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Market study on the Mexican market  
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**MARKET STUDY ON THE MEXICAN MARKET FOR  
ELECTRICAL DISTRIBUTION EQUIPMENT**

This market study has been prepared to assist Canadian firms interested in exporting to Mexico. While an effort has been made to examine the most important aspects of the sector, the study is not exhaustive. Companies will have to tailor their marketing approach according to their particular interests and circumstances.

Further assistance can be obtained by addressing requests directly to the Commercial Division of the Canadian Embassy in Mexico City located at Calle Schiller No. 529, Col. Polanco, 11580 Mexico, D.F., telephone (011-525) 254-3288, telex 177-1191 (DMCNME) and fax (011-525) 545-1769 (sending from Canada); or the Latin America and Caribbean Trade Division, External Affairs and International Trade Canada, 125 Sussex Drive, Ottawa, Ontario, K1A 0G2; phone (613) 996-8625; fax (613) 943-8806.

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MARKET STUDY ON THE MEXICAN MARKET FOR  
ELECTRICAL DISTRIBUTION EQUIPMENT

INDEX

	PAGE
1. BACKGROUND	2
2. ECONOMIC ENVIRONMENT	3
3. MARKET ASSESSMENT	5
3.1 Imports	6
3.2 Domestic Production	8
4. END USERS	9
5. PROJECTS	16
6. MARKET ACCESS	20
APPENDIX I : Industrial Chambers and Associations	22
APPENDIX II : Useful Government Agencies	23
APPENDIX III: Potential Agents and Distributors	27



## 1. BACKGROUND

During the last two decades of the 19th century, Mexico began its electrification process, by supplying principally mines, textile firms and other industrial establishments, and later with public lighting in Mexico City and a few homes. By the beginning of this century, there were 177 plants throughout the Mexican territory and several private electrical companies supplying the country's most important cities.

During the era of Porfirio Díaz, foreign investors began to consolidate large electrical firms in Mexico. In 1902, the Mexican Light and Power Co. Ltd. was founded in Ottawa, Canada to create a hydroelectrical plant in Necaxa with a capacity for 31,500 kW, and to supply Mexico City's electricity needs. Later it expanded to supply the states of Puebla, Hidalgo, Mexico and Michoacán. During over 50 years, this company supplied electricity to these places and others that were gradually incorporated to its network.

In the state of Jalisco, operated the Compañía Hidroeléctrica de Chapala, later called Compañía de Chapala. In 1907 it was reorganized under the name of Guadalajara Tramway, Light & Power Co. In 1909, the Compañía Hidroeléctrica Irrigadora de Chapala was founded to substitute the previous companies. By 1928, the hydroelectrical plant of Puente Grande had a capacity 14,400 kW, in addition to the Las Juntas plant with 7,400 kW.

The American and Foreign Power Co. began operating in 1928 by purchasing several existing companies, and began operating under the Compañía Impulsora de Empresas Eléctricas. After a few years, this group had three interconnected systems and four isolated companies.

By 1937, these three large conglomerates had an installed capacity of 628,980 kW. The consumers, however, were not satisfied with the supply of electricity by these companies. Service was defficient, tariffs were high, electricity was scarce and most of rural Mexico and marginal areas of cities were not being targeted at all to receive electricity.

On January 20, 1934, the Government published its initiative to create the Comisión Federal de Electricidad (CFE) in order to respond to these needs. It wasn't until 1937, however, under Presidente Lázaro Cárdenas, that the law creating CFE was passed.

The first major construction undertaken by CFE was the hydroelectrical plant of Ixtapantongo, in the state of Mexico, to supply Mexico City. This was mostly built with German equipment, since other countries, in particular the United States and Canada, were presssuring Mexico through an economic blockage in response to the 1938 nationalization of the petroleum industry. In order to finance this and other projects of CFE, in 1939 a 10% tax was assessed on the consumption of electricity.



In 1949, CFE became a public decentralized agency with its own legal and financial framework. Between 1944 and 1960, the CFE gradually consolidated and began to compete successfully with the foreign companies still operating in Mexico: the Mexican Light & Power Co.. (British-U.S.-Canadian capital) with their respective companies, although it sold most of the fluid through the private companies.

Between 1959 and 1960 CFE opened several plants with a total capacity of 308,000 kW, increasing thereby total installed capacity to three million kW. The most important plants were in Temascal, Oax; Monterrey, N.L.; El Fuerte, Sin.; Villahermosa, Tab. and Catemaco, Ver. During 1960, there were 20 plants in construction with a total capacity of 1.9 million kW. The most important ones were six hydroelectrical plants in Infiernillo-Mich., Mazatepec-Pue., Cupatitzio-Mich., Novillo-Son., Santa Rosa-Jal. and La Venta-Gro.; and three thermoelectrical plants in Monterrey-N.L., Tijuana-B.C. and Poza Rica-Ver. Many of these were used to provide rural areas with electricity. By then, there were eleven interconnected systems throughout the country.

In 1960, the Government decided to nationalize the electrical industry and purchased 90% of the shares of the Mexican Light and Power Co. and all of the American and Foreign Power Co. and it also demanded that the funds so obtained by the foreign companies (\$52 million and \$78 million respectively) were invested in Mexico. The industry now was constituted by the Compañía Mexicana de Luz y Fuerza Motriz (CMLFM) and its subsidiaries (previously the Mexican Light and Power Company), the NAFINSA electrical companies and CFE with its 19 new affiliates. Gradually, CFE purchased other small companies and integrated its operations by dissolving the 19 affiliates.

In 1960, total installed capacity of 2.3 million kW was distributed as follows: CFE 1.3 million kW, affiliates 128,000 kW, CMLFM 586,000 kW and NAFINSA 337,000. By 1970, only two companies remained: CFE with 5.4 million kW and CMLFM with 667,000 kW.

With the nationalization of the industry, the Mexican electrical system also began to be interconnected and to be unified to a 60 cycle frequency, in order to better supply large areas of the country.

## 2. ECONOMIC ENVIRONMENT

With the objective of reducing the inflation rate, the Mexican authorities implemented a stabilization program in 1988, called the Economic Solidarity Pact, which features traditional austerity measures, entailing tight fiscal and monetary policies and unorthodox measures, such as price, wage and exchange rate controls. This program has been the cornerstone of Mexico's economic policy over the past four years and has resulted in a drastic reduction of the inflation rate, from an annual rate of 159.2% in 1987 to 51.7% in 1988 and 19.7% in 1989. Inflation



rebounded to 29.9% in 1990 but the Mexican government aims to achieve a 14% inflation rate in 1991, which seems a reasonable estimate based on an annual inflation rate of 13.3% as of October 1991. Along with the objective of consolidating the progress made in price stabilization, Mexico's macroeconomic policy in the short run aims to reaffirm gradual and sustained economic recuperation, basically by establishing the necessary conditions to encourage national and foreign investment and by stimulating local demand.

After the 1986 recession, Mexico's gross domestic product (GDP) increased a moderate 1.7% in 1987 and an additional 1.3% in 1988. Domestic economic activity recovered for the third consecutive year in 1989 with a growth rate of 3.1% and further 3.9% in 1990 to reach \$234 billion (1). With an 81.1 million population, per capita GDP was estimated at \$2,874 in 1990. Additionally, manufacturing output grew by 5.2% in 1990 in real terms, private investment and consumption expanded 13.6% and 5.2% respectively and public investment was up 12.8%. During the 1991-1994 period GDP is expected to maintain an average annual growth rate of 2.5%-3%. Preliminary figures for 1991 place GDP growth at 4.5%-5% for this year.

In an effort to revitalize and open the Mexican economy, the Mexican Government undertook a series of structural changes, including the accession to the General Agreement on Tariffs and Trade (GATT) on August 24, 1986 leading to an extensive trade liberalization process: import permits were eliminated on all but 198 of the total 11,812 tariff items based on the Harmonized System adopted in 1988. Official import prices are no longer applicable, nor the 5% export development tax, and import duties were lowered from a maximum of 100% in 1982 to 20% since January 1988. The weighted average tariff rate is now 10.4%. The automotive and computer industries have also been liberalized, through the elimination of prior import permits, to allow free entry of products in these industries. The approval of the North American Free Trade Agreement will further strengthen trade between Canada, the United States and Mexico.

According to official data from the Mexican Secretariat of Commerce and Industrial Development (SECOFI), Mexico's trade balance in 1990 dropped once again to a \$3 billion deficit from -\$645 million in 1989. Exports increased by 17.5% in 1990, from \$22.8 billion to \$26.8 billion, while imports grew 27.3%, from \$23.4 billion to \$29.8 billion in 1990, having already increased 23.8% in 1989 and 54.9% in 1988. As of August 1991, total exports for the year amounted to \$18.3 billion and imports to \$23.6 billion.

Total Mexican imports from Canada increased 24% in 1989 and decreased 1.5% in 1990. Total Canadian exports to Mexico amounted

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1. Note: All values in this report, unless otherwise stated (Mexican pesos, Mex\$, Canadian dollars, Cdn\$, etc) are quoted in United States dollar equivalents.



to Cdn\$594 million, while total Canadian imports from Mexico were valued at Cdn\$1,730 million in 1990. According to Mexican figures, in 1989, 1.9% of Mexico's imports came from Canada, while 1.2% of its exports were to Canada. This makes Canada Mexico's fifth largest exporter and sixth largest importer.

### 3. MARKET ASSESSMENT

The Mexican market for electric power generation and distribution equipment, including such items as boilers, turbines for all power sources, nuclear reactors and related equipment, generators, capacitors, circuit breakers, conductors, insulated wire, fuses, switchboards, transformers and voltage regulators, reached \$761.2 million in 1990. The market increased 12.3% in 1990, 5.3% in 1989, 19.6% in 1988 and 5.6% in 1987 (see Table 1) in response to the growth in CFE's investments in major projects to face the increased demand for electricity (see Section 4).

**TABLE 1**  
**APPARENT CONSUMPTION OF ELECTRICAL**  
**GENERATION AND DISTRIBUTION EQUIPMENT**  
((\$000 U.S. dollars))

	1986	1987	1988	1989	1990	1994p
Production	384.4	420.2	320.6	508.5	550.8	719.4
+ Imports	152.9	148.2	354.4	197.8	243.8	356.9
- Exports	29.1	30.2	31.3	28.5	33.4	40.7
<b>TOTAL</b>	<b>508.2</b>	<b>538.2</b>	<b>643.7</b>	<b>677.8</b>	<b>761.2</b>	<b>1,035.6</b>

Source: CFE, import-export data by SECOFI. author's estimates.

Based on CFE's projected investment program, it is estimated that total demand will continue growing at an average annual rate of 8%, to reach slightly over one billion dollars by 1994. It is possible, however, that investments in the electricity sector will grow at higher rates, since demand for electricity has been growing at a faster pace than the growth in capacity and investment by the industry, thereby creating a backlog in demand. The budget assigned to CFE in 1992 is of Mex\$ 18,610.6 billion or roughly US\$6 billion, representing a 4.1% increase in real terms over 1991.

CFE's total physical investments have been as follows since 1983:

YEAR	PHYSICAL INVESTMENTS		GROWTH %
	Mex \$blln	US\$mlln	
1983	147.3	979.8	
1984	233.4	1260.4	28.6
1985	363.8	1172.4	(7.0)
1986	565.0	885.7	(24.5)



YEAR	PHYSICAL INVESTMENTS		GROWTH %
	Mex \$bln	US\$mlln	
1987	1318.4	937.9	5.9
1988	2569.7	1222.1	30.3
1989	2936.2	1182.5	( 3.2)
1990	3769.5	1328.2	12.3

Source: Informe de Labores CFE 1989-1990

Financing for these projects will depend on internal revenues of CFE, budget assigned to CFE by the Federal Government, private sector financing, and availability of foreign financing sources, such as World Bank (WB), International Reconstruction and Development Bank (IRDB) and Interamerican Development Bank (IDB). The IRDB granted a \$450 million credit and IDB a \$330 million loan for transmission, distribution, maintenance and renewal projects. During the 1989-1994 period, it is estimated that a total of \$1.7 billion will be available from these banks to finance CFE's projects. Additionally, the Canadian Export Development Corporation established a series of lines of credit with Mexican banks and companies, including a \$30 million line for CFE (contact Mr. Alberto Castelazo, tel. 553-6488). On the other hand, the financial situation of CFE has greatly improved through the 1985-1986 transfer of CFE's liabilities to the Federal Government, and the increases in tariffs on the use of electricity to reflect costs and avoid subsidies. This will allow CFE to finance 40% of its investment needs, while Federal Government transfers account for approximately 20% and loans for 40%.

### 3.1 IMPORTS

Imports have traditionally played an important role in CFE's purchasing program, since much of the equipment used by CFE is not produced locally. In 1990, imports accounted for 32% of total apparent consumption, or \$243.8 million, reflecting a 23% increase as compared to 1989.

According to CFE's annual report, total imports have been as follows since 1982:

YEAR	In million Mex \$ pesos	In million U.S. \$ dollars
	1982	24,358
1983	17,499	116.4
1984	28,499	153.9
1985	64,518	207.9
1986	97,527	152.9
1987	208,325	148.2
1988	811,670	354.4
1989	491,157	197.8
1990	691,983	243.8

Source: Informe de Labores CFE 1989-1990



CFE has made an effort to substitute imports by locally produced equipment through its Subcommittee for Import Substitution, which has made several studies and analysis to determine which products can be produced in Mexico rather than imported. It claims to have been able to reduce the import share of its purchases from 80% in 1977 to 30% by 1987 and to substitute imports by domestic purchases in an amount of \$183.8 million during the 1983-1989 period. Traditionally imported items include nuclear reactors and equipment therefor, steam and hydraulic boilers and turbines, turbogenerators, power breakers, valves, isolating switches, coal and ash handling equipment, relays, chemical treatment equipment, thermoelectrical plant equipment and parts, and in general high technology equipment. Among imports that were substituted, but which are still imported, are pipes and tubes, valves and accessories for thermoelectric plants, valves for geothermal wells, steam generators and their parts, filtering equipment, relays, parts for electric plants, shock absorbers, automatic controls, insulating equipment, measuring and control instruments, turbogenerators, steam turbines and inverse osmosis equipment.

The largest foreign supplier of electric generation and distribution equipment is the United States, which holds and import market share of 35%. It is followed by Japan with 22%, Switzerland with 18% and Germany with 13%. Following is a list of some of the major foreign suppliers of equipment to Mexico.

COMPANY	ORIGIN	PRODUCTS
A.E.G.A.G.	Germany	Power breakers, switch blades
Ansaldo, SPA	Italy	Turbines, generators, panels
Apparatenbau Rothemwehle	Germany	Spare parts
Aut Nachrichten Technik	Germany	Carrier wave eq.
Besco	USA	Spare parts
Brown Boverly	Switzerl.	Control equipment, protection, measuring equipment, lighting arresters, parts
C. Itoh	Japan	Pumps, valves, parts
Dravo	USA	Steam generators
General Electric	USA	A wide variety of products
Kanematsu Goshō	Japan	Pumps
Mannesman Anlagenbau	Germany	Hardware
Mitsubishi	Japan	Turbines, generators, sub- stations, control & protection equipment, parts
Mitsui	Japan	Generators, turbines, parts
Merlin Gerin	France	Parts
Siemens	Germany	Control & protection equipment carrier wave equipment, parts
Skoda Export	Chechosl.	Spare parts
Tubos Reunidos	Spain	Spare parts
Turbine Supplies	USA	Turbines, parts
Westinghouse	USA	Equipment and parts



Canadian exports to Mexico have until now been minimal and concentrated on the distribution rather than on the generation side of power equipment. The following table shows Canadian categories related to power generation and distribution. Some of these also include electrical equipment and materials used on the consumer side, when they could not be separated out.

**TABLE 2**  
**CANADIAN TRADE OF ELECTRICAL GENERATION**  
**AND DISTRIBUTION EQUIPMENT WITH MEXICO**  
(Cdn \$000 dollars)

	CANADIAN EXPORTS TO MEXICO			CANADIAN IMPORTS FROM MEXICO		
	1988	1989	1990	1988	1989	1990
Steam boilers	54	44	173	512	164	1253
Steam turbines	33	23	6	0	0	0
Hydraulic turbines	0	5	0	435	0	287
Gas turbines	0	17	167	0	0	0
Generators	331	4	65	448	208	475
Converters	152	0	0	110	0	0
Transformers	738	545	873	6573	7181	10995
Capacitors	0	0	74	3	11	5
Switchig & protec- ting apparatus	119	120	10	1910	208	210
Wire & conductors	836	435	338	4046	3596	3355
Insulators	0	33	29	0	8	5
<b>TOTAL</b>	<b>2263</b>	<b>1226</b>	<b>1735</b>	<b>14037</b>	<b>11376</b>	<b>16585</b>

Source: Statistics Canada - International Trade Division

As can be seen in Table 2, Canadian exports of power generation and distribution equipment have been minimal, amounting to Cdn\$ 1.7 million in 1990. They have also not been constant, but have fluctuated year to year in each category, reflecting an erratic market penetration. Canadian businessmen in this industry could improve their presence in the Mexican market by making periodical visits to CFE and distributors, participating in trade shows and through advertisement in specialized magazines.

### 3.2. DOMESTIC PRODUCTION

Local production of electrical generation and distribution equipment satisfies on average 70% of total demand. The Mexican electric products manufacturing sector is composed of slightly over 2,000 firms, employing 170,000 people. Its annual sales average approximately \$3 billion, although much of these are not



related to the generation and distribution of electricity but rather to the consumption side. Some 25 firms manufacture approximately 60% of the total requirements of CFE and are the backbone of Mexican electric power equipment manufacture. Among the most important ones are the following:

COMPANY	PRODUCTS
AB Chance	Tightener devices
ASEA	Panel Boards, capacitors, relays
Brown Boveri	Panel Boards, switch breakers
Byron Jackson	Pumps, mechanical seals
Cerrey	Electrical machinery and equipment tubing, burners, heaters
Cia. Manufacturera de Artefactos Eléctricos	Various electrical products
Conductores Monterrey	Wire and cable
Energomex	Panel boards, switch blades, switch breakers, high tension fuses
Industrias Conelec	Wire and cable
Industrias IEM	Transformers, substations, motors
Industrias Unidas	Watt-hour meters, wire and cable insulators, switch breakers
Inoxmex	Stainless steel
Motorola	Electrical machinery and equipment
Nacional de Conductores Eléctricos	Copper wire and cable
PEMEX	Fuel, oil, gasoline
Prolec	Transformers, lighting arresters, reactors, hardware
Sidermex	Steel wire, rods, pipe
Square D	Control panels
Swecomex	Electrical machinery, equipment, parts
Torres Mexicanas	Steel tows and structures
TAMSA	Steel pipe
Turbinas y Equipos Industriales	Turbines

#### 4. END USERS

The end users for electrical generation and distribution equipment are the Comisión Federal de Electricidad (CFE) and the Compañía de Luz y Fuerza del Centro (CLyFC), practically in bankruptcy and in the process of being dissolved (its shares are still partially held by private investors). CFE is in charge of planning, development and operation of the national electric system, and for the generation, distribution and sale of electrical energy conceived as a public service. GDP generated by the electricity sector represents 2% of total national GDP and CFE employs approximately 85,000 people. Income from sales amounted to \$3 billion in 1990. CFE's productivity standards have increased steadily, mostly through technological improvements in installed plants. In 1991, 204 users were attended by worker (vs.



156 in 1980), the interruption time per user has decreased from 2540 minutes in 1980 to 450 minutes in 1991, energy sold per worker increased from 864 MWH to 1221 MWH, and installed capacity per worker increased from 287 KW to 335 KW during the same period.

Mexico's electric system consists of several interconnected areas, each of which includes generating centers as well as consumer centers. This way, the system operates as a national connected system subdivided into the Northern and the Southern Interconnected Systems, each of which, in turn, is subdivided into three areas of control which include all of the Mexican states. Additionally, there is the Peninsular System, and the Baja California North and South systems. Thereby, CFE has a network throughout the Mexican territory of basic equipment, including generating centers, substations and transmission and distribution lines. The generating centers are interconnected through transmission lines and substations which allow the distribution of large volumes of energy throughout the country.

The national electricity sector is divided into the following areas: (see Map)

**NATIONAL INTERCONNECTED SYSTEM**

**SOUTHERN SYSTEM**

**NORTHERN SYSTEM**

CENTER AREA

CFE Center  
CLFC Center

NORTHEASTERN AREA

NORTHWESTERN AREA

WESTERN AREA

Western region  
Bajío region  
Michoacán region

NORTHERN AREA

EASTERN AREA

Eastern region  
Southeastern region  
Center-East region  
Acapulco region

**PENINSULAR SYSTEM**

**BAJA CALIFORNIA NORTE SYSTEM**

**BAJA CALIFORNIA SUR SYSTEM**

For the administration of the system, the country is subdivided into five hydroelectrical generating regions, five thermoelectrical generating regions, seven transmission regions and fourteen distribution regions. Due to their importance, the centers of Tula, Hgo. and Manzanillo, Col. operate as generating regions. The National Center of Energy Control (CENACE) was created in order to supervise the operation of Mexico's electrical system.



Until 1970, the national electricity system operated simultaneously under two systems; one of 50 cycles, which supplied Mexico City and its surrounding states, and one of 60 cycles in the rest of the country. Between 1970 and 1976, the whole system was unified under a 60 cycle standard. Electricity has a voltage of 4-22 kV when leaving the generators and for its transmission it increases to 69, 115, 230 or 400 kV. This voltage transformation occurs in the elevating substations of the respective centers and, after being transmitted at great distances, it is lowered again to the levels required by the distribution systems.

Electricity is distributed among 16.6 million users in over 50,000 communities, and 700,000 users are incorporated annually. CFE has a total of 302,000 Kms of transmission, subtransmission and distribution lines, 1268 substations with 102,000 MVA, and a capacity of 91 million KVA in transmission and distribution substations. The Mexican electricity sector ranks among the world's 20 largest.

In order to support CFE in the area of research and development, the Institute for Electrical Research (Instituto de Investigaciones Eléctricas - IIE) was created in 1976. It has some 700 researchers and works on eight basic areas: thermoelectrical centers, nuclear centers, hydroelectrical centers, geothermal energy, non conventional power sources, transmission and distribution, support to production and energy use. IIE has developed transmission and distribution projects, data obtention systems, on line monitoring, predictive maintenance and automation of distribution networks.

Additionally, CFE has a laboratory for testing and control (LAPEM), to develop new equipment designs, for research and analysis of operational errors, and it also supervises the quality of energy supplied by other sources than CFE, as well as the production of CFE's equipment suppliers.

The National Institute for Nuclear Research (ININ) was created to support nuclear electricity generation begun with the installation of Laguna Verde. Its functions are to develop nuclear fuel; to develop design, engineering and construction of nuclear installations; design nuclear waste disposal, security and control measures; as well as find different applications in other sectors.

In 1989, the National Commission for Energy Savings was created in order to promote savings measures in the production, transmission, distribution, and use of electricity, both by the producing and the consumer sectors.

Total installed capacity of the Mexican electric energy sector has been as follows between 1960 and 1991:



**TABLE 3**  
**INSTALLED CAPACITY OF ELECTRIC ENERGY**  
(Megawatts)

YEAR	GRAND TOTAL	TOTAL STATE	HYDRO	STEAM	TURBO GAS	INT COMB	COMB INED	GEO THER	COAL	NUC LEAR
1960	3048	2308	1249	839	0	205	0	3	12	0
1965	5238	4165	2149	1760	28	213	0	3	12	0
1970	7414	6068	3228	2316	216	271	0	0	37	0
1975	11251	9830	4044	3785	1028	251	610	75	37	0
1980	16862	14625	5992	6616	1190	137	540	150	0	0
1985	24069	20807	6532	9599	1789	112	1450	425	900	0
1986	23868	21266	6532	9949	1789	111	1450	535	900	0
1987	25755	23145	7546	10299	1789	111	1550	650	900	0
1988	26828	23954	7749	10800	1792	89	1624	700	1200	0
1989	26408	24445	7761	11300	1779	87	1618	700	1200	0
1990	28267	25299	7805	11367	1779	82	1686	705	1200	675
1991	30513	27395	8161	12847	1779	82	1906	745	1200	675

Source: Anexo del Informe

The net generation of electric energy has been as follows between 1960 and 1990:

**TABLE 4**  
**NET GENERATION OF ELECTRIC ENERGY**  
(Gigawatts-hour)

YEAR	GRAND TOTAL	TOTAL STATE	HYDRO	STEAM	TURBO GAS	INT COMB	COMB INED	GEO THER	COAL	NUC LEAR
1960	10813	8563	5174	2796	0	593	0	0	0	0
1965	17248	14232	8863	4980	0	389	0	0	0	0
1970	27653	25234	14758	9667	0	809	0	0	0	0
1975	42354	39395	14970	18252	3384	711	1587	491	0	0
1980	63013	59156	16661	34619	3551	288	3168	869	0	0
1985	90412	82360	25989	45959	842	41	4430	1559	3540	0
1986	93024	85166	19784	49885	589	62	5721	3253	5872	0
1987	99361	91669	18128	54649	595	60	7241	4257	6739	0
1988	104927	96970	20686	56996	467	72	6842	4464	7443	0
1989	112480	104836	24048	61034	620	93	6933	4474	7295	339
1990	120296	108787	23228	62608	660	82	7302	4906	7193	2808
1991	123066	113666	21813	66086	741	58	8161	5167	7870	3770

Source: Informe de Gobierno

From the above tables, it can be seen, that, on average the increase in installed capacity has been similar to the growth in net energy generation (9.5% annually between 1960 and 1990), although the latter responds to the former within a period of several years. During the 1985-1990 period, however, capacity only increased 17.4%, while generation grew 33.1%, this means



that capacity will need to grow substantially in the years to come in order to respond to increased demand. Between 1982 and 1990, investments in the electricity sector have remained below those of 1981, while, despite slow economic growth, the demand for electricity has increased 5.7% per annum on average.

The fastest growth has clearly been in steam generated electricity, followed by nuclear, in response to the installation of the Laguna Verde nuclear plants, combined cycle (coal-fuel), hydroelectrical and geothermal plants. Internal combustion plants have decreased, while no new capacity has been added to coal and turbogas powered plants. CFE has made an effort to reduce its dependence on oil as its principal source of energy, by trying to increase the use of water, coal and geothermal energy, as well as gas in the Mexico City valley in order to reduce pollution. In 1990, plants are fueled 60.6% by oil and 39.4% by alternate sources, as compared to 59.7% and 40.3% in 1988.

The national modernization program for the industry sets the following goals for 1994 and 2010:

<b>SOURCE</b>	<b>1988</b> (23,954 MW)	<b>1994</b> (33,615 MW)	<b>2010</b> (71,000 MW)
Hydroelectrical	32.4%	26.4%	21.7%
Nuclear	0%	4.0%	4.3%
Geothermal	2.9%	2.4%	3.5%
Coal	5.0%	7.7%	8.5%
Dual (imported coal)	6.0%	6.2%	18.3%
Hydrocarbons	59.7%	53.3%	42.7%
Diesel	0.4%	0.5%	0.2%
Combined cycle	6.8%	5.5%	2.7%
Turbogas	7.5%	5.5%	5.5%
Fuel oil	45.0%	41.8%	34.3%
Non conventional	0%	0%	1.3%

At present, capacity and generation are divided by type of plants as follows:

<b>TYPE OF PLANT</b>	<b>CAPACITY</b> %	<b>GENERATION</b> %
Steam	46.9	58.1
Hydroelectrical	29.8	19.2
Combined cycle	7.0	7.2
Turbogas	6.5	0.7
Coal	4.4	6.9
Geothermal	2.7	4.5
Nuclear	2.5	3.3
Internal combustion	0.2	0.1



The most important electricity generation centers with their installed capacity in MW in 1989 were the following: (see map)

**TABLE 5**  
**INSTALLED CAPACITY BY LARGEST PLANTS 1989**  
 ( MW )

**HYDROELECTRICAL**

Chicoasén	1,500
Malpaso	1,080
Infiernillo	1,000
Angostura	900
Other plants	
-central system	755
ElCaracol	594
Peñitas	420
La Villita	240
Mazatepec	220
Temascal	154
Plutarco Elías Calles	135
Bacurato	92
Humaya	90
La Amistad	66
El Fuerte	59
Falcon	31
Boquilla	18
<b>TOTAL</b>	<b>7,354</b>

**STEAM**

Tula	1,982
Manzanillo	1,900
Monterrey	943
Salamanca	820
Valle de México	818
Altamira	740
San Luis Potosí	700
Puerto Libertad	632
Mazatlán	616
Guaymas	582
Dos Bocas	480
Francisco Villa	390
Río Bravo	375
Lechería	362
Samalayuca	320
Tijuana	287
El Sauz	218
Mérida	217
Campeche	150
Poza Rica	117
Valladolid	70
Gómez Palacio	50
Topolobambo	40
Chihuahua	39
<b>TOTAL</b>	<b>12,848</b>



<b>TURBOGAS</b>	
Gómez Palacio	320
Samalayuca	124
Caborca	102
Monclova	78
Monterrey	74
Mexicali	62
Tijuana	60
Mérida	60
Chihuahua	58
Cancún	58
Ensenada	55
La Paz	48
Villa Constitución	30
Chetumal	14
Cd. del Carmen	13
Guerrero Negro	
Santa Rosalía	
<b>TOTAL</b>	<b>1,156</b>
<b>GEOHERMAL</b>	
Cerro Prieto	620
Los Azufres	80
<b>TOTAL</b>	<b>700</b>
<b>COAL</b>	
Río Escondido	1200
<b>NUCLEAR</b>	
Laguna Verde	675

Total sales of electric energy presently amount to 98,746 gigawatts-hour for a value of Mex \$15,800 billion or roughly \$5.5 billion dollars. During 1991, it is estimated that total exports of electricity, basically to California state electricity companies in the United States, will reach 1,960 gigawatts-hour, while total imports will amount to 413 gigawatts-hour. In the last decade, except for 1982 and 1985, the trade balance has always been favorable to Mexico, allowing CFE to generate a foreign exchange income, which has mostly been used to finance imports of equipment, machinery and parts.

There are approximately 14.5 million residential users, 1.8 million commercial users, 80,000 users for agricultural irrigation, 73,000 users for utilities and 57,000 industrial users. In terms of demand, however, in 1991, 65% corresponds to industrial uses, 26% to domestic use and 9% to agricultural uses. Although the balance between the three sectors has remained quite constant in the past 30 years, it is interesting to note that industrial demand has decreased relatively to the other sectors, while domestic demand has shown a constant increase, with fluctuations in agricultural demand, which initially decreased and has recently increased as electricity has become available in more rural communities.



The following table shows advances made in the electrification of rural areas:

**TABLE 6**  
**RURAL ELECTRIFICATION**

	1987	1988	1989	1990*
Rural communities	842	2,247	2,319	2,463
Low income settlements	279	335	508	408
Population covered (000)	729	1,003	1,229	1,191
Posts in networks	56,518	77,104	89,140	86,725
Distribution lines km	2,917	4,662	4,330	4,727
Wells for irrigation	542	1,242,	508	491
Hectares covered	21,806	24,771	12,839	15,903
Investment \$million			77	76

\* Based on Jan-Oct figures

**Source:** National Energy Modernization Program 1990-1994;  
CFE Informe de Labores 1989-1990

The industries with the highest demand for electricity are: steel, mining, cement, chemicals, automotive, aluminum, rubber, construction, fertilizers, pulp and paper.

Prices vary depending on the user of electricity. The average price of electricity measured in pesos per kilowatt-hour in 1991 was \$156.82 for industrial use, \$122.85 for domestic use and \$69.05 for agricultural use. Although the latter is the lowest tariff, it has undergone the highest increases in the past few years: 20.6% between 1986 and 1991 as compared to 9.7% for industry and 6.8% for homes.

## 5. PROJECTS

At the end of 1989, the Secretariat of Mines and Parastate Industry published the National Energy Modernization Plan for 1990-1994, which presently defines objectives and goals for the electrical industry. The general objective for this sector is to satisfy existing demand and improve efficiency in the use of energy through the modernization and integration of the system. Marginal and rural populations have specifically been targeted as priorities, as well as pollution control.

During the 1989-1994 period, total installed capacity is expected to increase by 9.7 GW, reflecting a 5.8% annual increase. This means finalizing 5 GW of those begun in previous years and begin operating another 5 GW of the 10 GW begun during the period.

Between 1995 and 2010, another 37.4 to 47.8GW will need to be installed.



In order to achieve this, two factors have been determined as crucial: real increases in investment and improved productivity. The latter through lower internal use of electricity, reduction in losses during transmission and distribution, improvement in lines and transformers, maintenance of generating plants and modernization of thermoelectrical centers. At the same time, the program aims at promoting energy savings both by producers and consumers, through higher tariffs, regulation of efficiency standards, fiscal and financial premiums to save energy, information and awareness campaigns among users. In the area of sales and distribution, objectives are: Strengthening the interconnected network, modernizing transmission and distribution networks, modernizing consumer services, and diversifying rural electrification programs to allow communities and municipalities to locally generate energy. Protection of the environment and pollution control are targeted through the reduction in the use of oil, the promotion of R&D to propose and use new technologies, such as solar, eolic and biomass, and the improvement of existing energy sources.

Goals set for the electricity sector in 1992 are as follows:

Electricity generation	127,331 GWh
Sales	
Domestic	99,610 GWh
Exports	1,933 GWh
Increases in installed capacity	1,315.5 MW
Transformation to other tension	4,715.0 MVA
Construction:	
Distribution substations	2,260.0 MVA
Transmission networks	1,565.0 KM
Distribution networks	2,417.0 KM
Subtransmission lines	32.4 KM
Subtransmission networks	119.0 KM
Distribution network installations	320.8 MVA
Electrification of:	
Rural communities	431 communities
Low income urban settlements	210 settlements

In order to decide its projected investments in its different areas and plants, CFE prepares an annual report called "Desarrollo del Mercado Eléctrico", which includes an analysis of the needs for electricity in all its areas and systems and the installed capacity in these areas. Based on this report, the need for electricity will be as follows in the next ten years:



**TABLE 6**  
**PROJECTED ENERGY PRODUCTION AND SALES**

YEAR	GROSS ENERGY			GROSS INVESTMENT		
	GWh	GROWTH %	SALES GWh	GROWTH %	\$*	GROWTH %
1991	124,512	6.2	102,358	6.2	1,226	3.3
1992	133,916	7.6	110,061	7.5	1,460	19.1
1993	144,404	7.4	118,273	7.5	1,544	5.6
1994	155,540	7.6	127,259	7.6	1,634	5.6
1995	166,954	7.4	136,455	7.2	1,658	1.5
1996	177,956	6.6	145,532	6.7	1,740	5.0
1997	188,892	6.3	154,493	6.2	1,754	1.0
1998	202,380	7.1	165,439	7.1	1,804	2.8
1999	216,689	7.2	177,270	7.2	1,894	5.0

\* \$ = billion pesos of 1980

Source: Desarrollo del Mercado Eléctrico 1985-1999, CFE

In terms of areas and systems, the following table shows net energy demand projected by area, based on the estimated increase in the use of electrical energy by the largest users within each area.

**TABLE 7**  
**NET ELECTRICAL ENERGY NEEDS 1991-1999**  
**BY AREAS AND REGION**  
(000 GWh)

REGION	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>1. CENTER</b>	<b>27.6</b>	<b>29.4</b>	<b>31.5</b>	<b>33.8</b>	<b>36.5</b>	<b>38.8</b>	<b>41.2</b>	<b>43.8</b>	<b>46.6</b>
1.1 Center-CFE	2.9	3.3	3.8	4.2	4.6	5.1	5.7	6.4	7.2
1.2 Center-CLFC	24.7	26.1	27.7	29.6	31.9	33.7	35.5	37.4	39.4
<b>2. WEST*</b>	<b>23.9</b>	<b>26.3</b>	<b>28.7</b>	<b>31.2</b>	<b>33.9</b>	<b>36.8</b>	<b>40.0</b>	<b>43.3</b>	<b>46.6</b>
2.1 West	6.6	7.2	7.7	8.2	8.6	9.2	9.7	10.3	11.0
2.2 Bajío	12.0	13.2	14.4	15.6	16.8	18.2	19.7	21.4	23.4
2.3 Michoacán	4.6	5.1	5.7	6.5	7.5	8.4	9.4	10.2	10.9
<b>3. EAST*</b>	<b>22.7</b>	<b>24.3</b>	<b>25.9</b>	<b>27.7</b>	<b>29.3</b>	<b>31.2</b>	<b>33.1</b>	<b>35.3</b>	<b>37.8</b>
3.1 East	11.9	12.7	13.4	14.0	15.1	16.1	17.0	18.1	19.4
3.2 Southeast	3.6	4.0	4.4	4.8	5.2	5.5	5.9	6.4	6.9
3.3 Center-East	4.4	4.5	4.8	5.0	5.2	5.5	5.8	6.0	6.3
3.4 Center-South	1.2	1.3	1.4	1.6	1.7	2.0	2.2	2.5	2.8
<b>4. PENINSULAR</b>	<b>3.1</b>	<b>3.5</b>	<b>3.9</b>	<b>4.3</b>	<b>4.9</b>	<b>5.3</b>	<b>5.7</b>	<b>6.1</b>	<b>6.6</b>
<b>5. NORTHEAST</b>	<b>15.0</b>	<b>16.0</b>	<b>17.2</b>	<b>18.5</b>	<b>19.8</b>	<b>21.1</b>	<b>22.6</b>	<b>24.3</b>	<b>26.1</b>
<b>6. NORTH</b>	<b>9.6</b>	<b>10.2</b>	<b>10.9</b>	<b>11.6</b>	<b>12.4</b>	<b>13.2</b>	<b>14.0</b>	<b>14.9</b>	<b>16.0</b>
<b>7. NORTHWEST</b>	<b>9.2</b>	<b>9.8</b>	<b>10.5</b>	<b>11.2</b>	<b>11.9</b>	<b>12.7</b>	<b>13.5</b>	<b>14.4</b>	<b>15.4</b>



8.	BAJA CAL. N.	6.8	7.2	7.7	8.2	8.7	8.6	8.0	8.7	9.5
9.	BAJA CAL. S.	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.3

\* Differences when totalling regions into areas are accounted for by losses in transmission.

Source: Desarrollo del Mercado Eléctrico 1985-1999, CFE

The following table shows hypothesis of annual growth in each area for the 1989-1994 and 1994-1999 periods, and the principal sources of increased demand.

**TABLE 8**  
**HYPOTHESIS OF ANNUAL GROWTH BY AREA**

AREA		89-94	94-99	SOURCE
CENTER	5.78%	6.44%		Cutzmala pumping, public transportation residential and industrial uses
WEST	8.36%	8.34%		Agricultural irrigation, steel industry
EAST	6.32%	6.45%		Industry growth and installation of new firms, tourism (Acapulco), new plants
PENINSULA	12.3%	8.9%		Tourism (Tulum-Cancún), residential
NORTHEAST	7.87%	7.11%		Industry, transportation, residential
NORTH	6.87%	6.3%		Industry, pumping for irrigation
NORTHWEST	6.74%	6.68%		Industry
BAJA N.	6.11%	3.03%		89-94 electricity exports, 89-99 industry, maquiladoras
BAJA S.	7.14%	6.07%		Tourism, irrigation, industry

Source: Desarrollo del Mercado Eléctrico 1985-1999, CFE

In order to respond to this increase in demand by area during the next four years, the plants which have been targeted for investment are the following:

NAME OF PLANT	TYPE	COST (billion pesos)
<b>1992</b>		
Carbon II	Coal	700
Petalcalco	Dual	350
Topolobampo		



**1993**

Petacalco	Dual	700
Lopez Mateos	Com	700
Carbon II	Coal	350
Topolobampo II	Com	160
Mérida II	Com	160
Temascal II	Hyd	100
Cerro Prieto	Geo	40
Cd. del Carmen	T.G.	30

**1994**

Laguna Verde	Nuc	675
Petacalco	Dual	350
Petacalco II	Dual	350
Carbón II	Car	350
Aguamilpa	Hyd	320
Topolobampo II	Com	160
Zimapan	Hyd	140
Temascal II	Hyd	100
Maritabo	Geo	40
Tecate	Hyd	30
Tecate	Hyd	30
Chilatán	Hyd	28

**1995**

Aguamilpa	Hyd	640
Ensenada	Dual	350
Petacalco II	Dual	350
Zimapan	Hyd	140
Sumiros	Geo	40

Source: SEMIP

**6. MARKET ACCESS**

As a result of Mexico's accession to GATT, the Mexican government has gradually opened the economy to international markets. Tariffs have been lowered from a maximum 100% in 1983, to 20% since December, 1988. The official price system has been totally eliminated and import permits are required on only 198 of the total 11,812 items in the Mexican Harmonized Tariff System.

The import climate for electricity generation and distribution equipment has improved significantly as a result of this commercial liberalization. Therefore, imports of equipment for this industry are subject to an ad valorem duty of maximum 20% assessed on the invoice value. In addition, a customs processing fee of 0.8% is assessed on the invoice value. A 10% value added tax (recently reduced from 15%) is then assessed on the cumulative value of both taxes in addition to the invoice value. Some manufacturers who use imported inputs for their products under a Mexican Government approved manufacturing plan may have the duty and/or VAT waived or rebated. Raw materials, intermediates and machinery for use in manufacturing or



assembling products for export are generally eligible to be imported either duty free or under bond.

Formerly, in order to bid on tenders and sell to a government agency or decentralized company, foreign manufacturers required having a local resident agent and to have the foreign supplier registered and accepted by the Secretariat of Planning and Budgeting (Secretaría de Programación y Presupuesto - SPP). As of July 1991, the above requirement for prior registration with SPP has been eliminated.

The new procedures now in force require the foreign supplier to have a local agent or representative and it has to be registered through his local representative as an accepted supplier with each government ministry and/or decentralized agency according to the international tender requirements under review.

International tenders financed by the World Bank or the International Development Bank are open to all member countries of these institutions. More recently, the World Bank, where its credits are involved, has required that bid documents should also include an affidavit confirming that the Canadian company is a bona fide Canadian company with an official residence in Canada and that Canada is recognized as a contributing member to the World Bank.

There are no official metric requirements applicable to imports into Mexico. However, since the metric system of units is, by law, the official standard of weights and measures in Mexico, importers will usually require metric labeling for packaged goods, although the English system is also used. Dual labeling is acceptable. Imported products should be labeled in Spanish containing the following information: name of the product, trade name and address of the manufacturer, net contents, serial number of equipment, date of manufacture, electrical specifications, precautionary information on dangerous products, instructions for use, handling and/or product conservation and mandatory standards. Mexico adheres to the International System of Units (SI). Electric power is 60 cycles with normal voltage being 110, 220 and 400. Three phase and single phase 230 volt current is also available.

Prepared by:  
Caroline Véruit for the  
Canadian Embassy  
Mexico City  
December 1991



To call all telephone and fax numbers listed below from Canada unless they are preceded by a different area code, dial 011-525 first, otherwise dial 011-52-(area)-number.

NOTE: The information on companies not located in Mexico City was not confirmed.

**APPENDIX I:  
INDUSTRIAL CHAMBERS AND ASSOCIATIONS**

**ASOCIACION MEXICANA DE FABRICANTES DE  
CONDUCTORES ELECTRICOS A.C. (AMEFACE)**  
ELECTRIC CONDUCTION EQUIPMENT MANUFACTURERS  
Sonora 166 - Piso 1  
Col. Hipódromo Condesa  
06100 México D.F.  
Phone: 533-44-41 207-22-54  
Fax: 286-77-23  
Contact: Ing. Edgar Ubbelohde  
Presidente

**ASOCIACION MEXICANA DE INGENIEROS EN COMUNICACION  
ELECTRICA Y ELECTRONICA (AMICEE)**  
ELECTRIC AND ELECTRONIC COMMUNICATIONS ENGINEERS  
Balderas 94  
Col. Centro  
06070 México D.F.  
Phone: 512-53-00 510-31-42  
Fax: 510-31-42  
Contact: Ing. Diódoro Guerra R.  
Presidente

**ASOCIACION NACIONAL DE ENERGIA SOLAR**  
SOLAR ENERGY  
Parque Real 2  
Col. El Parque de Coyoacán  
04890 México D.F.  
Phone: 677-69-57  
Fax: 677-69-57  
Contact: Dr. Hernando Guerrero  
Presidente

**ASOCIACION NACIONAL DE IMPORTADORES Y EXPORTADORES  
DE LA REPUBLICA MEXICANA (ANIERM)**  
IMPORTERS AND EXPORTERS ASSOCIATION  
Monterrey 130  
Col. Roma  
06700 México D.F.  
Phone: 564-86-18 584-95-22  
Fax: 584-53-17  
Contact: Sr. Ernesto Warnholtz  
Presidente



**APPENDIX II:  
USEFUL MEXICAN GOVERNMENT MINISTRIES  
AND DECENTRALIZED AGENCIES**

**COMISION FEDERAL DE ELECTRICIDAD (SEMIP)**

Río Ródano 14  
Col. Cuauhtémoc  
06598 México D.F.  
Phone: 553-71-33 536-64-00  
Fax: 553-6424

Ing. Guillermo Guerrero Villalobos  
Director General  
Piso 7  
Phone: 553-65-00

Ing. Andrés Moreno Fernández  
Subdirector de Construcción  
Piso 5  
Phone: 286-69-43

Lic. José Luis García  
Gerente de Abastecimientos  
(Purchasing manager)  
Piso 7  
Phone: 286-95-36 286-95-56

**COMPANIA DE LUZ Y FUERZA DEL CENTRO, S.A. (CFE)**

Melchor Ocampo 171  
Col. Tlaxpana  
11379 México D.F.  
Phone: 518-00-80 to 99  
Fax: 591-10-11

Ing. Guillermo Guerrero Villalobos  
Director General  
Río Ródano 14, piso 7  
Col. Cuauhtémoc  
06598 México D.F.  
Phone: 553-64-00 553-65-00

Ing. Jorge Gutiérrez Vera  
Subdirector General  
Melchor Ocampo 171, piso 8  
Col. Tlaxpana  
11379 México D.F.  
Phone: 546-77-70 592-42-73



Ing. Celestino Cázares Lazcano  
Gerente Administrativo  
(purchases)  
Melchor Ocampo 171, piso 8  
Col. Tlaxpana  
11379 México D.F.  
Phone: 546-79-58

**SECRETARIA DE ENERGIA, MINAS E  
INDUSTRIA PARAESTATAL**

Insurgentes Sur 552  
Col. Roma Sur  
06769 México D.F.

Ing. Fernando Hiriart Balderrama  
Secretario de Energía, Minas  
e Industria Paraestatal  
Piso 3  
Phone: 564-97-89 564-97-90

Dr. José Luis Aburto Avila  
Subsecretario de Energía  
Phone: 584-67-16 584-65-33

Lic. Javier Vega Camargo  
Director General de Asuntos Internacionales  
Phone: 553-38-15 553-27-02

Lic. Pedro Guillermo Hoth Bon-Vermeden  
Director de Negociaciones Internacionales  
Phone: 553-90-29

Francisco Márquez 160  
Col. Condesa  
06140 México D.F.

C.P. Héctor Pita Esquivel  
Director General de Operación Energética  
Phone: 553-91-43 553-91-45

Dr. Paul Hudlet Yáñez  
Director General de Política Energética  
Phone: 553-93-35 553-93-55

Lic. Miguel Angel Ugalde A.  
Director de Inversiones y Suministros  
Phone: 553-91-35 553-91-43

Ing. Mardonio Jiménez Rojas  
Director del Programa Nuclear  
Phone: 553-91-13



Ing. Guillermo Fernández de la Garza  
Secretario Técnico de la Comisión  
Nacional para el Ahorro de Energía  
Phone: 553-90-54

**INSTITUTO DE INVESTIGACIONES ELECTRICAS (SEMIP)**

ELECTRICAL RESEARCH INSTITUTE

Domicilio Conocido

Internado Palmira

Col. Palmira Tinguindin  
62490 Cuernavaca, Morelos

Phone: (73) 18-97-69 18-24-24

Fax: (73) 18-25-21

Dr. Pablo Mulas del Pozo  
Director de la División de Fuentes de Energía  
Phone: (73) 14-21-17

Ing. Pablo Guerra  
Jefe de Adquisiciones  
(purchases)  
Phone: (73) 14-31-98

Ing. Guillermo Fernández de la Garza  
Director Ejecutivo  
Leibnitz 14 PH  
Col. Nueva Anzures  
11590 México D.F.  
Phone: 514-82-59 531-98-99  
Fax: 207-79-26

Ing. Eduardo Lobatón González  
Director de la División de Equipos Eléctricos  
Dante 36 - Piso 3  
Col. Nueva Anzures  
11590 México D.F.  
Phone: 511-48-36 525-36-66

**INSTITUTO NACIONAL DE INVESTIGACIONES NUCLEARES**

NUCLEAR RESEARCH INSTITUTE

Carr. México-Toluca Km 36.5  
Salazar, Estado de México

Phone: 518-23-60

Fax: 521-37-98

Dr. Carlos Vélez Ocón  
Director General  
Phone: 521-94-02



Lic. Jesús Cedeño Blanquet  
Gerente de Adquisiciones  
Phone: 518-43-24

Phone: 50-12-275  
Fax: 55-11-575  
Contact: Ing. Marco Antonio Barba  
Director General

CASA VALIENTE, S.A. DE C.V.  
Parque de la Reforma 14 de octubre  
Col. Cuauhtémoc  
P.O. Box 00550  
Phone: 52-77-325  
Fax: 55-02-525  
Contact: E. Michaláng Garamilla  
Director General

V.C. DE C.V. DE C.V.  
Parque Lázaro Cárter  
Chih., Zarate, P.O. Box 82623  
Phone: 41-56-577 (Ext.)  
Fax: 01-56-577 (Ext.)  
Contact: E. S. Tucker  
Presidente

CONSORCIO DE MEXICO, S.A. DE C.V.  
Asis de Sooyam y Fray Marcos de Niza  
Col. San Lagarto  
Chih., Zarate, P.O. Box 02623  
Phone: 24-60-171 (Ext.)  
Contact: E. S. Tucker  
Director General

CONDUCTORES Y ACCESORIOS, S.A.  
Río Cuatrecasas 101-244  
Col. Cuauhtémoc  
P.O. Box 00530  
Phone: 55-08-225  
Fax: 55-28-115  
Contact: Ing. Alicia Cisneros  
Director General

CONSTRUCIONES Y SERVICIOS, S.A.  
711 Avenida  
Parque Lázaro Cárter  
Chih., Zarate, P.O. Box 07615  
Phone: 28-72-825  
Fax: 28-72-825  
Contact: Ing. Eusebio Cisneros  
Director General

ACCESORIOS ELECTRICOS, S.A.  
Tórceli 221  
Col. San Antonio  
02760 México D.F.  
Phone: 561-27-22  
Fax: 552-34-61  
Contact: Ing. José A. Chénahán  
Director General

AMP DE MEXICO, S.A.  
Alfredo B. Nobel 28  
Col. La Loma  
24050 Tlalpamtlán, Mex.  
Phone: 398-76-11  
Fax: 398-79-64  
Contact: Ing. Cristóbal Díaz Canales  
Director Ejecutivo

ARROW-HART, S.A. DE C.V.  
Poniente 148 No. 933  
Col. Industrial Vallejo  
02300 México D.F.  
Phone: 587-02-11  
Fax: 567-40-48  
Contact: Robert L. Williams  
Director General

BALMUC, S.A.  
Escage 21  
Fracc. Alice Blanco  
23370 Nancuipán, Mex.  
Phone: 526-23-22  
Fax: 388-25-01  
Contact: Ing. Salvador Portillo A.  
Director General

BARRAS DE MEXICO, S.A. DE C.V.  
Ladrón de Guevara 302 Oriente  
Col. del Norte  
64500 Monterrey, N.L.  
Phone: (83) 51-37-37  
Fax: (83) 51-17-77  
Contact: Werner Bressmann Grimm  
Presidente



**APPENDIX III:  
POTENTIAL DISTRIBUTORS AND REPRESENTATIVES**

**ACCESORIOS ELECTRICOS, S.A.**

Tóchtli 221  
Col. San Antonio  
02760 México D.F.  
Phone: 561-27-22  
Fax: 352-34-61  
Contact: Ing. José A. Chehuán  
Director General

**AMP DE MEXICO, S.A.**

Alfredo B. Nobel 28  
Col. La Loma  
54060 Tlalnepantla, Mex.  
Phone: 398-76-11  
Fax: 398-79-64  
Contact: Ing. Cristóbal Díaz Canales  
Director Ejecutivo

**ARROW-HART, S.A. DE C.V.**

Poniente 148 No. 933  
Col. Industrial Vallejo  
02300 México D.F.  
Phone: 587-02-11  
Fax: 567-40-49  
Contact: Robert L. Williams  
Director General

**BALMEC, S.A.**

Escape 21  
Fracc. Alce Blanco  
53370 Naucalpan, Mex.  
Phone: 576-23-22  
Fax: 358-25-01  
Contact: Ing. Salvador Portillo A.  
Director General

**BARNES DE MEXICO, S.A. DE C.V.**

Ladrón de Guevara 302 Oriente  
Col. del Norte  
64500 Monterrey, N.L.  
Phone: (83) 51-37-37  
Fax: (83) 31-17-77  
Contact: Werner Husemann Grimm  
Presidente



**BURNDY MEXICO, S.A. DE C.V.**  
Calle del Río 12  
Fracc. Industrial Alce Blanco  
53370 Naucalpan, Mex.  
Phone: 576-23-00  
Fax: 576-31-69  
Contact: Ing. Marco Antonio Barbosa  
Director General

**CASA VALENTIN, S.A.**  
Paseo de la Reforma 393-202  
Col. Cuauhtémoc  
06500 México D.F.  
Phone: 533-07-07  
Fax: 525-60-56  
Contact: Guillermo Gramlich B.  
Director General

**CCC DE MEXICO, S.A. DE C.V.**  
Parque Industrial Juárez  
32638 Cd. Juárez, Chih.  
Phone: (16) 775-66-14  
Fax: (16) 775-66-10  
Contact: John Moure  
Presidente

**COILCRAFT DE MEXICO, S.A. DE C.V.**  
Melquiades Alanís y Fray Marcos de Niza  
Col. San Lorenzo  
32320 Ciudad Juárez, Chih.  
Phone: (16) 17-09-42  
Contact: Tom Tucker  
Gerente General

**CONDUCTORES Y ACCESORIOS, S.A.**  
Río Lerma 345-101  
Col. Cuauhtémoc  
06500 México D.F.  
Phone: 553-60-53  
Fax: 211-86-68  
Contact: Ignacio Alegría Iturrioz  
Gerente General

**CONTROLES Y SERVICIOS, S.A.**  
Protón 117  
Parque Industrial Naucalpan  
53370 Naucalpan, Mex  
Phone: 358-27-62 358-27-74  
Fax: 358-27-74  
Contact: Ing. Onésimo Sánchez  
Director General



**CONTROLMATIC ALLEN-BRADLEY, S.A. DE C.V.**

Av. Patriotismo 579  
Col. Noche Buena  
03720 México D.F.  
Phone: 598-81-10 563-40-50  
Fax: 598-81-21  
Contact: Ing. Roberto Alegría Soni  
Gerente General

**DELPHY BOMBAS Y EQUIPOS, S.A. DE C.V.**

Poniente 128 No. 496  
Col. Industrial Vallejo  
02300 México D.F.  
Phone: 368-86-55  
Fax: 368-86-55  
Contact: Ing. Gabriel Cejudo Funes  
Director General

**ENERGIA Y POTENCIA DE EMERGENCIA MEXICO, S.A. DE C.V.**

Calle 5 Sur No. 1102  
Ciudad Industrial - Mesa de Otay  
22500 Tijuana, B.C.N.  
Phone: (66) 23-38-54  
Fax: (66) 23-38-52  
Contact: Ing. Francisco Cervante León  
Gerente General

**EQUIPOS IEM, S.A. DE C.V.**

Calle 9 No 192  
Fracc. Civac  
62500 Cuernavaca, Mor.  
Phone: (73) 19-08-75  
Fax: (73) 19-14-06  
Contact: Ing. Francisco J. Reed  
Director General

**GENERAL ELECTRIC DE MEXICO, S.A. DE C.V.**

Horacio 1855-501  
Col. Los Morales Polanco  
11510 México D.F.  
Phone: 545-07-38 545-07-91  
Fax: 250-45-63  
Contact: Sr. Jeffrey Gannon  
Presidente

**INDUSTRIAS CONELEC, S.A. DE C.V.**

José Vasconcelos 184  
Col. condesa  
06140 México D.F.  
Phone: 553-06-33 211-60-00  
Fax: 553-38-33  
Contact: Ing. Carlos Espinal Guifarro  
Director General



**INDUSTRIAS IEM, S.A. DE C.V.**  
Vía Gustavo Baz 340  
54000 Tlalnepantla, Mex.  
Phone: 565-69-00  
Fax: 565-49-14  
Contact: Ing. Francisco J. Reed  
Director General

**INDUSTRIAS UNIDAS, S.A. DE C.V.**  
171 Oriente No 398  
Col. Ampliación Sn. Juan de Aragón  
07470 México D.F.  
Phone: 760-60-00  
Fax: 760-10-89  
Contact: Ing. Alejo Peralta  
Presidente

**LUMISISTEMAS, S.A. DE C.V.**  
Blvd. Toluca 520-A  
Fracc. Industrial Sn. Andrés  
53500 Naucalpan, Mex.  
Phone: 576-04-33  
Fax: 359-38-04  
Contact: Ing. Victor Serrato  
Director General

**PLANTAS ELECTRICAS MEXICO, S.A. DE C.V.**  
Unidad Torres de Mixcoac  
Edif. A-12 , Desp. 802  
Col. Mixcoac  
01490 México D.F.  
Phone: 593-46-20  
Fax: 651-49-62  
Contact: Ing. Roberto Arena  
Gerente General

**TDK DE MEXICO, S.A. DE C.V.**  
Ohm s-n  
Parque Industrial A.J. Bermúdez  
32470 Cd. Juárez, Chih.  
Phone: (16) 18-40-66  
Fax: 549-46-89  
Contact: Osamu Tazaki  
Director General

**TORK ELECTRO SISTEMAS, S.A. DE C.V.**  
Hortensia 97-2  
Col. Los Angeles Femenina  
09830 México D.F.  
Phone: 691-06-11  
Fax: 691-68-57  
Contact: Ing. Javier Tecocoatzi  
Director General



**TURBINAS SOLAR, S.A. DE C.V.**  
 Dante 36 - Piso 9  
 Col. Anzures  
 11590 México D.F.  
 Phone: 533-13-41  
 Fax: 208-64-34  
 Contact: Ing. Luis Ramírez Corzo  
 Gerente General

INDUSTRIAS TEM, S.A. DE C.V.  
 Vía Gustavo Díaz 340  
 58000 Tlalapalapa, Mex.  
 Phone: 555-69-00  
 Fax: 555-49-14  
 Contact: Ing. Francisco J. Rodríguez  
 Director General

INDUSTRIAS UNIDAS, S.A. DE C.V.  
 Vía Oriente No. 398  
 Col. Amaliation San Juan de Aragón  
 07470 México D.F.  
 Phone: 760-60-00  
 Fax: 760-10-82  
 Contact: Ing. Atilio Baratta  
 Presidente

LUMISTEMAS, S.A. DE C.V.  
 Blvd. Toluca 230-A  
 Fracc. Industrial San Andrés  
 53500 Naucalpan, Mex.  
 Phone: 576-04-33  
 Fax: 550-38-04  
 Contact: Ing. Víctor Serrano  
 Director General

PLANTAS ELÉCTRICAS MEXICO, S.A. DE C.V.  
 Unidad Torres de México  
 Edif. A-17, Desp. 602  
 Col. México  
 01450 México D.F.  
 Phone: 522-16-20  
 Fax: 521-18-62  
 Contact: Ing. Roberto Arias  
 Gerente General

PRK DE MEXICO, S.A. DE C.V.  
 Cda. 8-9  
 Fracc. Industrial A-1, Bermeles  
 33470 Cd. Juárez, Chih.  
 Phone: (52) 13-10-86  
 Fax: 249-16-82  
 Contact: Osamu Takaki  
 Director General

PRK ELÉCTRO SISTEMAS, S.A. DE C.V.  
 Horrelas 27-2  
 Col. Los Angeles Femenitas  
 06310 México D.F.  
 Phone: 621-06-11  
 Fax: 621-06-27  
 Contact: Ing. Javier Tecocoatzi  
 Director General

INDUSTRIAS Y SISTEMAS DE ENERGÍA  
 Calle 5 No. 101  
 Ciudad Industrial - Man. de  
 21500 Tijuana, B.C.M.  
 Phone: 45-82-12 (66)  
 Fax: 45-82-12 (66)  
 Contact: Ing. Francisco J. Rodríguez  
 Gerente General

ENERGÍA Y SISTEMAS DE ENERGÍA  
 Calle 5 No. 101  
 Ciudad Industrial - Man. de  
 21500 Tijuana, B.C.M.  
 Phone: 45-82-12 (66)  
 Fax: 45-82-12 (66)  
 Contact: Ing. Francisco J. Rodríguez  
 Gerente General

BOUROS TEM, S.A. DE C.V.  
 Calle 9 No. 192  
 Fracc. Civas  
 62500 Cuernavaca, Mor.  
 Phone: 57-60-61 (73)  
 Fax: 57-61-19 (73)  
 Contact: Ing. Francisco J. Rodríguez  
 Director General

GENERAL ELÉCTRICAS DE MEXICO, S.A. DE C.V.  
 Horacio 105-5281  
 Col. Los Morales Polanco  
 06111 México D.F.  
 Phone: 52-70-545  
 Fax: 52-52-022  
 Contact: Sr. Jeffrey Cannon  
 Gerente General

INDUSTRIAS Y SISTEMAS DE ENERGÍA  
 José Velasco 400  
 Col. San Andrés Borel  
 06100 México D.F.  
 Phone: 55-26-252  
 Fax: 55-21-252  
 Contact: Sr. Jeffrey Cannon  
 Gerente General



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