector needs investments to meet those requirements. In addition, private generation investment in gas-fired power generation has placed extra pressure on demand. If added to the potential for growing demand in currently uncovered distribution areas (such as Pachuca and Merida), the conclusion is that the current production conditions are too far behind the domestic supply requirements to be able to keep pace with increasing demand. According to Chávez Presa (2003), there is potential to extract more natural gas.

Imports of liquefied natural gas (from Bolivia and Peru) provide another option for closing the gap. There have been investments on the west coast towards the storage and insertion of this product into the gas system, and there are new possibilities for investment in this area. In addition, there are business opportunities related to transport infrastructure connecting the north-west region to the central system.

With respect to the regulatory agency, activities seem to be spread between the CRE and SENER. Also, interaction with regulated companies is underway to revise charges.

### 3.3. POLICY OPTIONS AND IMPLICATIONS

Mexico's option for a model based on state ownership of public utilities and heavy public funding of investments and subsidies in the electricity sector has produced mixed results. Access of households to electricity services is relatively high, lower only than Costa Rica in the sample of Latin American countries under consideration. Even access for families in sparsely populated areas is high by Latin American standards, at over 94%. This has not, however, translated into high use of electricity for cooking needs in rural households, probably due to lack of electric appliances and to the generally low income of families living in rural areas.

Electricity services are relatively affordable to Mexican families, with residential tariffs lower than the average of countries such as Argentina, Brazil, Costa Rica, Guatemala, Jamaica and Peru. Also, if using the percentage of GDP per capita spent on electricity as a proxy for the share of a household's income spent on electricity, electricity does not appear to constitute a heavy burden on income. However, this has been accomplished at the price of heavy subsidies, which is not a sustainable policy given increasing fiscal constraints.

In terms of quality of service, assessments vary depending on how one looks at the available indicators. Some economists, based on a comparison of average durations of interruption of service, argue that quality is quite low in Mexico when compared with the performance of developed countries. However, such comparison is carried out using numbers including interruptions due to natural events such as earthquakes, which are clearly outside the company's control. It is therefore necessary to filter out such occurrences from the indicators. After doing so, at least one of the public utility companies, the CFE (*Comisión Federal de Electricidad*), can be seen to have made substantial progress in terms of reducing the duration of interruptions and time for connecting customers to the grid. The company's current figures are close to those reported by developed countries such as France and the USA. The same conclusion cannot be reached, however, for the other public utility company, LFC (*Luz y Fuerza del Centro*), whose average interruption time per user is significantly higher than that of the CFE.

The technical efficiency of the electricity industry in Mexico is in line with that of other countries in Latin America. Compared with grid losses in countries with similar levels of development, Mexico's performance (14.45%) was a little worse than Argentina's (13.59%) and better than Brazil's (17.24%). Mexico's consumption of energy per unit of GDP, on the other hand, was consistently above the average of its Latin American counterparts in the sample selected, indicating that, despite recent improvement, there is still room to improve efficiency in terms of energy usage. Further efficiency gains can potentially be made from the replacement of the CFE's old generation plants, some of them more than 35 years old, which account for around 40% of its installed capacity. This is certainly a priority policy, as concerns about the future reliability of electricity supply are having an impact upon current foreign investment decisions in industrial sectors in Mexico.

Our overall assessment of the efficiency of infrastructure investments in the energy sector in Mexico, measured in terms of accessibility, affordability, quality and technical efficiency, indicates that it is relatively high by Latin American standards. Priorities in terms of policy choice would be to increase coverage and reduce the usage of solid cooking fuels in rural areas, and to make investments to guarantee the future reliability of the service. Since in the past policies like these have been financed mainly through public funds, the question is whether further improvements can be achieved given fiscal constraints.

The level of Mexico's public debt, defined as a percentage of GDP, decreased substantially from the mid-1990s. However, if off-balance liabilities stemming from the banking crisis, toll-road bail-outs and private-sector-financed investments in the energy sector are taken into account, the "augmented" public debt has remained in the range of 40%-45% of GDP in recent years.<sup>27</sup>

This is bad news for the energy sector, which, as discussed previously, is heavily dependent on public funds. Public electricity companies would probably not survive without government transfers, and investments in the expansion and maintenance of the grid would not be made at the necessary levels. In fact, although this is not required for the purpose of further investment expenditure, the CFE and LFC's current debt situation probably calls for capital increases by the government.

Given the dismal performance of public utility companies and the fact that the energy sector is not regarded as a safe harbor for private investments, as confirmed by the very low level of private investments in energy in recent years, the energy sector in Mexico finds itself in a rather grim scenario. Public policy here should focus on easing the concerns of both private investors and the public in order to make private-public partnerships possible, as will be discussed in the next section.

### 3.4. PRIORITIES FOR FUTURE REFORMS

The expansion and modernization of Mexico's electricity sector depends upon the public funds available. However, the demand for electricity in Mexico has, historically, grown at a faster rate than GDP and public revenues, a sign of the deteriorating capacity of the public sector to provide the resources needed by the electricity sector and to underwrite debt issued by public electricity companies. It is estimated that the demand for energy should grow at an average 5.6% per year from 2003 until 2012<sup>28</sup>, and the main state-owned companies, CFE (*Comisión Federal de Electricidad*) and LFC (*Luz y Fuerza del Centro*), which are heavily in debt, cannot keep up with that demand. In other words, the model used to finance the growth of the Mexican electricity system in the past decades is showing signs of fatigue. If that model stays unchanged and the current unwillingness to invite private investments and provision of services is not overcome, the increasing demand for electricity in Mexico will not be met and investments in infrastructure modernization will not be made.

It is true that in 1992 legislation regarding the public provision of electricity was reformed to allow some forms of private participation in the electricity sector, the independent power producers (IPPs) being the most common. However, due to its limited scope, the reform was not successful in attracting private investments to the electricity sector, which basically changed from a vertically integrated monopoly to a single-buyer model, the single buyer being the state. Problems included uncertainty about the tariffs generators could charge (prices continued to be determined by the Ministry of Finance), control of dispatch by the CFE, mandatory sales of IPP energy to the CFE, and all of these issues played a role in restricting the participation of IPPs in generation to only about 6% today.

<sup>27</sup> See, for instance, World Bank, *Memorandum of the President of the International Bank for Reconstruction and Development and the International Finance Corporation to the Executive Directors on a Country Assistance Strategy of the World Bank Group for the United Mexican States*. Colombia and Mexico Country Management Unit, Latin America and the Caribbean Region, Draft version, 2004.

<sup>28</sup> *Dirección General de Formulación de Política Energética, Secretaría de Energía, "Prospectivas del Sector Eléctrico 2003-2012"*, México, 2003.

Many Mexican governments have acknowledged that the electricity sector faces great challenges. For instance, by the end of the 1990s there was an urgent need for investment<sup>29</sup>, leading the then-President Ernesto Zedillo to propose to Congress a reform that would competition into the generation, distribution and marketing activities, a model that had been adopted in the United Kingdom. The proposal faced strong resistance, based mostly on anti-privatization rhetoric. The Zedillo proposal was never seriously discussed in Congress and was quickly set aside.

In May 2001, President Vicente Fox issued a presidential decree amending the constitution, a watered-down reform that basically only modified the terms and limits of self-generation and cogeneration schemes to make them more attractive to private investors. Congress subsequently filed a petition before the Supreme Court to review the decree. The Supreme Court not only ruled in favor of Congress but, in addition, implied in its decision that, if asked, it would rule against the IPPs scheme that had become the foundation of efforts to expand the power system.

It is obvious that such a history of decisions and movements against private participation in infrastructure projects completely discourages private investments in the Mexican energy sector. The fact remains that the electricity system is in great need of resources, and the Mexican authorities need to be creative in finding new ways to fund the necessary investments and other expenditures through private or public resources.

On the fiscal side, for instance, the Mexican government has maintained tight budget policies in the recent past, largely meeting its annually established fiscal targets. Also, automatic budget adjustment rules requiring expenditure cuts in case of lower-than-expected revenue and allocating higher-than-budgeted revenue have been adopted and applied through the annual budget laws. This means that additional fiscal funds may become available for use in the energy sector. Electricity subsidies, for example, have done little to help the poor as they are badly targeted and subsidize consumption rather than connection. If subsidies are to be maintained, they should be part of a more general policy of making tariffs reflect costs, with a social tariff designed to better target poor households. Rural electrification programs promoting the expansion of electricity services to poor households in remote areas, where connection to the electricity grid is not feasible, should also be a priority.

No matter how much public finances have improved, the Mexican government needs to promote policies to attract private investors into the electricity sector. Given the great opposition to this idea from a large part of the population and a significant range of the political spectrum, it should be done initially in the form of public-private partnerships and not through the sale of public assets. The government should run campaigns to enlighten the population about the shortcomings of a publicly-funded electricity sector and the benefits of inviting in private capital. The regulatory environment constitutes another important front in this endeavor. Measures to increase the volume of transactions performed in energy markets and to reduce the uncertainty of the regulatory framework are indispensable in order to allow the entry of private investments into the electricity sector.

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<sup>29</sup> In summer 2000, the reserve capacity was reduced to less than the adequate base level for the security of the system - 1%.

## 4. WATER AND SANITATION

### 4.1. OVERVIEW

In Mexico, the municipalities are in charge of the provision of water and sanitation services, in accordance with the Mexican Constitution; these services may be delegated to public or private operators. Indeed, since the early 1980s, responsibility for the provision of urban water and sanitation services has been progressively transferred from the federal government to local authorities. This policy was strengthened in 1983 with the amendment to article 115 of the Constitution, according to which municipalities were assigned direct responsibility for most basic infrastructure services, including water. Currently, there are more than 2,000 municipal water companies in Mexico, serving 65 million inhabitants. More specifically, one hundred and forty-five companies provide service to cities of more than 50,000 people. These cities constitute more than 50% of the population and 75% of those with access to the piped water supply.

The relationship between the municipalities and the water company usually functions on the following basis: the public water company is authorized to undertake operations and maintenance, billing and collection on behalf of the municipality; the water company does not own or manage existing assets, which are therefore not included in the company's financial statements.

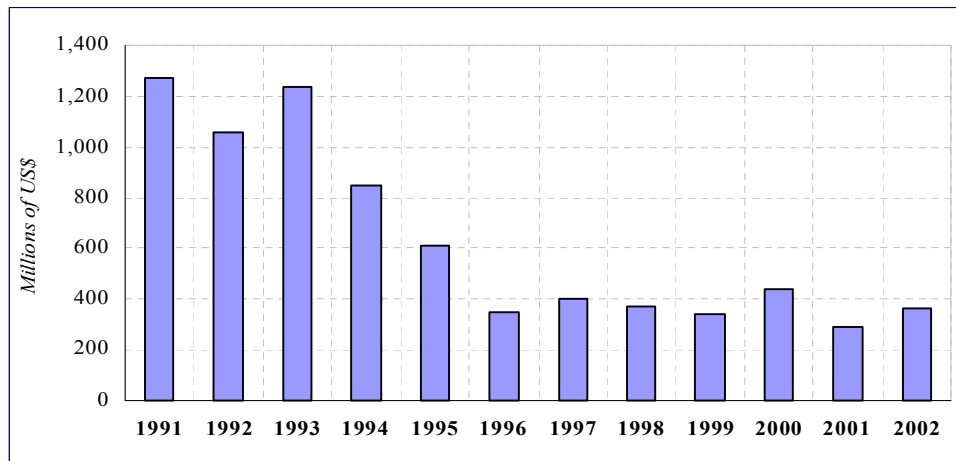
The proceeds derived from payment for water services often have the legal character of tax, rather than income. In fact, these revenues are not considered as resources of the water company, and their disposition is governed by municipal or state government administrative procedures. Moreover, tariff rates are set by the same procedures as those used for authorizing taxes rather than being transparently related to costs and quality of service.

The main federal agency for the supervision of sector is the National Water Commission – *Comision Nacional del Agua* (CNA). It is an administrative agency of the *Secretaria de Medio Ambiente y Recursos Naturales* (SEMARNAT), created on January 16, 1989. The CNA is responsible for formulating and implementing national water policies, which form part of the national policy for environmental management, health, and economic development. One element of that mandate is the definition of policies and strategies aimed at strengthening the technical, managerial and financial capacities of state and municipal water companies.

Even though the Mexican indicators have improved significantly during the 1990s, during which the government made many improvements in service provision, the number of people without access to these services remains high. Investments are basically funded through fiscal resources, since no tariff plan is in place and private participation is still lacking. New environmental laws, requiring water treatment and environment preservation, could boost investment in the sector, although the shortage of capital resources remains a serious problem.

Indeed, as indicated in Figure 4.1, which describes the investments made by the federal government and its counterparts (state and municipal governments) where the CNA is involved, it should be noted that investments decreased sharply in the period under consideration (1991-2002), and especially between 1993 and 1996, due to budget constraints. The total investment in 2002 was nearly one-third of the figure for 1991. In particular, considering that GDP is about US\$ 600 billion, investments were equal to less than 0.1% of the GDP in 2002, confirming that a very limited amount is allocated to this important and basic service.

Figure 4.1 – Investments in the Drinking Water, Sewerage and Sanitation Sub-Sectors



Source: CNA (Comision Nacional del Agua) 2003 <sup>(1)</sup>

<sup>(1)</sup> Million of pesos, at 2003 constant prices, currency exchange rate Pesos/US\$ based on 01/01/2003 value

Table 4.1 shows the breakdown of investments by federal, state, municipal and other actors. It is estimated that, considering the investments made by other government agencies and institutions such as the Ministry of Social Development (SEDESOL), the Mexican National Bank of Public Works and Services (BANOBRAS), and state agencies, investments reached US\$ 1,053 million in 2003.

Table 4.1 – Investments in the Drinking Water, Sewerage and Sanitation Sub-Sectors

Year	Federal	State	Municipal	Others <sup>a</sup>	Total
1991	495	361	*	414	1,270
1992	545	269	*	242	1,056
1993	613	354	40	226	1,234
1994	521	156	46	129	852
1995	148	182	117	161	608
1996	237	70	35	10	352
1997	214	86	84	18	403
1998	246	65	35	30	376
1999	200	93	25	20	339
2000	241	150	12	39	441
2001	112	79	33	65	289
2002	170	102	70	19	362

Source: CNA <sup>(2)</sup>, 2003

\* the amounts are included in the “Other” column

<sup>a</sup> Investments made by State Commissions, housing developers, and private enterprise, as well as loans and contributions from the EPA. The conversion of pesos at current prices to pesos at 2003 constant prices was effected based on the Mexican Consumer Price Index, using an average for each year currency exchange rate Pesos/US\$ based on 01/01/2003 value.

In 2003, the budget of the National Water Commission (CNA), as approved by the Mexican Chamber of Deputies, amounted to US\$ 1,202 million (at 2003 prices) including FONDEN – Mexico’s Fund for Natural Disasters. In that year, the funds came from complementary fiscal resources (21%); revenues from the collection of duties, contributions for improvements and usufruct (77%); and the remaining 2% came from foreign loans. These financial resources, excluding personal services, went towards drinking water, sewerage and sanitation (40%); hydro-agricultural infrastructure (32%); and water management and regulation (28%)<sup>30</sup>.

<sup>30</sup> CNA Statistics on Water in Mexico, 2004

Table 4.2 – CNA Budget

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003
Millions of US\$ <sup>31</sup>	925	1,013	1,191	1,416	1,181	1,130	1,031	960	1,202

Source: Gerencia de Evaluacion y Programacion. SGP. CNA

Table 4.3 shows the evolution of the revenues of the National Water Commission (CNA). *The Ley Federal de Derechos*, or LFD (Federal duties Law), stipulates the payment of duties for the use, exploitation, or usufruct of national waters, for wastewater discharges, for the use of federal zones, and for the extraction of petrous materials, as well as for the different administrative procedures it carries out. The money collected by the CNA is sent to the *Tesoreria de la Federacion* (Federal Treasury) and does not remain in the CNA.

Table 4.3 – CNA Revenues

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Millions of US\$ <sup>32</sup>	982	828	772	620	680	632	693	691	677	710

Source: Gerencia de Evaluacion y Programacion. SGP. CNA

## 4.2. ASSESSMENT OF THE KEY POLICY AREAS

### 4.2.1. ANALYSIS OF THE TECHNICAL DIMENSIONS OF THE SECTOR

The first important aspect to be considered in the following analysis is the *coverage* of services: that is, the percentage of population with access to these utilities.

As presented in Table 4.4, in accordance with PHO indicators, in 2000 84.99% of Mexicans had *access* to a connected drinkable water supply, while another 1.55% of the population had reasonable access to water sources, resulting in a total coverage of 86.5% of the population. This means, however, that about 13.5% of the country's inhabitants did not have any kind of access to water service. In order to appreciate the progress made, it is worth mentioning that, at the beginning of the 1990s, the first indicator stood at only 78%.

<sup>31</sup> Million of pesos, at 2003 constant prices, currency exchange rate Pesos/US\$ based on 01/01/2003 value.

<sup>32</sup> Million of pesos, at 2003 constant prices, currency exchange rate Pesos/US\$ based on 01/01/2003 value.

**Table 4.4 – Water Coverage: Percentage of Population – 2000**

	Total	Urban	Rural
<b>With Connection</b>	84.99	93.30	61.90
<b>Without Connection</b>	15.01	6.70	38.10
- Reasonable Access (1)	1.55	1.15	2.65
- Without Service	13.46	5.55	35.45

Source: Pan American Health Organization (PHO)

<sup>1</sup>Availability of at least 20 liters of safe water per person per day from a public water point (public standpipes, rain water collection, etc.) located within 200 meters from users

Table 4.5 draws a comparison between the higher-middle income countries with regard to water coverage indicating how in 2000 Mexico showed better indicators than its main regional benchmarks. Indeed, only Costa Rica performed better than Mexico in terms of connections, and the only concern lay in the percentage of the population without service (13,46), which was slightly higher than the peer group average, due to dismal performance in the rural areas.

**Table 4.5 – Water Coverage: Percentage of Population – 2000 – Selected Countries**

	Argentina	Brazil	Costa Rica	Mexico	Higher middle-income countries
<b>With Connection</b>	67.00%	75.28%	89.22%	84.99%	79.12%
<b>Without Connection</b>	33.00%	24.72%	10.78%	15.01%	20.88%
<b>- Reasonable Access <sup>1</sup></b>	11.55%	13.74%	5.77%	1.55%	8.15%
<b>-Without Service</b>	21.45%	10.99%	5.01%	13.46%	12.73%

Source: Ernst & Young Italy and Cohen&Co. elaborations on data from Pan American Health Organization

<sup>1</sup>This percentage is the sum of people with direct access to the network with the percentage of population having at least 20 litres of safe water per person per day from a public water point (public standpipes, rain water collection, etc.) located within 200 meters

Indeed, in Mexico, as in other Latin American countries, the water supply problem is more serious in rural areas, where service provision is more difficult. As indicated in Table 4.4, in 2000 only 61.9% of the rural population was connected, whereas 35.45% was not reached by any type of service. The performance indicators in urban areas fare much better: (i) 93.3% of the population was connected; (ii) 1.15% had an alternative source of easy access; and (iii) 5.55% remained without service.

Moreover, it should be noted that water coverage is unevenly distributed throughout the national territory. Considering all entities within the water services sector, in accordance with the PHO, 23 had coverage of over 85%, 4 between 70% and 85%, and 5 under 70%.

The sanitation situation in Mexico, as Table 4.6 shows, is more troublesome than the water supply: in 2000, 58.35% of the country’s population was able to reach the sewerage system through connections and 14.14% had on-site facilities, while 27.53% had no access whatsoever. In urban areas, 74.63% of the population was connected, 12.4% had on-site facilities, and 12.97% had no service. However, the problem in rural areas was more pronounced: 67.95% of the population was not connected to any type of service; only 13% was connected to the network. The population without services makes use of cesspits. In any case, as in the water supply, there were significant improvement in sanitation coverage during the 1990s: from 60% at the beginning of the decade to over 72% by the end, meaning that a further 12% of the population was incorporated into the system during this period. In addition, it is worth mentioning that, also in this case, access differs from region to region: in accordance with PHO, when considering the 27 regions, one had coverage of more than 85%, 14 between 70% and 85%, and 12 under 70%.

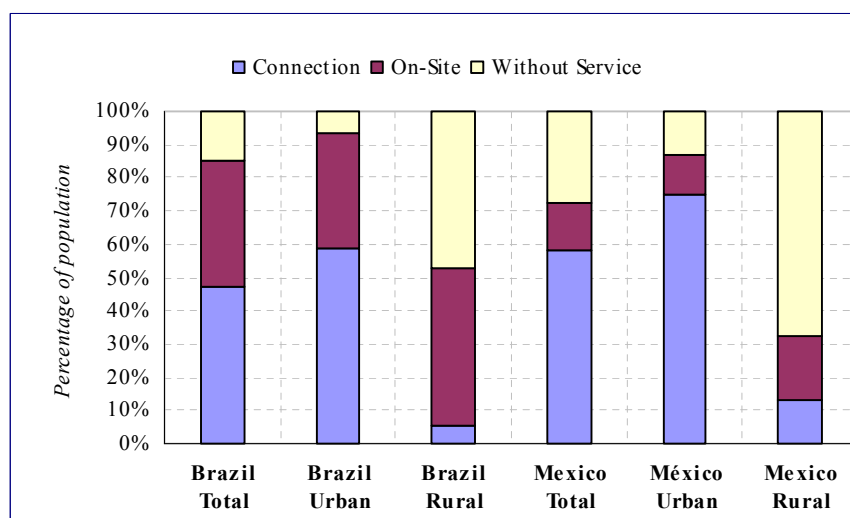
**Table 4.6. – Sanitation Coverage: Percentage of Population – 2000**

	<b>Total</b>	<b>Urban</b>	<b>Rural</b>
<b>With Connection</b>	58.35	74.63	13.07
<b>Without Connection</b>	41.65	25.37	86.93
- On Site (1)	14.14	12.40	18.99
- Without Service	27.51	12.97	67.95

Source: Pan American Health Organization (PHO)

<sup>1</sup>On-site sanitation system includes any of the following technologies: connection to septic systems; latrines, wet or dry, etc. Obs: Adequate disposal of human excreta refers to a private or shared satisfactory sanitary means of excreta disposal that hygienically separates human excreta from human contact, such as any of the above.

Compared with Brazil, considering coverage in terms of connections or septic tanks, in 2000 the indicators for Mexico were unsatisfactory: the population of Brazil without access was only 15%, while in Mexico this figure was 27%. However, considering only connection coverage, Mexico’s level was higher than Brazil’s, especially in urban areas where a higher percentage of the population was connected to the network (see Figure 4.2 below).

**Figure 4.2 – Mexico versus Brazil: Sanitation Coverage – 2000**

Source: Pan American Health Organization (PHO)

Expanding the analysis to the other Latin American countries in the higher middle-income sample, as shown in Table 4.7, the overall picture of the sample in 2000 was quite negative. In fact, Mexico's indicators are shown to be even better than those of the comparable countries, in particular, in terms of connections. By contrast, however, Mexico showed the highest percentage of population without any kind of access to sewerage service (27.51%), indicating a crucial issue that needs to be addressed by the government and CNA.

**Table 4.7 – Access to Improved Sanitation: Percentage of Population – 2000**

	Argentina	Brazil	Costa Rica	Mexico	Higher middle-income countries
<b>With Connection</b>	48.69%	47.50%	21.01%	58.35%	43.89%
<b>Without Connection</b>	51.31%	52.50%	78.99%	41.65%	56.11%
<b>- On Site<sup>33</sup></b>	35.26%	37.32%	72.51%	14.14%	39.81%
<b>- Without Service</b>	16.06%	15.18%	6.48%	27.51%	16.31%

Source: Ernst & Young Italy and Cohen&Co. elaborations on data from Pan American Health Organization

<sup>33</sup> On-site sanitation system includes any of the following technology: connection to septic systems; latrines, wet or dry etc. Obs: Adequate disposal of human excreta refers to a private or shared satisfactory sanitary means of excreta disposal that hygienically separates human excreta from human contact, such as any of the above.

According to this analysis of service coverage, it must be stressed that, despite the improvements achieved in recent years by government policies, coverage deficits (especially in sewerage) remain a serious issue for Mexico. Indeed, improvements in the service have enabled significant improvements in several health indicators - reduced infant mortality rate and fewer deaths due to water-transmissible diseases – but the sector still needs sizeable investments in order to achieve total service coverage.

To make a comparison between the *quality* of Mexican water and sanitation services and that of the other Latin American countries classified by OECD as higher middle-income countries, three main indicators have been analyzed:

- (i) Water supply time (hours a day);
- (ii) the disinfection in urban systems; and
- (iii) the percentage of volume treated from the sewerage system.

As for *water supply time*, Table 4.8 shows that Mexico’s performance indicator of 24 hours a day was in line with the other comparable countries.

In 1990, the second indicator, *disinfection in urban systems*, was estimated at about 55%. In 2000, it was 95%, slightly lower than in the other peer countries (Costa Rica – 100%; Argentina -98%). It should be noted that in the main cities this indicator reached 100%.

Unfortunately, as far as sewerage service is concerned, only a small percentage of water (15.4%) was treated in 2000, creating environmental risks. In spite of this, the indicator in Mexico was better than in the other countries with similar levels of development. Indeed, in Brazil treatment levels reached only 10%, as in Argentina, while in Costa Rica it was even lower at 4%, representing a major environmental problem.

**Table 4.8 – Water and Sanitation Quality Indicators – 2000 – Selected Countries**

	Argentina	Brazil	Costa Rica	Mexico
<b>Water supply time (hours a day)</b>	24	24*	24	24
<b>Disinfection urban system – Drinking water</b>	98%	n.a.	100%	95%
<b>% of treated volume collected from sewerage system</b>	10%	10%	4%	15.40%

Source: Pan American Health Organization

\* except for Brazil data which refers to “Informe Regional sobre la evolucion 2000 em la region de las Americas”

#### 4.2.2. ECONOMIC EFFICIENCY AND PRIVATE SECTOR FINANCING

One of the main problems in the Mexican water and sanitation sector lies in the limited capacity for generating resources (through self-financing). Indeed, the operating margin is usually negative. More specifically, the average cost of the production and distribution of drinkable water in Mexico in 2000 was US\$ 0.33 per m<sup>3</sup> (see Table 4.9) – including only operational costs, and excluding the loss of invoicing, capital remuneration and investment resources - while the country's average tariff, which was similar to the tariff of the Federal District, was US\$ 0.25 per m<sup>3</sup>. Evidence shows that the Mexican tariff, which ranges from US\$ 0.08 per m<sup>3</sup>, in Villahermosa province, to US\$ 0.88 per m<sup>3</sup> in La Paz province, generally just covers operational costs and ordinary maintenance costs. Tariffs are not able to generate a positive cash flow in order to finance the necessary investments for expanding services and maintaining the system at an acceptable standard. The system could be improved by increasing tariff revenues so as to reduce dependency upon fiscal resources and to use profits for new investments, as well as encouraging private sector investment in this sector.

**Table 4.9 – Production and Distribution Cost and Tariffs – 2000 – US\$/m<sup>3</sup>**

	Argentina	Brazil	Costa Rica	Mexico
Average cost of water production and distribution	0.25	0.52	0.07	0.33
Average drinkable water tariff	0.48	0.54	0.42	n.a.
Average sewerage tariff	0.31	0.55	0.06	n.a.

Source: Pan American Health Organization

Low profitability also results from verifiable invoicing losses. Indeed, according to information from the PHO, in 1998 this was around 27% of the total - that is, 27% of the entire water distributed was left uncharged, a level similar to that of Brazil. The situation is different in each region: for instance, in 1998, the city of León recorded an invoicing loss of 50%, while in Heroica Zaragoza, the loss was estimated at 25%, in Guadalajara, 36%, and in Monterrey 42%. It is worth mentioning that the loss in invoicing is typical in systems dominated by the public sector, as the sector is more concerned with the final client rather than the actual consumption of services.

#### 4.2.3. REGULATORY FRAMEWORK AND INSTITUTIONAL DEVELOPMENT

Article 27 of the Political Constitution stipulates that the state is the sole owner of water sources within the country. The Law of National Water (*Ley de Aguas Nacionales*) regulates this Article with respect to the operation, use, distribution and control of water, as well as the preservation of both quality and quantity to achieve sustainable development.

The National Commission of Water (*Comisión Nacional del Agua*, CNA) is the authority managing water nationwide, in coordination with states and municipalities. The CNA issues norms in order to protect this national resource. The CNA consists of a Technical Council,

composed of representatives of the Secretariats of Finance and Public Credit, Social Development, of General Comptrollership, of Energy, of Agriculture and Hydro Resources. The CNA is responsible for administering and regulating water resources at national level, overseeing sector reforms throughout the country, planning and administering major (interstate) bulk supply works, licensing, proposing tariffs, and collecting charges for the extraction of water from all sources in the territory. The Secretariat of Health is responsible for regulating the quality of water for human consumption.

The regulation of water and sanitation is decentralized at state level through state water commissions. The Law of National Water states that the provision of water, sewerage and wastewater disposal services is the responsibility of the municipal authorities, either directly or through concessions.

Several norms issued by the CNA regulate dispositions, specifications and test methods to ensure that the products and services offered meet the goals of using, preserving and managing water efficiently. The Secretariat of Health, in coordination with the CNA, has issued several norms on environmental health and quality of water for human consumption. The Secretariat of Natural Resources, in coordination with the CNA, has issued several norms regarding the contamination of wastewater for final disposal and re-utilization.

The management of water distribution in the urban areas is separated from government activities through the creation of autonomous, self-financing entities. In Mexico City, for example, water management has been assigned to the private sector. But, according to Kessides (2004), the management of contracts requires an appropriate institutional and political environment, while in Mexico City there is confusion and overlapping between several agencies and municipal entities (see also, Shirley and Menard, 2002, cited in Kessides, 2004). Hall (see IDB, 2004) states that well-applied rules add transparency and credibility to decisions regarding who runs services and how tariffs are set. Finally, although service contracts were awarded in the mid-1990s, the delay in defining the following stage of the management contracts (concessions) damaged the government's credibility and reduced support for further reforms.

The mode of provision defined was through management rather than concession contracts (unlike in other Latin American countries). For reference, it is worth considering the reforms made in the water system in Chile. The most significant reforms were initiated in the late 1980s with the sector's new regulatory framework, which centralized a large part of the regulations on provision. This framework was based on the electricity sector, with the application of the price cap regulation with a reasonable return under efficient operation ("*empresa modelo*"). In 1989, the regulatory body *Superintendencia de Servicios Sanitarios* (SISS) was created. SISS was in charge of inspecting the sector and regulating charges and fees. This institution enabled the pre-existing dual role of operator and regulator to be broken up. Furthermore, in 1989 the public operators were converted into corporations, and in 1997 that they were put to privatization after an important re-accommodation (increase) of prices. The privatizations pursued the double objective of obtaining private resources for financing infrastructure and services and the government's exit from productive activities. However, there was some debate as to whether the government should have awarded concessions instead of privatizing the companies.<sup>34</sup>

The situation remains delicate in some parts of the country. According to global indicators, service quality is poor, as measured by the proportion of households who receive service all day. Approximately 65% of rural households have access to the water supply, and almost 23%

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<sup>34</sup> For further details, see Fischer and Serra (2003), "*Efectos de la Privatización de Servicios Públicos en Chile: Caso Sanitario, Electricidad y Telecomunicaciones*", *Serie Estudios Económicos y Sociales*, IDB.

do not receive complete coverage. Approximately 32% of rural households have access to sanitation.

### 4.3. POLICY OPTIONS AND IMPLICATIONS

The water and sanitation sectors lag behind the other infrastructure segments, especially in rural areas, where service is extremely inefficient. In particular, the quality and coverage of sewerage services are inadequate and, as a consequence, there have been environmental problems and an increase in diseases related to poor sanitation services.

Another main issue relates to the tariff system, which is inefficient and incapable of providing the necessary amounts of money needed for ordinary maintenance, let alone generating resources for investment funding. In fact, as already mentioned, tariff rates are set by the same procedures as those used for authorizing taxes, rather than being transparently related to costs and quality of service. An efficient tariff system would be strongly advised to enable the correct allocation of service costs over the different population brackets, as there is a high level of wastefulness due to the lack of consumer awareness. Indeed, in order to develop the water sector, private investor involvement and the optimization of consumer tariffs are needed. Investors would be attracted to this market only if the legal framework were clear and well-regulated, and if the tariff mechanism rendered management profitable. In a situation in which revenues are chronically exceeded by operational costs it is impossible to attract private capital, and it is even more difficult to recover the costs of extraordinary maintenance needed in order to expand and develop the system overall.

Mexico has gained solid experience in privatization processes from other infrastructure segments (such as toll roads and telecom) and it should try to replicate these models also in the water sector in order to be considered a developed country. The best mechanism would enable the government to take responsibility for service provision in the poorest rural areas, while awarding concessions to private companies in the urban developed areas where services can be offered in a profitable and cost-efficient way. This mechanism could be arranged through a subsidy transfer from the richest to the poorest regions.

Then, in terms of water wastefulness, it must be also stressed that Mexico uses a great part of its hydro resources in irrigation programs for agriculture, while there might be more efficient mechanisms for this purpose. Educational campaigns on the correct use of water and an efficient collection system might reduce wastefulness.

Finally, it must be stressed that Mexico does not show a good indicator for sewerage treatment which has damaging consequences for the environment. Legislation has been implemented in order to tackle this important issue, and institutions have been created to manage and plan the use of hydro resources, and to establish procedures for water usage. Among these institutions, the River Basin Councils are the most representative. These entities are in charge of coordination between the National Water Commission, agencies and entities at the federal, state, and municipal levels, and representatives of users of the respective river basins. The aim of these councils is to design and implement programs and related services, and to preserve the river basins' resources (Article 13 of the National Waters Law). For their proper functioning, River Basin Councils may have auxiliary organizations at the level of a sub-basin, micro-basin and aquifer named, respectively, River Basin Commissions, River Basin Committees and Technical Groundwater Committees (COTAS). By November 2003, a total of 25 out of 26 River Basin Councils covering all of Mexico's territory had been installed, 7 River Basin

Commission had been set up and 13 River Basin Committees had been established. However, it is still necessary to achieve an integrated and sustainable water management system at the level of the River Basin Councils.

In March 2000 the Water Advisory Council was created; this is a group of distinguished citizens who support the National Water Commission (CNA) in its work which is geared towards creating a new water culture in Mexican society through the Coalition for Water Conservation. The State Citizen's Councils for Water are participatory channels at the local level, and work by spreading information on water and promoting care for the sustainable use of this natural resource. This is a good system for favoring the sustainable use of this scarce resource, but there is a need to consolidate the participation of users and organized society in water management in order to achieve the best results possible.

#### **4.4. PRIORITIES FOR FUTURE REFORMS**

The main target for the Mexican water sector is to achieve 100% coverage throughout the country, in both the water and sewerage segments, and in both rural and in urban areas. During the last decade the system improved substantially by comparison to previous years, but the goal has not yet been achieved, especially in rural areas, where coverage is low; improvements in coverage mostly affected urban areas.

The current subsidies system does not boost efficiency, as explained earlier; the involvement of private investors is therefore strongly advised in order to reduce dependence on the fiscal budget.

Another important step to be taken would be to establish a tariff system based on costs and usage, provided that the poorest income brackets received a subsidy for service affordability. This could help the process of rationalization in water use and stimulate the treatment of residues, e.g. it might be possible to link payment for the use of hydro resources to the quality of the water treated, which can be returned to the rivers or other water sources.

To summarize, the priorities for the water and sanitation sector are to:

- (i) expand coverage and improve service quality for the drinking water supply, sewerage and basic sanitation;
- (ii) establish a tariff system based on costs and usage;
- (iii) increase private sector participation;
- (iv) achieve integrated, sustainable management of water in watersheds, basins, and aquifers;
- (v) promote the technical, administrative, and financial development of the water sector;
- (vi) consolidate the participation of users and organized society in water management;
- (vii) promote a widespread awareness about appropriate use of water; and
- (viii) reduce the risks and effects of floods and droughts.

## 5. TELECOMMUNICATIONS

### 5.1. OVERVIEW

Mexico's telecom market indicates a combination of a populous country (around 100 million inhabitants) with a low fixed-line density.

First of all, it should be recognized that Mexico is one of the first countries to have initiated the privatization of telecom industries. The involvement of private capital in the telecom industry dates back to 1990, when the Mexican government sold a controlling stake of 20.4% in Telmex, the state-owned monopoly supplier of telephone services, to a consortium formed by *Grupo Carso*, Southwestern Bell and France Telecom for US\$1.757 billion; the consortium was awarded a six-year monopoly concession. Telmex was expected to interconnect with other providers which started to operate in 1997. Competition in local services has increased since then, but Telmex still remains the dominant operator. The remaining stake of Telmex in public hands (34.7%) was then sold in several tranches; the last one was sold in 1994 enabling the government to raise US\$ 6 billion.

Table 5.1 shows private investments from 1995 to 2002. They fluctuated greatly during this period, between the peak of 0.77% in 1995 and the minimum of 0.39% of GDP in 2000, according to the waves of privatization.

**Table 5.1 – Private Investment in the Telecom Industry**

	1995	1996	1997	1998	1999	2000	2001	2002
<b>current million US\$</b>	2,191	1,963	1,410	2,891	2,303	2,269	3,928	2,663
<b>Percentage of GDP – current US%</b>	0.77%	0.59%	0.35%	0.69%	0.48%	0.39%	0.63%	0.42%

*Source: World Development Indicators 2004 – The World Bank*

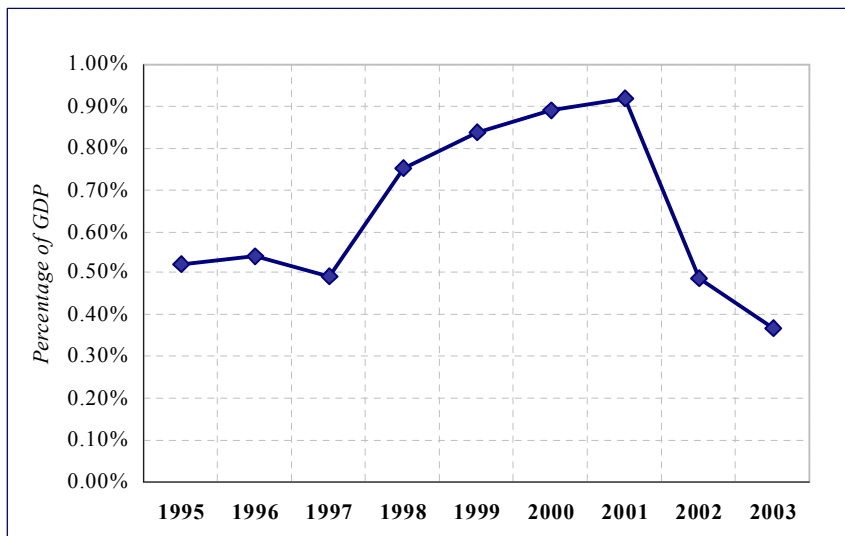
The Mexican privatization process also reveals the drawbacks of promoting private sector participation without an adequate regulatory framework. In 1995, the Mexican Federal Communication Law was issued and the *Comision Federal de Telecomunicaciones* (COFETEL) and the Secretariat of Communications (SCT) were organized. The SCT is responsible for awarding concessions on spectrum frequency, setting equipment standards and approving and monitoring Telmex tariffs and performance. COFETEL is a regulatory agency independent from the SCT and is responsible for overseeing concession contracts and granting equipment certification. Competition began first in mobile telephony, then in long distance and finally in fixed access services. Nevertheless, major regulatory issues concerning interconnection rules and prices remain to be addressed.

Moreover, the decision to privatize Telmex as a temporary monopoly, introducing competition and regulatory institutions only after privatization was completed, allowed Telmex to earn

excess profits. The government's aims were to sell the company at the highest value and to enable Telmex to pursue universal service. Telmex received a six-year exclusivity period for the operation of basic telecommunication services. Yet the unaffordable monopoly prices led to a reduction of demand for services, making the sector less attractive for new private operators and resulting in lower than expected private investment. As a consequence, the telecommunications sector has not reached its full potential. In fact, Mexico's telecom infrastructure lags behind other Latin American countries as far as fixed-line penetration is concerned, even though this sector grew at four times the rate of GDP growth during the 1990s. According to COFETEL's figures, telecommunications represented 1.07% of total GDP in 1990, and increased to more than 3% of GDP by 2000. On average, the telecommunications share of GDP grew by 14.9% per year while the Mexican economy grew by 3.6% between 1991 and 2003. However, capital expenditure has been decreasing in recent years owing to the difficulties experienced by the largest international telecom players.

Finally, Figure 5.1 analyzes public investment in the telecom industry. As noted, there was a sharp decline in public resources in 2001; in fact, public investments fell from roughly 0.93% to 0.35% in 2003, following the budget restrictions common to the other infrastructure sectors.

Figure 5.1 – Public Investment in Telecom Industry on GDP



Source: World Economic Outlook, Cofetel and The World Bank

## 5.2. ASSESSMENT OF THE KEY POLICY AREAS

### 5.2.1. ANALYSIS OF THE TECHNICAL DIMENSIONS OF THE SECTOR

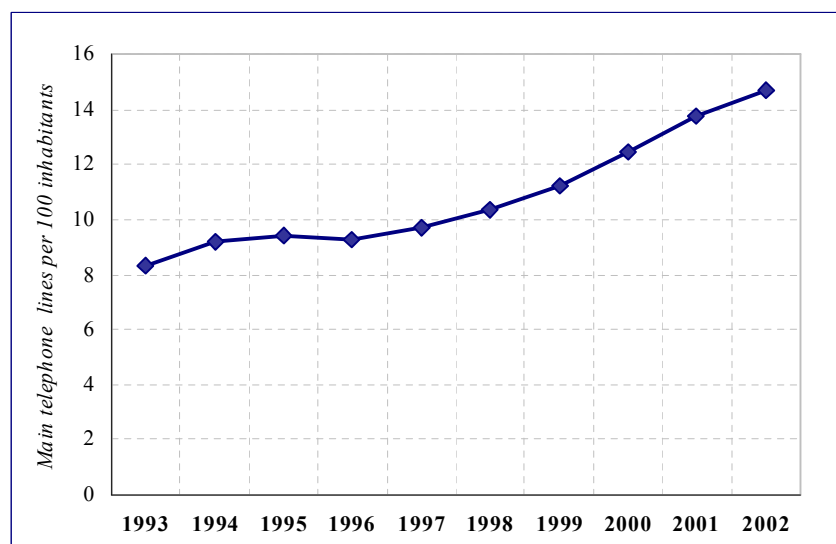
In order to assess the technical dimensions of the telecommunications sector in Mexico, the following sub-sectors have been analyzed:

- (i) access;
- (ii) affordability; and
- (iii) quality of service.

*Access.* Mexico's fixed-line penetration was about 15% in 2002, having almost doubled since 1993, as shown in Figure 5.2. But, in spite of this increase in main-line teledensity, in the period 1998-2002, the values for Mexico are still below those of the other Latin American countries, as shown in Figure 5.3, not to mention the actual comparisons with countries with similar levels of development.

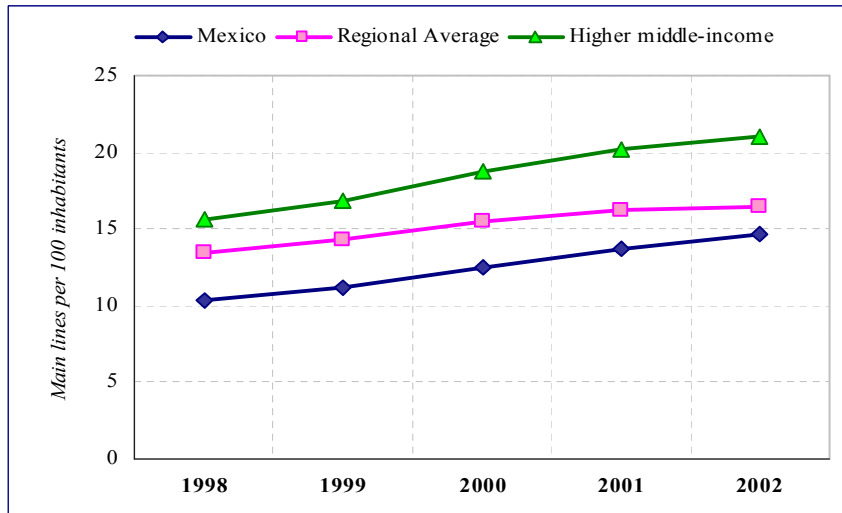
The low fixed-line teledensity in Mexico is also related to the relatively high level of tariffs for local services due to the aforementioned monopoly status of Telmex. Indeed, according to COFETEL, the basket of regulated telecom services started to decrease in real terms continuously since 1997, but local tariffs for residential customers have decreased only 14% in real terms since that year. The decrease was greater for commercial customers, based on a decline of 18% in local call tariffs and 21% in monthly fees.

Figure 5.2 – Fixed line Teledensity



Source: The Yearbook of Statistics 1993-2002 - ITU

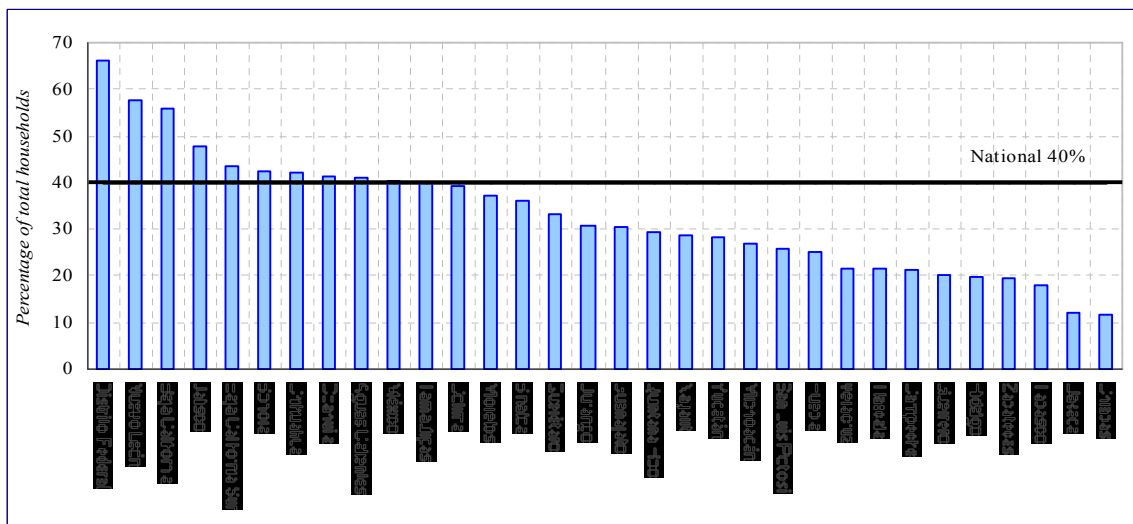
Figure 5.3 – Fixed line Teledensity – Benchmarks



Source: World Telecommunication Indicators 2004 - ITU

However, the main issue is that the teledensity indicator shows differences in the penetration rate between the different regions. Indeed, according to COFETEL, although mainline teledensity per household reached an average of 40% in 2004, this indicator was quite different from that of the federal district, where the figure was 66.2%, and Chiapas, where it remained at 11.8% (see Figure 5.4 below).

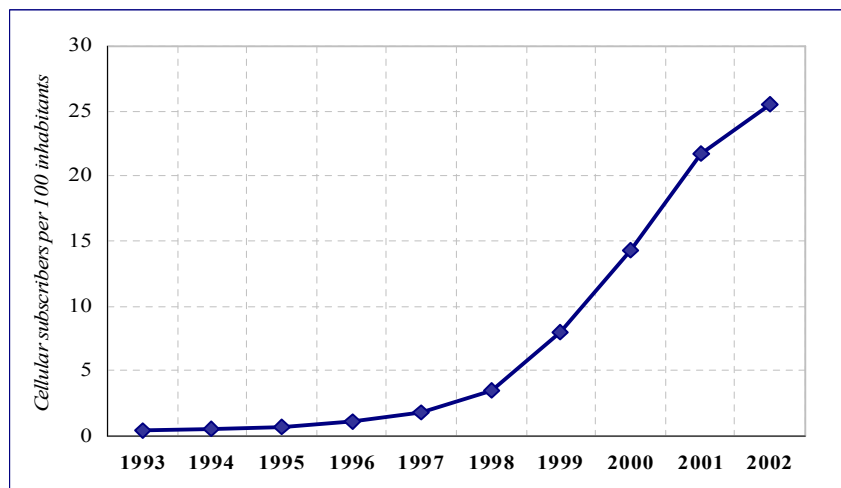
Figure 5.4 – Fixed Lines – Household Penetration – 2004



Source: Cofetel

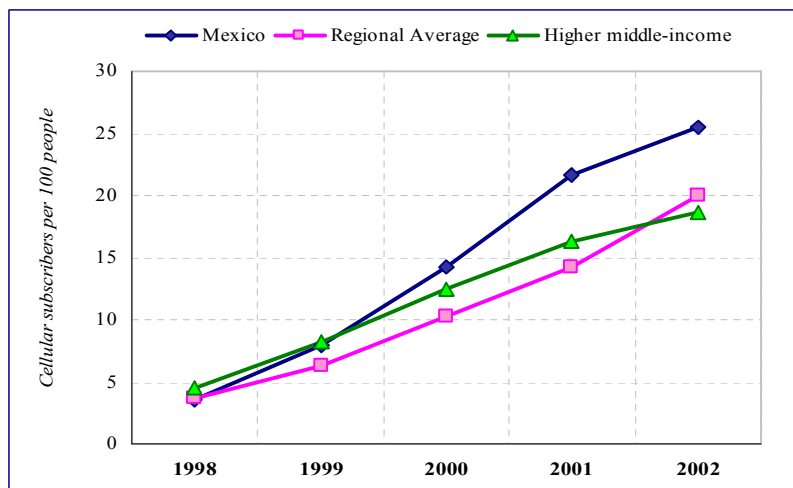
In the **mobile market** there was a period of tremendous growth in penetration of services due to the 18 concessions granted by the government in 1990. Moreover, mobile penetration was promoted in 1996 with the introduction of a prepaid system, whereby the calling party pays in advance for the telephone call and, in 2000, mobile service overtook fixed-line service, with almost 90% of mobile service prepaid. As shown in Figure 5.6, this growing trend in mobile services brought Mexico's mobile penetration far above both the regional average and, more notably, the average of the countries with similar levels of development. This result is the opposite of the results recorded for main-line teledensity.

Figure 5.5 – Mobile Teledensity



Source: Yearbook of Statistics 1993-2002 - ITU

5.6 – Mobile Teledensity - Benchmarks



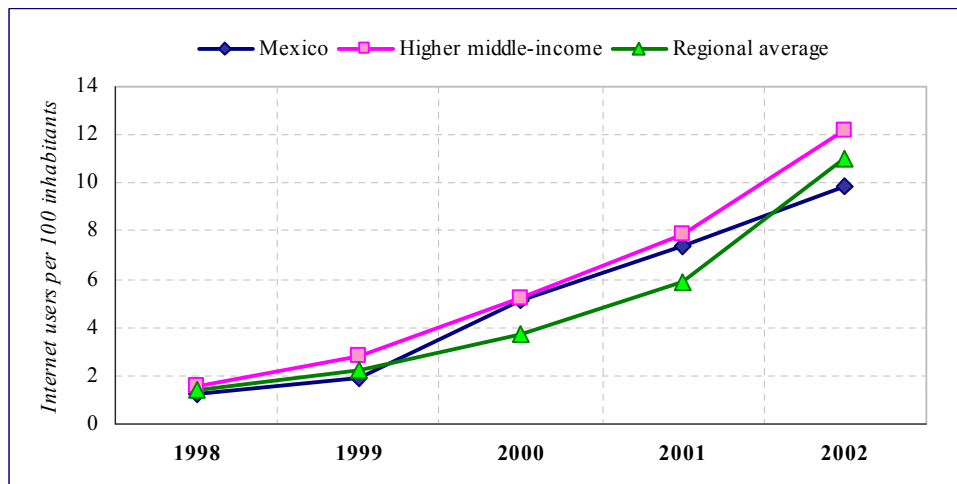
Source: World Telecommunication Indicators 2004 - ITU

With regard to long-distance service, it must be stressed that traffic is mainly directed toward the United States: around 90% of all Mexico's international calls are routed to the U.S., while 13% of all U.S. international calls are directed to Mexico, the second international call destination after Canada. There are around 25 long-distance operators in the Mexican market. However, during recent years a number of lawsuits have arisen connected with anticompetitive behavior, which have caused bitter disputes with the United States Trade Representative (USTR).

Finally, Figure 5.7 summarizes the indicators for Internet access, showing a surge in Mexico from 1.28% in 1998 to 9.85% in 2002. However, notwithstanding this growth trend, Internet penetration in Mexico was still lagging behind the benchmark countries in 2002, as can be observed in Figure 5.7.

In relation to this issue, the government has recently implemented programs such as E-Mexico, which started in 2001 with a budget of US\$ 4 billion. Its goal is to increase Internet use; the Mexican government ambitiously expects to bring 98% of the population online by 2025.

Figure 5.7 – Internet Users



Source: World Telecommunication Indicators 2004 - ITU

**Affordability.** In order to assess the affordability of telecommunications services in Mexico, the following call costs have been analyzed:

- (i) cost of local phone call (US\$ per 3 minutes);
- (ii) cost of phone call to the US (US\$ per 3 off-peak minutes); and
- (iii) cost of mobile local call to the US (US\$ per 3 off-peak minutes).

Despite a reduction in nominal terms, as shown in Table 5.2, the *cost of a local call* in Mexico is still very high, far above both the average of the higher middle-income countries and the average of all Latin American countries included in the sample analyzed. Moreover, it should be

noted that, while the cost of a local call in Mexico is increasing, costs in the rest of the LACs show a stable or even a decreasing trend. This constitutes a major problem since local calls are the most important segment of the market, representing 58% of revenues.

**Table 5.2 – Cost of Local Phone Call (US\$ per 3 Minutes)**

	1998	1999	2000	2001
<b>Mexico</b>	0.13	0.14	0.15	0.16
<b>Higher middle-income countries</b>	0.08	0.07	0.08	0.08
<b>Regional average</b>	0.07	0.07	0.07	0.07

Source: *World Development Indicators 2004 – The World Bank*

It should be noted that, in the second indicator analyzed, the *cost of a phone call to the United States* (see Table 5.3), the cost of a telephone call almost doubled between 1998 and 2002, reaching the level of the other Latin American countries. However, the trend observed in Mexico gives rise to concern and calls for stronger competition in the long-distance market, which is dominated by Telmex (60% market share), in order to reduce tariffs.

**Table 5.3 – Cost of Phone Call to the US (US\$ per 3 Off-Peak Minutes)**

	1998	1999	2000	2001
<b>Mexico</b>	1.58	3.01	3.01	3.04
<b>Higher middle-income countries</b>	2.57	2.40	2.47	2.92
<b>Regional average</b>	2.93	2.11	2.47	2.92

Source: *World Development Indicators 2004 – The World Bank*

Finally, taking into consideration the cost of mobile calls, despite the boom in prepaid cards, mobile calls continue to be very expensive, especially in comparison with the costs in the other Latin American countries. Once again, it is due to the presence of a dominant player – Telcel, a Telmex subsidiary, which accounts for 78% of the Mexican mobile market in 2004. Certainly, stronger antitrust regulation could help in lowering the cost of this service.

Table 5.4 – Cost of Mobile Local Call (US\$ per 3 Off-Peak Minutes)

	1998	1999	2000	2001
<b>Mexico</b>	0.84	0.81	0.82	0.83
<b>Higher middle-income countries</b>	0.74	0.66	0.67	0.46
<b>Regional average</b>	0.67	0.53	0.51	0.37

Source: World Development Indicators 2004 – The World Bank

**Quality of service.** To assess the quality of service the indicator *phone call faults per 100 mainlines* has been analyzed. With regard to this indicator, as shown in Table 5.5, Mexico's performance, showed an improvement and, by comparison with the other Latin American countries, was much higher in the period 1998-2002. Indeed, the values for this indicator fell from 2.81 in 1998 to 1.90 in 2002.

Table 5.5 – Phone Call Faults per 100 Mainlines

	1998	1999	2000	2001	2002
<b>Mexico</b>	2.81	2.22	1.90	1.85	1.90
<b>Higher middle-income countries</b>	16.72	2.51	3.35	3.18	n.a.
<b>Regional average</b>	30.04	32.25	20.47	13.77	21.93

Source: World Development Indicators 2004 – The World Bank

Finally, it must be mentioned that the quality requirements for mobile services and compensation for subscribers were only introduced in 2000, and by 2001 included all the wireless operators. Monitoring of quality service indicators is based on COFETEL standards. A sample of information for mobile providers shows that in 2003 only one of the four operators in the Guadalajara area failed to achieve the COFETEL standards. Similar results were found in the Toluca area and in Ensenada.

## 5.2.2. ECONOMIC EFFICIENCY AND PRIVATE SECTOR FINANCING

The competition framework in the Mexican telecom market has been the subject of debate between Telmex, COFETEL, and the antitrust authority *Comisión Federal de Competencia* (COFECO). Moreover, in 2002, the United States raised the dispute against Mexico at the World Trade Organization (WTO) concerning free access to the telecom services market and accused Mexican companies of anticompetitive practices. Indeed, the United States Trade

Representative (USTR) estimated that the entry barriers to the market between Mexico and the United States costs a half billion dollars in excess payment to U.S. customers.

The main problem with the competition framework in Mexico is the dominant position of Telmex. Indeed, Telmex, which is the largest telephone company in Latin America and had a US\$ 21 billion market cap by mid-2004, operates 90% of local calls, 60% of long-distance traffic and 40% of Internet accounts in Mexico. According to Pyramid Research, the combined revenues of the Telmex's two largest competitors, Avantel and Alestra, represented less than one tenth of Telmex revenues in 2001, and they have been unable to obtain a significant market share.

Accordingly, Telmex has a strong balance sheet and an outstanding ability for generating revenues; in 2002 it demonstrated a strong EBITDA margin at 50% and total revenues at US\$ 11.5 billion, as summarized in Table 5.6. Operating income accounted for more than 30% of net sales, achieving high profitability. Also, as the company leverage is less than 50% and a large cash reserve is available for acquisitions, Telmex has expanded significantly in the Latin American region in recent years. Its main acquisition was the purchase of AT&T Latin American operations in several Latin American countries (Argentina, Brazil, Chile, Colombia and Peru), and it has recently bought Embratel operations in Brazil.

**Table 5.6 – Telmex Results**

	2002	2003
<b>EBITDA Margin</b>	50%	50%
<b>ROE</b>	5%	3%
<b>Net income/Total asset (ROA)</b>	4%	2%
<b>Operating income/Net sales</b>	33%	32%
<b>Net income/Operating income</b>	67%	45%
<b>Net income/Equity<sup>1</sup></b>	10%	5%
<b>Net debt/Total capital</b>	47%	4%

Source: Telmex

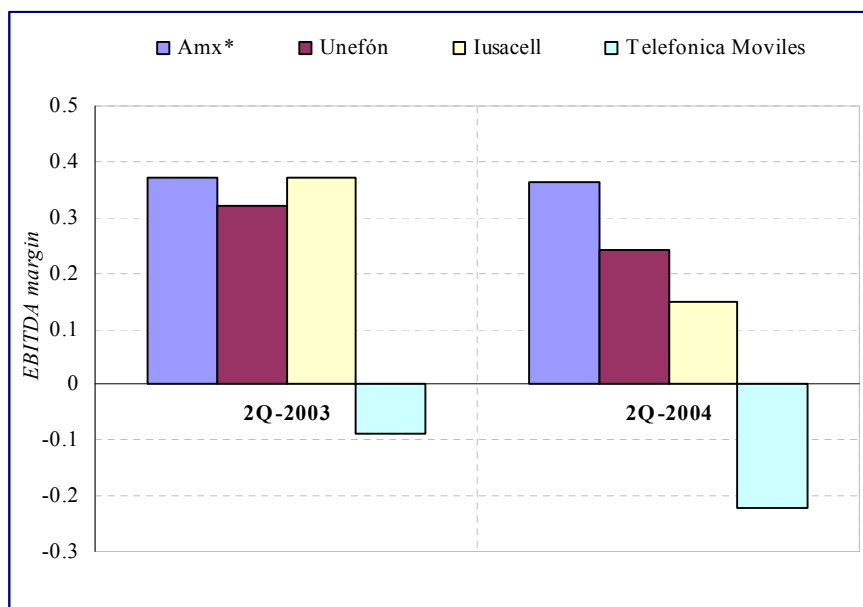
<sup>1</sup> Note: This net income is up to 2Q.

To deal with the inefficient and uncompetitive situation created by the Telmex's market dominance, at the end of 1999, the Mexican antitrust authority COFECO declared that Telmex had a monopoly power. In 2000, COFETEL imposed restrictions on Telmex. In 2001, the judiciary ruled a set of procedural failures against COFECO and COFETEL decisions. In July 2004, COFECO issued another resolution against Telmex for its quasi-monopoly market position in relation to local telephony access, and domestic and international long-distance services, that could in practice translate into a set of restrictions for the company.

The mobile market began to be operative in Mexico in 1990, when two operators were permitted to operate in each region. Market dynamics increased after the introduction of telephone charges paid by the calling party. By 2004, certain regions had up to four mobile operators (*Telcel*, *Iusacell*, *Telefonica*, *Unefòn*). However, although the market is more competitive than in the case of fixed telephony, Telmex, which has also extended its coverage in the Latin American mobile market with the company Telcel (owned by *America Movil* (Telmex

group) and accounting for 78% of the Mexican market in 2004) has no competitors in Mexico and this is one of the main reasons for its sound financial health. Indeed, *America Movil* is expecting revenues of around US\$ 20 billion for 2004, with an EBITDA of 37% and a net income of 16% of sales. Instead, *Telefonica Moviles*, in spite of estimated sales at US\$ 136 million, with 4 million customers in Mexico by mid-2004 (a 61% increase in a year) still had a negative EBITDA by mid-2004. Also *Iusacell*, which operates mostly in the southern part of Mexico, had a smaller customer base (1.3 million subscribers) with an EBITDA of around 15%, related in particular to the conservative accounting policies for handset sales. Finally, *Unefón* is the smaller country operator in terms of subscribers and was the first company to employ a prepaid only category.

Figure 5.8 – EBITDA Margin – Mobile Providers in Mexico



Source: Crédit Suisse /First Boston and Deutsche Bank

\*Note: Amx includes Tecel operations

### 5.2.3. REGULATORY FRAMEWORK AND INSTITUTIONAL DEVELOPMENT

The Federal Law of Telecommunications (*Ley Federal de Telecomunicaciones*) regulates the use of the radioelectric spectrum, the telecommunications network and satellite communications, which are considered as general ways of communication. The Law promotes competition by delegating the provision of services to the private sector, but the state, through the Federal Telecommunications Bureau (*Comisión Federal de Telecomunicaciones, COFETEL*), is in charge of the regulatory and mediatory roles. The Laws of General Ways of Communication, National Goods, Radio and TV, Administrative Procedures, and the Commercial, Civil and Federal Codes complete the Federal Law of Telecommunications in the aspects otherwise uncovered.

COFETEL, under the SCT, is the institution in charge of promoting the efficient development of telecommunications, issuing the necessary norms and dispositions within the sector, granting and supervising concessions, promoting interconnection (including the design of interconnection plans and the resolution of conflicts arising from interconnection issues), keeping a record of frequency assignments and a Telecommunications Registry, gathering information of prices set by providers, and so on.

An operator must be awarded a concession to obtain frequency bands, to install and operate public telecommunication networks, satellite positions, and to receive or send satellite signals. Concessionaires must be Mexican citizens or companies, but a foreign investment of up to 49% of shares is allowed. Radio-electric concessions are granted through auction mechanisms, have a duration of 20 years and may be renewed. Concessions for public telecommunication networks last for 30 years and may be renewed. A permit is needed for ground transmission stations and to provide telecommunication services other than public services, with the exception of value-added services (which only have to be listed in the Registry).

Prices and rates are freely determined, subject to non-discrimination and cross-subsidy constraints. In cases where the SCT regulates such prices or rates (for example, in the presence of a dominant operator), the regulatory principle is the coverage of at least long-run incremental costs.

Mexico followed an international wave of deregulation and privatization of the sector, as in the case of other Latin American countries. One of the precursors in privatization reforms in Latin America was Chile. Reforms were initiated in the 1970s-1980s, with the creation of a regulatory agency (in 1977), a regulatory framework for the sector (in 1982, defining objectives and non-discriminatory access, continuity and quality criteria to grant concessions) and the privatization of fixed link and long-distance companies (CTC and Entel, respectively, between 1985 and 1988). The regulatory framework defined regulated charges for fixed telephony and, since 1994, access. Competition started to develop with the entry of mobile telephony operators, multi-carriers and cable TV companies in telephony and broadband. Chile is currently facing some challenges with regard to the regulation model (specifically, the “*empresa modelo*” is based on a real enterprise – a similar problem that may arise in Mexico with long-run incremental cost remuneration – and the lack of sanctions for non-deliveries of relevant information), the allocation of common charges, asymmetries in access charges, and so on.<sup>35</sup>

In Mexico, even though the ground for competition seems to be prepared, some regulatory problems need to be revised for the full benefits of privatization to be obtained. First, fixed line density is still low in Mexico and very uneven across the states. Moreover, a significant proportion of households do not have access to the basic lines. Second, the lack of agreements among operators for the implementation of interconnection has had negative effects on competition. A recent report by Kessides (2004) states that the main obstacle to competition is the overwhelming size of Telmex (which seems to have extended its power to competitive segments such as Internet and value-added services) on the one hand, and the weakness of COFETEL on the other hand.

<sup>35</sup> For further details, see Arellano (2004), “*Evolución de los Servicios Públicos en Chile*”, presentation in LAURIN.

### 5.3. POLICY OPTIONS AND IMPLICATIONS

The telecommunications sector in Mexico is affected by a combination of closely related strong incumbents in the fixed and mobile markets and a weak regulatory environment.

Indeed, Telmex is maintaining its dominance in the fixed line market and obtained 95% of new fixed lines during the first half of 2004. Moreover, its dominant behavior is reflected in Telcel, which obtained 73% of new mobile lines during the first half of 2004.

Further development of telecom services will require increased powers and an improvement in the credibility of the regulator, as COFETEL has received criticism in the past for its ineffective role. New regulatory decisions need to be put into effect in order to promote competition with new services, to obtain gains in efficiency, and to give better incentives to operators. Key areas could be the licensing of cable TV operators to enable them to get a foothold in the voice market and to promote VoIP services to improve access of the local exchange carriers to the “last mile”. The need for new regulatory decisions is especially important given that discussions about reforms in the Mexican telecom laws have been unsuccessful during the last three years and that regulatory decisions expected for 2004 have been delayed until 2005 and have given rise to increased uncertainty among operators.

Finally, it must be stressed that although mobile operators are recovering from financial difficulties, *Telefonica Moviles*, the strongest competitor to Telcel, is still losing money. In order to achieve further penetration of mobile services, it will be necessary to deal with the trade off between decreasing ARPUs, due to a more competitive environment, and the lower-income population receiving the service. The government is also expecting more competition by putting up a new mobile license for sale.

### 5.4. PRIORITIES FOR FUTURE REFORMS

The main priorities for the policymaker, in order to improve the Mexican telecommunications sector, are to:

- (i) promote of competition by increasing licenses and players in the market, while imposing restrictions on the Telmex group quasi-monopoly market position;
- (ii) strengthen of COFECO’s antitrust authority role and power;
- (iii) enhance the power and credibility of the regulator, COFETEL, by supporting its decisions instead of protecting the dominant players, which has the effect of delaying the new regulatory framework and increasing uncertainty among operators;
- (iv) force an agreement concerning the implementation of interconnection among operators; and
- (v) promote the diffusion of new telecommunications services such as the Internet, VoIp, and cable TV, by assisting new operators in providing access to the “last mile”.

## 6. REGULATION: THE WAY FORWARD

This chapter takes stock of the analyses given in the previous sections. The Mexican government has taken several steps to achieve a modern and efficient **road system**, granting concessions for the operation of infrastructure and service provision. The key challenges faced by the government are associated with the improvement of coverage, safety, efficiency and competitiveness of transportation services. In order to achieve these goals, a revision and harmonization of the legal framework is needed, specifically, by harmonizing state legislation in order to avoid the use of discretion, providing legal security to investors, rendering better and more efficient services, and strengthening the supervision of concessions.

In recent years, improvements in the **railway sector** have opened up options for diversifying domestic transport services. Concessions have improved the productivity, safety and quality of rail services. But in order to achieve optimal performance in relation to both infrastructure and services, it is necessary to strengthen interaction between concessionaires (e.g. interconnection services), which must be regulated by clear norms, and to consolidate the agency's supervisory and regulatory role in order to promote efficient, safe and high quality services. Regulatory efforts should be concentrated on consolidating the framework to attract new investments and to promote competition.

In the **port sector**, the decentralization program in the mid-1990s showed that important benefits could be derived from reduced tariffs, improved efficiency and productivity, self-sustainability within the sector, and new investments. The need for an efficient, autonomous and independent agency to undertake regulatory, supervisory and dispute-solving roles must be emphasized, especially given that Mexico is facing a significant need for decentralized maritime and port services.

The **airport sector**, as in the case of the ports, is becoming a strategic sector for satisfying the needs of trade and tourism. The challenges for facing such competitive conditions are (i) the consolidation of the airlines' financial health in order to achieve efficient, high quality and safe services; (ii) the fostering of access and competition; and (iii) the strengthening of the airport authority's regulatory and supervisory role. In order to do so, government actions should concentrate on increasing coverage of air transportation services, increasing the quality of services and infrastructure towards international standards, and improving efficiency of both infrastructure and services. An option for the development of competition in air transport services may be the transfer of national companies to the private sector. With respect to the legal framework, it should be noted that the regulatory agency is a state institution. Therefore, normative reforms that modify the airport authority in the direction of a more autonomous and independent body may help to provide more regulatory certainty for the sector.

In the **electric power sector** there is consensus about the need for reforms to face the future of the market, specifically regarding private sector participation to develop investments.

The main steps towards reform in the sector include amendments to Articles 27 and 28 of the Political Constitution to permit concessions, and amendments to the current legal framework to improve regulation. But there has to be a clear awareness of the benefits of creating a fully-fledged power market, well isolated from opportunistic interventions. A similar consideration applies to liquid hydrocarbons and natural gas (see the discussion on the next page).

Second, so far, the rules given by the reforms have not been clear enough to foster investment in several kinds of supply (other than IPPs). Given that PPAs create the risk of future contingent liabilities, the government should take this into account and find other alternative contractual models to apply for future investments; however, the choice of instruments to be adopted depends on the future structure of the market.

Third, a revision of the current performance of the main actors is recommended, especially in cases of bad accounting or when there is strong interference from interest groups in the functioning of a company. A structural reform of the public operators is recommended (including the revision of goals, current structure, performance, etc.). The transfer of transmission and distribution activities to the private sector is a possibility. Again, feasible reforms depend on the future structure of the market.

Fourth, given that subsidies to low-income and rural users are poorly targeted, and considering that an important proportion of low-income and rural users have no access to this service, a revision of the subsidy structure from consumption to access may have positive welfare effects.

Fifth, a coordination of the different regulatory tasks under the auspices of a specific autonomous and independent agency would be a positive step towards regulation of the sector.

In the *liquid hydrocarbons sector*, the need to promote efficiency and productivity in order to meet demand and quality requirements to improve environmental standards, requires private participation in investments. (See the notes for electricity regarding the reform of the Political Constitution.)

Second, the way in which current participation in production is handled, through service contracts, does not give incentives to private actors to explore and produce. The above-mentioned revision in the Constitution may also help to revise contracts in order to base them on performance.

Third, a revision of the current performance of Pemex is recommended, especially when there is strong interference from interest groups (labor unions) in the functioning of a company.

In the *natural gas* sector, appropriate regulatory instruments are needed to encourage new investments in production, transportation and distribution. As mentioned above, a good starting point would be a revision of the Political Constitution. In the areas currently under the Nation's jurisdiction, one option would be to open exploration and production to the private sector through concessions, which could be feasible if reforms in the regulatory framework (including the Constitution) are successful.

Regulatory activities are divided between the CRE (under SENER) and the other Secretariats (including other divisions of SENER), which may hamper the goals of regulation in the three energy sectors (electric power, hydrocarbons, including natural gas). The unification of all these activities under the same institution (e.g. the CRE) is recommended. Also, the CRE Board shows continuity in its functions, but decisions may be subject to political pressure (either through SENER or the Executive); a reform of this institution is therefore necessary to give it greater independence in its actions.

In the *water and sanitation sector*, it is difficult to evaluate the regulatory framework given the high degree of decentralization. However, the fact that well-defined rules provide transparency and credibility to service providers and final users is broadly accepted. Along these lines, several aspects require revision. In the case of Mexico City, the management of services was achieved through service contracts without going ahead with full concessions. The division of

regulatory activity across several agencies and municipal governments implied a diffuse institutional and political environment in the city. This may have reduced the impact of regulation on the performance of the sector. Hence, it is clear that the simplification of the regulatory role in a single agency is necessary. This general rule is applicable to all Mexican cities in which this problem exists.

In addition, there appear to be some problems with the legal framework governing the concession in Mexico City, and more specifically with the lack of a legal basis for cutting service to non-paying customers. A revision of the legal framework to provide efficient service and also to give the final user appropriate incentives for the use of water and sanitation services is recommended.<sup>36</sup> Although service contracts were awarded in the mid-1990s, delays in defining the following stage of management contracts (concessions) have reduced government credibility and limited support for advancing to the next step in reforms.

Finally, given the delicate situation in relation to coverage and quality, governments should dedicate efforts to designing instruments for fostering investments to extend coverage and improve quality (targeted mainly to low-income and rural areas).

The *telecommunications* sector has demonstrated significant progress in developing a comprehensive framework for fostering competition. In a second stage of reforms, some revisions could be made in order to achieve the full benefits of competition. First, given that coverage is still poor in several areas, the implementation of universal service regulation linked to interconnection should be analyzed. Alternatively, an increasing coverage of cellular phone lines may compensate for the lack of fixed-link line access. In fact, by 2000, the number of cellular phone lines already far exceeded the number of fixed lines. Second, the revision of interconnection and access rules (such as selecting the service operator through dialing), along with certain forms of assistance to entry to remove obstacles to competition, should be studied. A study by the Antitrust Agency regarding the extension of market power may clarify whether Telmex is hindering the development of competitive services.

With regard to the regulatory agency, there are two aspects to note. First, in almost all sectors the regulator (COFETEL in telecommunications, CRE in energy, CNA in water, etc.) lacks autonomy and independence from political actors. A full assessment of the benefits deriving from an independent and autonomous regulatory agency could help to improve control over activities within the corresponding market. Second, in several instances the normative framework is heterogeneous (roads) or the regulatory role is diffuse and shared by several agencies (water, electricity). Harmonization of regulation and regulatory activities would help in the pursuit of a coherent sector policy.

Table 6.1 summarizes the main challenges regarding regulation.

<sup>36</sup> Access to the contracts was not available. There may be additional regulatory flaws in the contract, and also in the service contracts of other cities.

Table 6.1 – Regulation: The Way Forward

SECTOR		WAY FORWARD	
Sub-Sector		Short Term (0-2 years)	Medium Term (2-5 years)
TRANSPORT	Roads	<ul style="list-style-type: none"> <li>* Expand coverage and access to road infrastructure (including rural areas)</li> <li>* Improve road quality conditions, as well as safety, efficiency and competitiveness of transportation services</li> <li>* Strengthen supervision of concessions</li> </ul>	* Harmonize the legal framework throughout the national territory
	Ports	* Unify regulatory activities in an autonomous and independent agency	-
	Airports	<ul style="list-style-type: none"> <li>* Foster access and competition</li> <li>* Strengthen the regulatory and supervisory norms that guide the airport authority's activities</li> </ul>	* Transfer of national companies to the private sector
	Railways	<ul style="list-style-type: none"> <li>* Regulate interconnection services to allow for interaction between concessionaires</li> <li>* Consolidate the role of the supervisory and regulatory agency</li> </ul>	-
ENERGY	Electricity	<ul style="list-style-type: none"> <li>* Assess the need to amend Arts. 27 and 28 of the Political Constitution to allow for private participation at all stages.</li> <li>* Foster private generation through contract instruments</li> <li>* Assess targeting of subsidies to low-income and rural users</li> <li>* Assess the independence and autonomy of the CRE and coordinate its regulatory activities.</li> </ul>	* Structural reform of the normative framework to include participation of the private sector
	Oil	<ul style="list-style-type: none"> <li>* Assess the need to amend Arts. 27 and 28 of the Political Constitution to allow for private participation</li> <li>* Explore contract alternatives to give incentives for private exploration and production</li> </ul>	* Revise the organic structure of Pemex
	Natural Gas	<ul style="list-style-type: none"> <li>* Assess the need to amend Arts. 27 and 28 of the Political Constitution to allow for private participation</li> <li>* Unify regulatory activity in one independent and autonomous entity</li> </ul>	-
WATER & SANITATION		<ul style="list-style-type: none"> <li>* Unify regulatory activity in a single entity</li> <li>* Revise legal basis for provision and charge (e.g. the policy of not cutting service to non-paying customers)</li> <li>* Envisage instruments to extend coverage and improve quality targeted to low-income and rural areas</li> </ul>	* Embark on credible commitments for the next stage of reforms (from management to concessions)
TELECOMMUNICATIONS		<ul style="list-style-type: none"> <li>* Implementation of universal service regulation to increase coverage in several areas</li> <li>* Revision of regulation for interconnection and access</li> <li>* Strengthen the regulatory power of COFETEL.</li> </ul>	* Pro-competitive measures (entry assistance)

## 7. ESTIMATES OF INVESTMENT NEEDS

The aim of this section is to provide some indicative estimates of infrastructure investment needs in Mexico for the time period 2003-2010. We rely on a fairly simple procedure. First, we estimate the underlying relationship between infrastructure investment and a set of socio-economic variables for a sample of 40 countries. Second, we use these estimates to assess Mexico's infrastructure gap in 2002. Third, we project the country's investment needs over the full projection period, from 2003 and 2010. For this latter step, we rely also on projected values of the determinants of infrastructure over the 2003-2010 period. Finally, we convert projected physical investment needs into money terms.

We consider four different types of infrastructure: electricity generating capacity, roads, railroads and telephone mainlines. In Table 7.1, we list the sources of all those variables as well as those of the socio-economic variables that are assumed to determine the demand for infrastructure stock.

**Table 7.1 – Description of Variables**

Variable	Notation	Source
Electricity generating capacity (000s of Kw)	Energy	Calderon and Servén (2004)
Main telephone lines in operation	Tcom	Calderon and Servén (2004)
Paved Road Length (in km)	Road	Calderon and Servén (2004)
Railroad route length (in km)	Rail	Calderon and Servén (2004)
Agriculture, value added (% of the GDP)	Agr	WDI
Manufacturing, value added (% of the GDP)	Man	WDI
Population density (people/sq. Km)	PopDen	WDI
Urban Population (% total)	Urb	WDI
GDP per capita in constant 1995 US\$	GDP	WDI

The first step is the estimation of a statistical relationship linking infrastructure with the explanatory variables listed in Table 7.1. Table 7.2 reports the econometric estimates. We rely throughout on the GMM-IV procedure. Our sample spans from 1960 to 2001 and covers 40 countries, including East-Asian, industrialized and less-developed countries. The choice of the GMM estimator was dictated by the need to control for possible endogeneity problems. Dependent variables are defined as the ratio between a given considered infrastructure stock and total population, in order to avoid problems of non-stationarity in time series.

Table 7.2 – Estimated Models for Infrastructure Predictions

Dep. Var.:	RAIL	ROAD	ENERGY	TCOM
Constant	0.000571 (12,619)***	0.018174 (16,007) ***	-0.000282 (-5,144)***	-3.038919 (-6,140) ***
Lagged dep. Var.				0,000312 (8.657) **
GDP CAP	-8.86E-09 (-3,693)***	9.38E-07 (4,035) ***	1.80E-07 (11,647)***	2.82E-05 (27,264) ***
MAN	5.70E-06 (7,177) ***	3.11E-06 (4,505) ***	1.47E-06 (0,152) ***	-0.00236 (-7,820) ***
AGR	1.00E-06 (1,357)	-8.54E-07 (-1,236)	5.16E-06 (4,569) ***	-0.000423 (-1,352)
POP DEN		2.16E-06 (9,082)***		-0.000246 (-3,163) ***
POP URB	-6.37 (-11,639) ***	2.38E-06 (3,197) ***	9.70E-06 (14,802) ***	0.001499 (4,535) ***
TIME				0.001509 (5,854) ***
R <sup>2</sup>	0.985	0.976	0.983	0.976
N. of obs.	1,037	1,031	1,018	1,064

Notes: Estimates are obtained with GMM-IV procedure with fixed effect, for which instruments are all lagged variables

\*\*\* significant at 99%; \*\* significant at 95%; \* significant at 90%

To forecast infrastructure investment needs for the period 2003-2010, we must project the values of the regressors in Table 7.2. Fay and Yepes (2003) rely on UN projections for population and on the Global Economic Prospects by the World Bank for the other variables. Unfortunately, those figures are only available at regional level. We follow, therefore, Loayza *et al.* (2004) and rely on the dynamic simulation of simple stochastic processes (ARMA). Results are summarized in Table 7.3.

Table 7.3 – Projected Values

	GDP	Population Density	Man	Agr	Urb
2003	3,669.05	53.60	21.79	4.57	75.40
2004	3,688.55	54.39	21.81	4.44	75.68
2005	3,707.39	55.19	21.82	4.31	75.97
2006	3,725.61	55.99	21.83	4.19	76.24
2007	3,743.21	56.79	21.84	4.07	76.51
2008	3,760.24	57.58	21.85	3.95	76.77
2009	3,776.70	58.38	21.86	3.84	77.02
2010	3,792.63	59.17	21.87	3.73	77.27

For the percentage of agricultural value added, we simply assume a constant value over the projection period.

We can now project future investment needs in physical terms. To assess the required amount of spending, we use the following unit costs (Fay and Yepes, 2003):

- (i) \$1,900 per kilowatt of generating capacity, including associated network cost;
- (ii) \$410,000 per kilometre of paved road;
- (iii) \$900,000 per kilometre of rail; and
- (iv) \$400 per telephone mainlines.

**Table 7.4 – Infrastructure Investment Needs (% of GDP)**

	Mexico			
	Average (2004-2010)	To fill the gap (2003)	LAC median	EAP median
<b>Energy</b>	0.70%	0.01	0.98	1.24
<b>Rail</b>	0.06%	0.05	0.06	0.06
<b>Road</b>	0.69%	0.01	0.89	0.50
<b>Tcom</b>	0.31%	0.31	0.41	0.85
<b>Total</b>	1.76%	0.38	2.42	3.33

In Table 7.4, we distinguish between the initial level of investment needed to bring Mexico's infrastructure stock in line with what is warranted by its socio-economic characteristics and subsequent investment spending required to keep pace with changes in GDP and the other determinants of infrastructure needs. According to our estimates, Mexico should invest about 0.38% of its GDP in 2003 simply to bring the country's infrastructure stock in line with our estimated benchmark. Alternatively, we could have assumed that the large initial investment should be spread over the full projection period. From 2004 onward, further investment in infrastructure is mainly driven by the demand factors in regressions in Table 7.2 and is therefore designed so as to keep the infrastructure supply and the demand in equilibrium.

It is interesting to note that Mexico does not need to invest more in infrastructure, as the period average estimate is larger than the investment needed to fill the gap with its benchmark. Notice that this figure is corroborated also by what is reported in Chapters 3 and 5 of the present Country Brief, as values reported in Table 7.4 are very close to the present path of investment in the country. However, according to data in Calderon and Servén (2004), Mexico is expected to invest 0.36% of GDP more than the average amount for the period 1994-1998 (1.4%).

## 8. CONCLUDING REMARKS

The aim of this country brief has been to give a snapshot of the current infrastructure outlook in Mexico, focusing particularly on key challenges and on priorities for implementing future reforms in order to meet the Millennium Development Goals. In particular, the country has been analyzed by comparing it with two main benchmarks:

- (i) *the regional sample* consists of seven Latin American countries, namely Argentina, Brazil, Colombia, Costa Rica, Guatemala, Mexico and Peru; and
- (ii) *a peer group of countries* (classified by OECD's Development Assistance Committee to be higher middle-income countries – HMIC) characterized by the same level of development – Argentina, Brazil and Costa Rica.

The following summarizes the main results of this report.

Mexico is one of the most developed countries in Latin America, with the second highest GDP PPP per capita (following that of Argentina). This is due in part to its internal natural resources (petroleum, for example) and its proximity to developed countries such as the United States. Recently, Mexico has strengthened the commercial relationship with the USA and CANADA, joining the free market area of the North American Free Trade Agreement (NAFTA).

This agreement is certainly at the core of recent improvements in infrastructure facilities, enabling Mexico to face the challenges offered by the two North American giants. Hence, there has been a strong impetus towards privatization, mostly in the transport system.

The privatization model aims at keeping the ownership of infrastructure in public hands and awarding management to the private sector under concessions agreements. Although the wave of privatization has touched almost every sector, liberalization has not been successfully completed in some cases, especially in the energy sector, in which almost the entire market share has been left in public hands and the issues of regulation and the establishment of competitive market rules have been delayed.

The main purposes of the reform were to collect resources for new projects and at the same time to reduce the capital burden on fiscal budget expenditure. The first goal has been achieved through the sale of the main state-owned companies to private investors, and the second one has been achieved by setting up a tariff plan to cover both capital expenses for maintenance and operating expenses, granting a reasonable return to private investors.

The **road system** shows inadequate overall performance. In particular, the extension of the road network has lagged behind, leading to a fairly low road density indicator. By contrast, the road quality indicator for Mexico road is better than that of comparable countries. The poor performance of the road network is mainly due to privatization. This is due to over-optimistic estimates of traffic demand; as a consequence, a great part of the network was returned to the previous owner (i.e., the state) when private management ownerships failed. The supporters of privatization should give some thought to this issue, particularly in the transport sector; the government or the municipality in charge of the tender procedure had not paid attention to the actual traffic flows, had failed to allocate the risks appropriately and, above all, did not deliver on guarantees and contractually obliged adjustments during the toll roads debacle, due to political constraints. This experience continues to cast a shadow over toll roads. Devising mechanisms to finance the operation and maintenance expenditure required in this sector remains an urgent priority. Furthermore, the role of the SCT has not yet evolved from operator to watchdog.

The **railway network** is one of the most developed in Latin America; a higher rail density indicator was recorded only by Costa Rica.

The railway system also underwent major reforms during the last decade, especially in 1995 when a large part of the network was awarded to the private sector. The results of the reforms may be summarized as follows:

- (i) concessions have generated a significant cash flow to the federal government;
- (ii) the government does not grant subsidies either to the operation or to investment activities;
- (iii) the main trunk concessions last for a 50 year term;
- (iv) concessionaires must pay a concession fee to the government based on invoiced revenues (0.5% in the first 15 years and 1.25% from the 16<sup>th</sup> year);
- (v) contracts did not foresee inversion limits; and
- (vi) tariffs must cover all costs under a cap registered with *Secretaria de Comunicaciones y Transportes* (SCT).

Another important point worth underlining is the failure to achieve progress in inter-modality in the Mexican transport sector; certainly, one of the major obstacles to achieving inter-modal competition is the lack of coordination between multi-modal agents and authorities, leading to a lack of inter-modal facilities.

The **port sector** has undergone major changes in recent years and many concessions have been granted (64 by 2003). Until 1993, *Puertos Mexicanos* (PUMEX) was the sole port operator in Mexico, and it had, until then, a monopoly power over the construction and exploitation of port infrastructure. Eventually PUMEX's low productivity led to its dissolution and to the passing of the Port Law. The key points of the Port Law are:

- (i) decentralization of port management through the establishment of the *Administración Portuaria Integral* (APIs), state-owned commercial companies responsible for port management. These companies are open to state participation and local entities as well as private sector representatives; in fact, one of their main objectives is to attract private investments;
- (ii) competition between operators; and
- (iii) simplification of regulatory issues.

The reform enabled the government to maintain ownership of port infrastructure, but services became privatized. The port reform significantly improved performance in the sector. According to Sanchez (2003), ports no longer receive subsidies for their activities, but rather have started contributing to the government budget (owing to the dividends on profits). Indeed, between 1990 and 1994, state fiscal transfers to ports had reached US\$ 67 million; while, between 1996 and 2002, APIs paid up to US\$ 35 million to the federal government. Aside from this fiscal issue, it is worth mentioning that, following reforms, there were increases in investments, in terminals and storage capacity, and improvements in performance indicators.

As for the **airport sector**, Mexico is endowed with 12 large airports (over 3,047 meters), more than all the other higher-middle income countries. The six major airports are in Cancun, Guadalajara, Mexico City, Monterrey, Puerto Vallarta and Tijuana, all located in the main commercial cities or tourist centers.

The privatization of airport management is practically complete, while ownership is mainly in public hands, and managed by *Aeropuertos y Servicios Auxiliares* (ASA). The privatization program launched in 1998 is believed to have been an intelligent step as it allowed private participation in the sector. The concessions awarded were to last 50 years and involved 35 airports, with four controlling entities – Mexico City Group, the Northern Central Group, the Pacific Group and the South-Eastern Group.

With regard to the indicator *number of passengers per 1,000 people*, it is significantly lower than the average of all the Latin American countries taken into account; however, it is higher than the average of the higher-income group. The indicator *ton-kilometers of freight per 1,000 people* shows relatively low performance on the part of Mexico compared with the figures of the two other benchmarks, but the differences are becoming smaller, mainly due to decreasing benchmark values.

In conclusion, according to the World Economic Forum report, the quality of airport infrastructure in Mexico is in line with that of its income group.

The **energy sector** is dominated by two state-owned incumbents, CFE and LFC, which have near exclusivity over the generation, dispatch, transmission, distribution and marketing of electricity as a public service. The status quo is maintained by politicians interested in keeping the sector in public hands. Nevertheless, the incumbents are leveraged and will not succeed in facing energy restructuring and modernization needs. Although the level of energy coverage is among the highest in Latin America, the main power generators are 30 years old and require extensive refurbishment or complete maintenance, and the debt situation is a constraint to development. The fostering of private investments through a more open market could be the solution.

Mexico's option for a model based on state ownership of public utilities and heavy public funding of investments and subsidies in the electricity sector has produced mixed results. Household access to electricity services is relatively high, lower only than Costa Rica in the sample of Latin American countries under consideration. Even access by families in sparsely populated areas is high by Latin American standards, at over 94%.

Electricity services are relatively affordable to Mexican families, with residential tariffs lower than the average in countries such as Argentina, Brazil, Costa Rica, Guatemala, Jamaica and Peru. Also, if using the percentage of GDP per capita spent on electricity as a proxy for the share of a household's income spent on electricity, it may be concluded that electricity does not constitute a heavy burden on household income. However, this has been accomplished at the price of heavy subsidies, a policy given which cannot be sustained given increasing fiscal constraints. In fact, recently, electricity tariffs have become more expensive, both for residential and non-residential users, reflecting the Ministry of Finance's aim of squeezing the subsidies.

On the other hand, service quality has improved recently; in fact, better performance may be seen in relation to both interruption time per user and connection time indicators. With regard to technical efficiency, Mexico's electricity transmission and distribution losses indicators are slightly higher than those observed in the other higher-middle income countries.

From an economic point of view, both the CFE and the LFC show very poor financial indicators, characterized by an alarming downward trend. Certainly, greater efficiency is necessary, and the replacement of the old generation plants is an issue requiring urgent attention.

On the fiscal side, the main points are as follows: Mexico's electricity sector is largely dominated by state-owned utility companies, tariffs are subsidized and energy markets are limited; therefore, it is to be expected that the sector is largely dependent on fiscal funds. In fact, around 1.8% of GDP on average has been poured into the electricity sector during recent years. The transfer amount is exceptionally high, especially when compared with the corresponding figures for Brazil and Argentina, countries with similar levels of development. In 2001, Brazil's total expenditure amounted to 0.30% of GDP, while Argentina's equaled 0.12% of GDP. In conclusion, by controlling input prices (oil and kerosene), output prices (electricity tariffs) and most of the generation and all electricity transmission and distribution, the government has created an enormous fiscal burden. Public electricity companies probably would not survive without government transfers and investments in expansion and maintenance of the grid would not be made at the necessary levels. In fact, although this is not required for the purpose of further investment expenditure, the CFE and LFC's current debt situation probably calls for capital increases by the government.

Therefore, no matter how much public finances have improved, the Mexican government needs to promote policies favoring the attraction of private investors into the electricity sector. There have been significant fluctuations in the levels of private investment in energy as a percentage of GDP, due to the dominant position exercised by publicly owned companies and the lack of a firmly established regulatory framework for the sector. Given the heavy opposition to this idea from a large part of the population and a significant range of the political spectrum (as shown by the opposition of Congress to the IPP scheme), it should be initiated through public-private partnerships (PPP) rather than sales of public assets. The government should run campaigns to enlighten the population about the shortcomings of a publicly-funded electricity sector and the benefits of inviting in private capital. The regulatory environment constitutes another important front in this endeavor. Measures to increase the volume of transactions performed in energy markets and to reduce the uncertainty of the regulatory framework are indispensable in order to allow the entry of private investments into the electricity sector.

As for *the water and sanitation sector*, in accordance with the Constitution, the municipalities have been assigned direct responsibility for water and sewerage services, which may be delegated to public or private operators. However, the water companies do not own the infrastructure and the proceeds derived from payment for these services are considered as taxes rather than income. In fact, they are managed by the main federal agency responsible for overseeing the sector: the National Water Commission, the CNA. This agency is responsible for the formulation and implementation of national water policies, which form part of the national policy for environmental management, health, and economic development. One element of this mandate is the definition of policies and strategies aimed at strengthening the technical, managerial and financial capacities of state and municipal water companies. Mexico has environmental legislation and there is a group of institutions responsible for managing and planning the use of hydro resources, including procedures on water usage. The River Basin Councils are the most representative of these institutions. They are responsible for coordination between the National Water Commission, agencies and entities at federal, state, and municipal levels, and representatives of users of the respective river basins. The aim of these councils is to design and implement programs and related services, and to preserve the river basins' resources (Article 13 of the National Waters Law). In order to function appropriately, River Basin Councils may have auxiliary organizations at the level of the sub-

basin, micro-basin and aquifer named, respectively, River Basin Commissions, River Basin Committees, and Technical Groundwater Committees (COTAS).

With regard to the technical dimensions of the sector, given the drop in investments due to the budget constraints, the situation is not really different from the rest of Latin America and it is at the core of environmental deterioration and the spread of diseases among the lowest income bracket population. This is a particular problem in rural areas, which are adequately covered neither by the water connection service nor, above all, by the sewerage service. As for the water coverage indicator, compared with the other Latin American higher-income countries, overall performance is fairly good in terms of connection (85% of the population reached); however, rural coverage (only 62% of population served) remains an issue to be addressed. The situation regarding the sewerage service is even worse, in fact, coverage in 2000 according to PHO data, was just 58% of the population. Nevertheless, this figure is the highest among the peer group of countries analyzed. Attention should again be drawn to the inadequate coverage in rural areas (13%) and to the significant percentage of the population without any type of sewerage service (68%) in this area, causing environmental and health problems.

As for service quality, according to PHO it is in line with the other comparable countries in terms of water supply time (24 hours) and slightly better in terms of the percentage of treated volume collected from the sewerage system; however, major efforts are needed to improve this type of service, given its importance for quality of life and health care.

Finally, considering sector efficiency, tariffs generally cover only operational costs and ordinary maintenance costs, but are not sufficient to generate positive cash flow in order to finance the necessary investments for expanding services or maintaining the system at an acceptable level. In fact, tariffs are subject the same procedures as those for authorizing taxes, rather than being transparently related to costs and quality of service. The system could be improved by increasing tariffs so as to reduce dependency upon fiscal resources and to enable the use the profits for new investments. This could induce private sector investment in this sector. Tariff setting focused on economic factors and greater private involvement could improve this sector's performance.

To summarize, the priorities for the water and sanitation sector are to:

- (i) extend coverage and improve service quality for drinking water supply, sewerage and basic sanitation;
- (ii) establish a tariff system based on costs and usage;
- (iii) increase private sector participation;
- (iv) achieve integrated, sustainable management of water in watersheds, basins and aquifers;
- (v) promote the technical, administrative, and financial development of the water sector;
- (vi) consolidate the participation of users and organized society in water management;
- (vii) promote widespread awareness about appropriate water use; and
- (viii) reduce the risks and effects of floods and droughts.

With regard to the *telecom sector*, Mexico has carried out a deep privatization program since the 1980s, aiming at withdrawing the state interest from the main infrastructure sectors of the

country and at attracting private investments. Telmex, the state-owned telecom carrier, was privatized in the 1990s, and since then competition has been slowly introduced in all the telecom segments. Telmex has retained its market leadership and the competitors have complained on several occasions about the uncompetitive behavior of the incumbent. During the first half of 2004, Telmex obtained 95% of new fixed lines. The dominant behaviour of Telmex is reflected in Telcel, a Telmex subsidiary in the mobile market, which obtained 73% of new mobile lines during the first half of 2004. The decision to privatize Telmex as a temporary monopoly, introducing competition and regulatory institutions only after privatization was completed, allowed Telmex to earn excess profits. The very expensive monopoly prices led to a reduction in demand, making the sector less attractive to new private operators, and resulting in a lower than expected private investment. In fact, universal access is far from being achieved and fixed-line penetration lags behind the other Latin American countries. Conversely, there is widespread access in the mobile market, which enjoyed major competition at an early stage, compared to the other Latin American countries.

Unfortunately, the affordability of service remains an issue; in fact, overall, in Mexico telecommunications services are expensive than in the benchmark countries, although it is fair to note that service quality is also higher. The high prices have led to outstanding financial performance, especially by the two closely related dominant players in the fixed-line and mobile markets, while the competitors are still struggling to achieve economic positive results.

To conclude, the main priorities for the policymaker in order to improve the Mexican telecommunications sector are:

- (i) to promote competition by increasing the licenses and the players in the market, along with imposing restrictions on the Telmex group quasi-monopoly market position;
- (ii) to strengthen the role and power of COFECO as an antitrust authority;
- (iii) to enhance the power and credibility of the regulator, COFETEL, by supporting its decisions instead of protecting the dominant players, which has the effect of delaying the new regulatory framework and increasing uncertainty among operators;
- (iv) to force an agreement concerning the implementation of interconnection among operators;
- (v) to promote the diffusion of new telecommunications services such as the Internet, VoIp, and cable TV, by assisting new operators in providing access to the “last mile”.

Finally, to summarize the main conclusions achieved in Chapter 7 regarding investment needs, as shown in Table 7.4, the estimated average for the period 2004-2010 is around 1.76% of GDP. The breakdown of this figure is as follows: Road, 0.69%; Rail, 0.06%; Energy, 0.70%; and Telecommunications, 0.31%. It is worth mentioning that on average during the period 1995-1998 the total investment in infrastructure in Mexico, according to Calderon and Servén (2003), has been 1.04% of GDP. Furthermore, the initial investment level needed to bring Mexico’s infrastructure stock in line with the level warranted by its socio-economic characteristics would account for 0.38% of GDP.

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## **COUNTRY BRIEF - MEXICO**

*Nacionales, que incluye aquellas disposiciones que se reforman, adicionan y derogan, así como las que no han sido objeto de enmienda alguna”.*

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