Chapter one

Domestic electricity market 1997-2007

During the 1997-2007 period, domestic electric power consumption maintained an average annual growth rate of 3.9% as a result of the dynamics observed mainly in the residential and medium-sized industry sectors. Self-supply has also shown a dynamic behavior of 10.2%. This chapter presents the detailed behavior of economic variables and of domestic electricity consumption, the recent evolution of installed capacity, electric power production, fuel consumption for public service as well as self-supply.

1.1 Domestic electric power consumption

Domestic electric power consumption (CNEE for its Spanish acronym) is integrated by two components: i) domestic electric power sales, including the electricity delivered to users with the public sector's production resources, considering independent power producers, and ii) self-supply, including self-supply license-holders, cogeneration, continuous own usage, small-scale production and electric power imports.

In 2007 domestic electric power consumption amounted to 203,638 GWh, representing a 3.1-% increase with regard to the previous year, which is a variation similar to that observed during 2005-2006, that is, 3.2% (see chart 1). Likewise, Gross Domestic Product (GDP) growth was 3.2%, while domestic electric power sales increased by 2.9% with respect to 2006, reaching 180,469 GWh. Self-supplied consumption grew by 5.0%, propelled mainly by remote self-supply, reaching a consumption of 23,169 GWh.

Chart 1

Domestic electric power consumption, 1997-2007

GWh

Concept	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	aagr (%) 1997-2007
Domestic consumptio	**139,024**	**146,289**	**155,860**	**166,379**	**169,270**	**172,566**	**176,992**	**183,973**	**191,339**	**197,435**	**203,638**	**3.9**
variation (%)		*5.2*	*6.5*	*6.7*	*1.7*	*1.9*	*2.6*	*3.9*	*4.0*	*3.2*	*3.1*	
Domestic sales	130,255	137,210	144,996	155,352	157,204	160,203	160,384	163,509	169,757	175,371	180,469	3.3
variation (%)		*5.3*	*5.7*	*7.1*	*1.2*	*1.9*	*0.1*	*1.9*	*3.8*	*3.3*	*2.9*	
Self-supply	8,769	9,079	10,864	11,027	12,066	12,363	16,608	20,463	21,582	22,064	23,169	10.2
variation (%)		*3.5*	*19.7*	*1.5*	*9.4*	*2.5*	*34.3*	*23.2*	*5.5*	*2.2*	*5.0*	

Source: Sener, CFE and CRE.

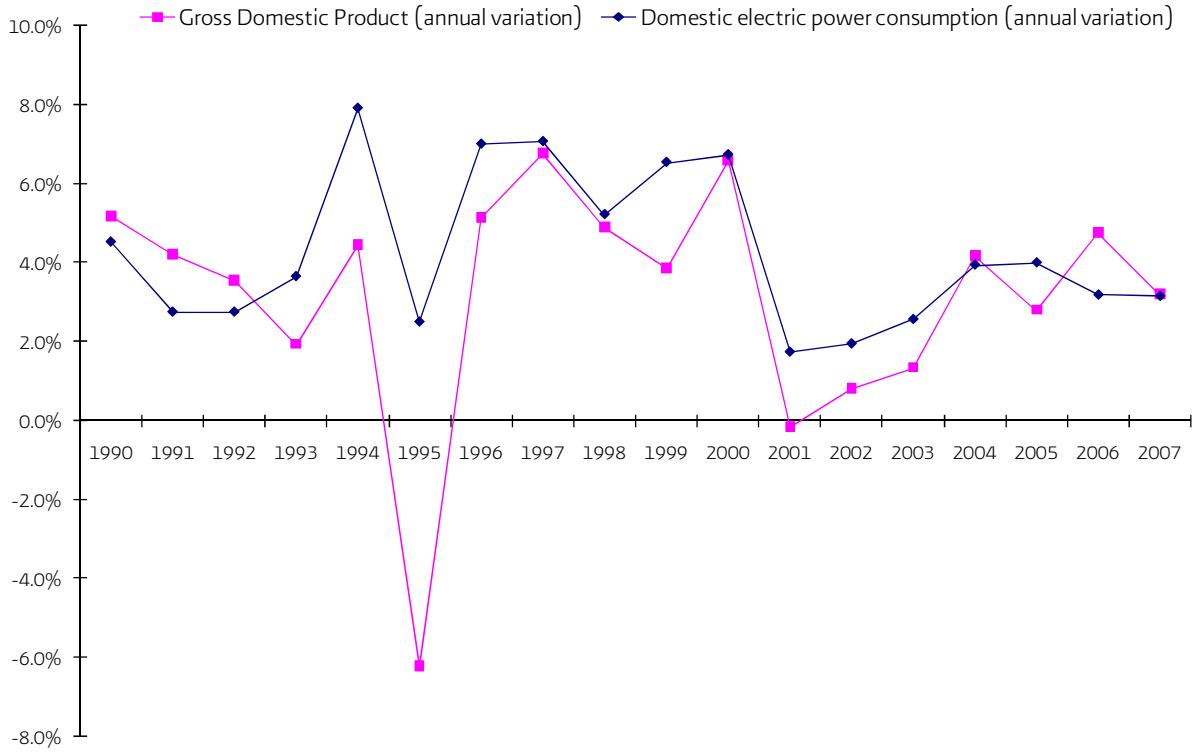
Usually, the behavior of electric power consumption has a positive correlation with the rhythm of economic activity; whenever GDP increases, electric power consumption increases as well (see graph 1). Notwithstanding the fact that domestic electric power consumption usually increases faster than GDP, there are years when power consumption increases are smaller in magnitude due to diverse factors, such as lower demand by some industry types that are otherwise intensive electric power consumers. In 2007, GDP variation was 3.2%, slightly higher than power consumption increase (3.1%).

In the same year, the GDP dynamism was lower than in 2006. Specifically, the economic activity areas that reduced their growth were the manufacture industry (from 4.7% to 0.9%) and industries that are intensive power consumers (iron steel, glass and aluminum, among others) that decreased their consumption from an average 8.6% to 2.4%.

Graph 1

Historical evolution of GDP and domestic electric power consumption, 1990-2007

(%)



Source: CFE and INEGI.

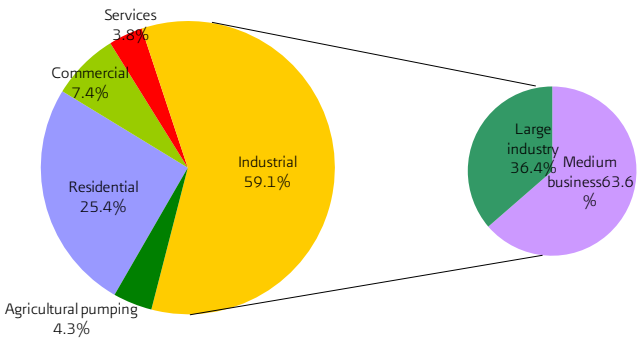
1.1.1 Electric power sales by sector

For the analysis of domestic electric power consumption, consumption is separated into five sectors: industrial, residential, commercial, services and agriculture. In order of magnitude, the industrial sector is the main power consumer, due mainly to the large variety of production systems and processes that make intensive use of this energy type on an almost continuous basis. In 2007, aforementioned sector consumed 59.1% of total sales with 106,633 GWh, most of which corresponded to general medium-tension service, including medium-sized industry users, as well as commercial establishments and medium to large-scale services. Due to the diversity of applications in electric power usage within the industrial sector, large part of the electric power supply must be provided in medium, high and very high tension; therefore, sales in this sector are subdivided into large industry and medium businesses. In the case of large industry, the sub-sector includes the consumption of users of HS, HSL, HT and HTL fees, for general high-tension service, constituted mainly by large industrial establishments and by the most important drinking water pumping systems of the country. On the other hand, the residential sector consumed 25.4% of total domestic sales, becoming the second most important electric power consumer, followed by the commercial sector with 7.4%, by agricultural pumping services with 4.3% and finally by the services sector with 3.8% (see graph 2).

Graph 2

Domestic sales distribution by sector, 2007

(%)



Source: CFE.

The most dynamic power consuming sector during the last 10 years has been the residential sector, with an average growth of 4.5%, followed by the industrial sector with 3.2%, by the commercial sector with 3.1%

and the services sector with 2.9%. Electric power consumption for agricultural pumping has remained almost invariable during the period (see chart 2 and graph 3). In terms of consumption magnitude, the industrial sector, specifically the medium-sized business sector, is the one that concentrates the largest share of total domestic sales with 37.6%.

Chart 2

Domestic electric power sales by sector, 1997-2007

(GWh)

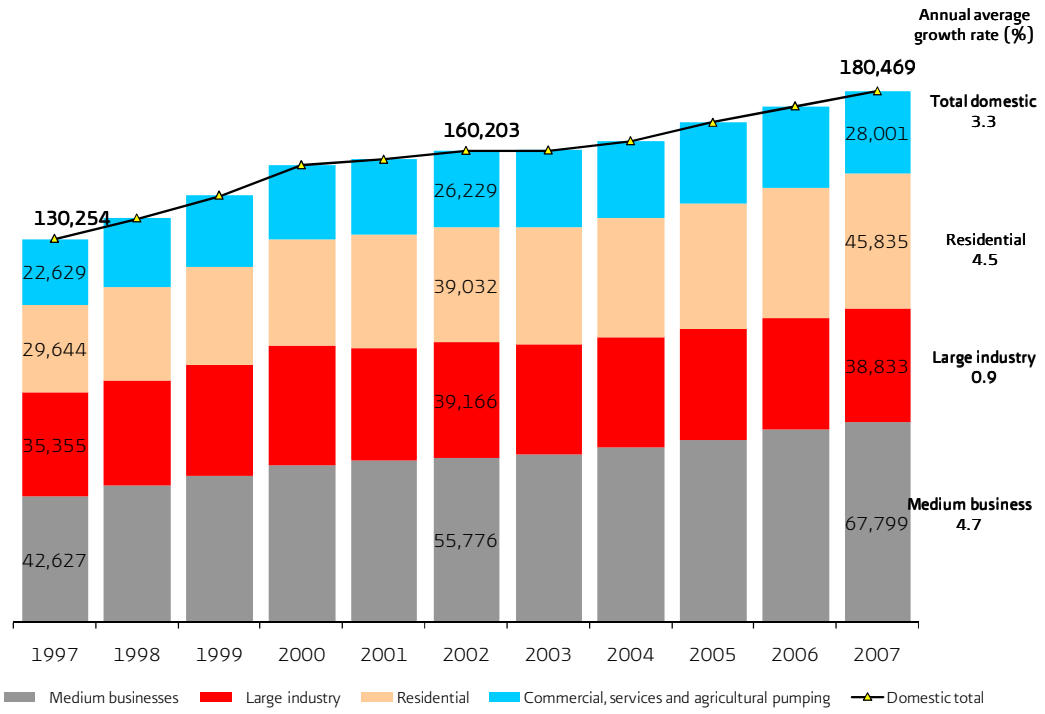
Sector	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	aagr (%) 1997-2007
Domestic total	**130,254**	**137,209**	**144,996**	**155,349**	**157,204**	**160,203**	**160,384**	**163,509**	**169,757**	**175,371**	**180,469**	**3.3**
Residential	29,644	31,690	33,369	36,127	38,344	39,032	39,861	40,733	42,531	44,452	45,835	4.5
Commercial	9,871	10,496	10,945	11,674	12,167	12,509	12,808	12,908	12,989	13,210	13,388	3.1
Services	5,109	5,192	5,450	5,891	5,973	6,076	6,149	6,288	6,450	6,596	6,809	2.9
Industrial	77,982	82,088	87,234	93,755	93,255	94,942	94,228	96,612	99,720	103,153	106,632	3.2
Medium businesses	42,627	46,264	49,446	53,444	54,720	55,776	56,874	59,148	61,921	65,266	67,799	4.7
Large industry	35,355	35,824	37,788	40,311	38,535	39,166	37,354	37,464	37,799	37,887	38,833	0.9
Agricultural pumping	7,649	7,743	7,997	7,901	7,465	7,644	7,338	6,968	8,067	7,960	7,804	0.2

Source: CFE.

Graph 3

Domestic electric power sales evolution by sectors, 1997-2007

(GWh)



Source: CFE.

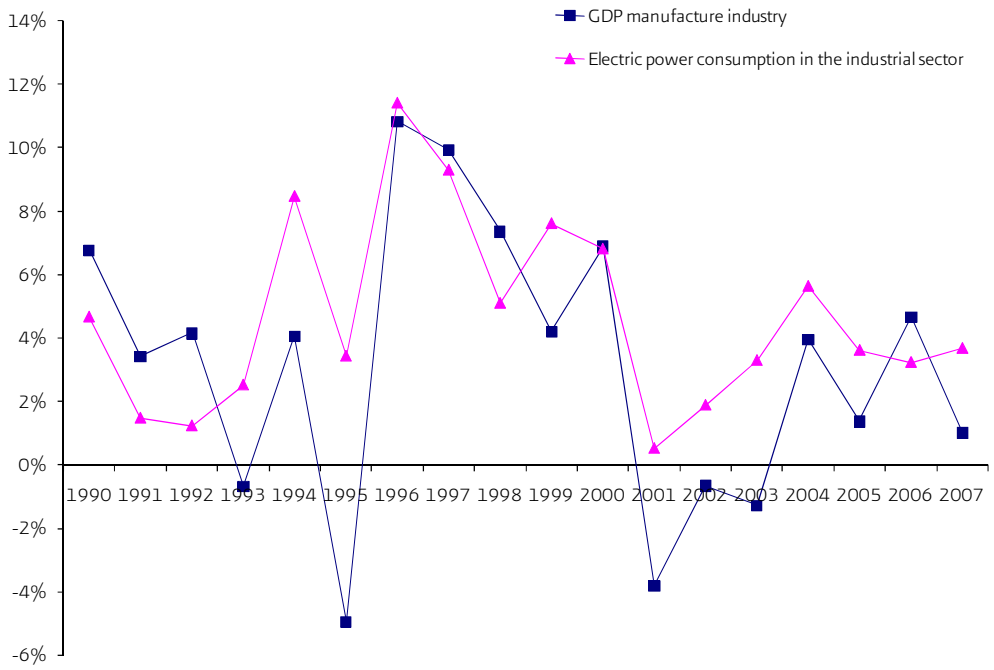
The behavior of sales to the industrial sector has been greatly fostered by medium-sized businesses, showing the highest degree of dynamism with a growth of 4.7% during the last 10 years, while sales to the large industry have registered smaller growth as a result of their own economic dynamics and of the possibility of choosing self-supply in branches with intensive electric power use, among other factors.

In view of its economic relevance and its high share in domestic electric power consumption, the economic performance of the manufacture industry is an important factor in the industrial sector's electric power demand. In recent years, and after a period of three years (2001-2003) with negative rates, the manufacture industry's GDP has grown at average annual rates ranging from 1.0% to 4.7% (see graph 4). Electric power consumption in the industrial sector has maintained an average growth rate of 4.0%.

Graph 4

Electric power consumption evolution in the industrial sector and the manufacture industry's GDP, 1990-2007

(annual percentage variation)



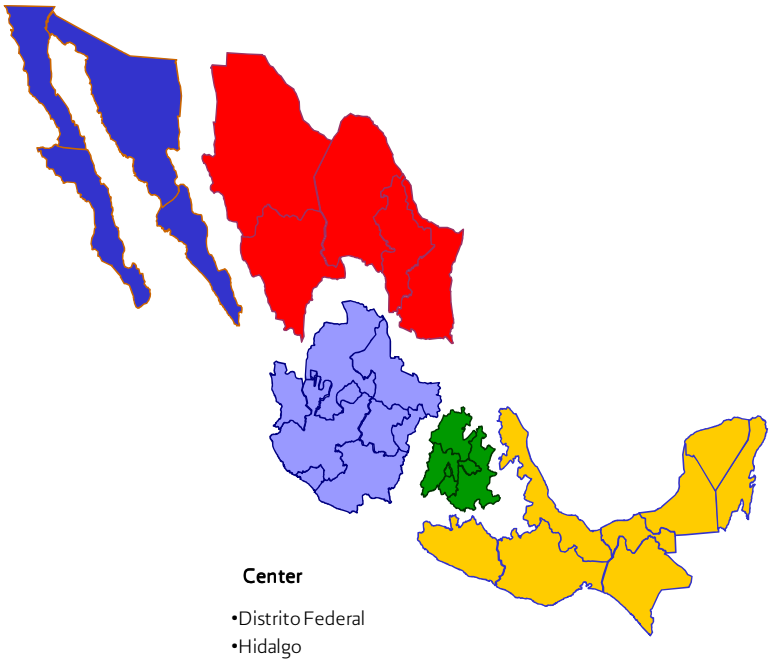
Source: CFE and INEGI.

1.1.2 Domestic electric power sales by region

Five statistical regions have been established in Mexico for the analysis of the domestic electricity market (see Map 1). It is important to point out that CFE divides the National Electricity System (SEN for its Spanish acronym) into nine areas, according to their infrastructure and operation. However, for the analysis made in this prospective, with the exception of the topic of gross demand by operative areas and demand behavior by stations, reference will be made only to the five statistical regions.

Map 1

Statistical regionalization of the domestic electric power market



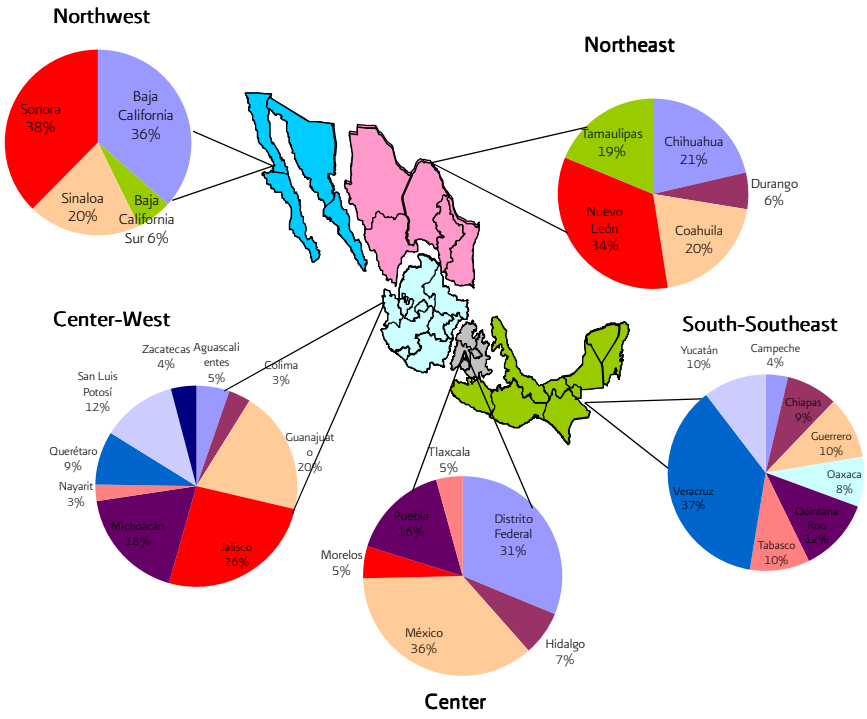
Source: Sener, based on data from the President's Office.

Map 2 shows every region with the respective percentage share of each federal entity in the regions' electric power sales. In descending order of magnitude in electric power consumption, entities with the highest share during 2007 were: Estado de México, Nuevo León, Distrito Federal, Jalisco, Veracruz and Sonora.

Map 2

Domestic sales structure (GWh) by federal entity and statistical region, 2007

(average percentage share)



Source: CFE.

In 2007, domestic sales -compared to the previous year- grew by 2.9%, fostered mainly by sales in the South-Southeastern region with 4.8%, in the Central-Western region with 3.6% and in the Northwestern region with 3.3%.

Chart 3

Total domestic sales by region, 1997-2007

(GWh)

Region	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	aagr (%) 1997-2007
Total	**130,254**	**137,209**	**144,996**	**155,349**	**157,204**	**160,203**	**160,384**	**163,509**	**169,757**	**175,371**	**180,469**	**3.3**
variation (%)		5.3	5.7	7.1	1.2	1.9	0.1	1.9	3.8	3.3	2.9	
Northwestern	16,901	17,230	18,505	19,949	20,480	20,354	21,270	22,311	23,195	24,345	25,145	4.1
variation (%)		1.9	7.4	7.8	2.7	-0.6	4.5	4.9	4.0	5.0	3.3	
Northeastern	31,658	33,961	36,404	39,236	39,989	40,863	39,235	39,421	41,221	42,843	43,644	3.3
variation (%)		7.3	7.2	7.8	1.9	2.2	-4.0	0.5	4.6	3.9	1.9	
Central-Western	28,926	30,763	32,801	35,192	34,909	35,570	36,242	37,451	38,843	40,249	41,708	3.7
variation (%)		6.4	6.6	7.3	-0.8	1.9	1.9	3.3	3.7	3.6	3.6	
Central	35,080	36,611	38,239	40,733	40,993	41,280	40,969	41,006	42,111	42,548	43,350	2.1
variation (%)		4.4	4.4	6.5	0.6	0.7	-0.8	0.1	2.7	1.0	1.9	
South-Southeastern	17,617	18,574	18,970	20,160	20,744	22,046	22,582	23,227	24,294	25,289	26,512	4.2
variation (%)		5.4	2.1	6.3	2.9	6.3	2.4	2.9	4.6	4.1	4.8	
Small systems	73	71	77	80	90	89	86	93	93	97	110	4.2

Source: CFE.

1.1.2.1 Northwestern region

In this region, electric power sales increased by 3.3% during 2007. Sonora and Baja California states concentrate 74.1% of sales. On the other hand, Baja California Sur registered the largest annual percentage variation in sales, with 9.0%. Though sales in this entity are smaller when compared to other federal entities, during the last 10 years they have grown at an annual average rate of 5.7%, due mainly to the new real estate developments established in the zone for tourism. In Baja California, sales have increased by an average 4.7% during the period as a result of industrial and population growth in cities like Tijuana and Mexicali. It is important to remember that the Northwestern region's principal characteristic is extreme climate with high summer temperatures and intense winter colds, affecting electric power consumption patterns in the region's urban zones, in Mexicali for instance, where power consumption increases noticeably during the summer months (from mid-May through the end of September) due to the intensive use of air-conditioning.

1.1.2.2 Northeastern region

In 2007, this region registered a variation of 1.9%, representing an increase of smaller magnitude compared to that observed in 2006. Durango state showed the highest dynamics in electric power sales with 6.8%, while Chihuahua registered only 2.3% and the rest of the states had growth rates below 2%. Notwithstanding marginal sales increase during 2007, Nuevo León concentrated the highest share of regional sales with 33.7% and with a share of 8.2% in domestic sales. It is publicly known that an important industrial and manufacturing plant is located in this entity, including branches that are intensive electric power consumers, such as the glass, iron steel, cement and chemical industry, among others.

1.1.2.3 Central-Western region

Similar to 2006, electric power sales in this region increased by 3.6% in the last year. Jalisco, Guanajuato and Michoacán states together represented 63.8% of regional electric power sales; the two former registered

growth rates above 4.0% during the last 10 years. Notwithstanding its low share in regional sales, Nayarit registered an increase of 6.5% during the 1997-2007 period, and of 5.7% during the last year. The Central-Western region is another region with relevant loads corresponding to the variety of intensive industries in zones like Guadalajara, Lázaro Cárdenas, Querétaro and León.

1.1.2.4 Central region

Sales increased by 1.9% in this region, fostered mainly by Morelos and Puebla states, with 4.3% y 4.1%, respectively. The Federal District registered a growth of 1.3% and its share, together with Estado de México, represent 67.4% of the region's sales and 16.2% of total domestic public service sales. In addition to the industrial facilities that make intensive use of electric power in the region, the Cutzamala pumping system is also a relevant consumer. Due to the area's high population density, medium and high-tension loads[1] represent the largest share in the region's sales.

1.1.2.5 South-Southeastern region

The South-Southeastern region registered the highest growth in public service sales in 2007, representing 4.8%. During the last 10 years, this region has maintained a constant annual average growth of 4.2%. Quintana Roo state presented the highest annual average growth rate with 8.5% during 1997-2007, and in 2007 its share in regional sales was 12.2%. In the case of Veracruz, though annual average growth was only 0.9%, the entity concentrates 37.0% of regional sales and 5.5% of total domestic public service sales. Iron steel, paper and beer factories in the Veracruz-Orizaba region and in the Papaloapan river basin, as well as refining and petrochemical facilities of Pemex and private companies in the Coatzacoalcos-Minatitlán region constitute important loads in the state and in the region.

1.1.3 Demand behavior of the National Interconnected System (SIN) by hour and station

The production of electric power required to satisfy domestic consumption (domestic sales and self-supply), taking into account usage by production centrals, as well as own usage and losses in transformation, transmission and distribution stages, among other factors, constitutes total production or gross energy.

Since electric power cannot be stored, in order to determine the production capacity required to satisfy added demand, temporary variations must be considered (by station, weekly, daily and hourly) and maximum annual demand, that is, the maximum value of demand presented in each area at different times during a year, must be determined for each operative area.

As to the operation and planning of the National Electricity System, CFE divides the system into nine areas[2]. Hence, interconnected operative areas may share capacity resources, and the system's functioning as a whole becomes more economic and reliable.

[1] Basically the residential, commercial and services sectors.

[2] Northwestern, Northern, Northeastern, Western, Central, Eastern and Peninsular areas, Baja California and Baja California Sur. With the exception of the two latter, these regions form the SI; the Northwestern region was interconnected in March 2005.

Though there have been links from the Northwestern region to the Northern and Western regions for years, for stability reasons the Northwestern area had been operating separately. In March 2005, the Northwestern area became permanently interconnected to the rest of the system. This important step has allowed for great savings in electric power generation, as well as local benefits to avoid affecting loads in the Northwest and North. On the other hand, studies have been carried out to assess the feasibility of interconnecting the Baja California area to SIN, which would allow for the sharing of the system's production resources to attend to peak demand in the area, as well as power and energy transactions between SIN and the Western Electricity Coordinating Council, WECC, in the California area.

1.1.3.1 Maximum coincidental demand

Maximum coincidental demand is the maximum value of the sum of hourly demand registered in each operative area of SIN at the same moment or time interval; this demand is lower than the sum of maximum annual demands of each area, since they occur at different times.

Unlike between 2002 and 2004, when maximum coincidental demand was reached in May, in 2005 it was registered in September, while in 2006 and 2007 it was registered during June, increasing by 3.3% this last year (see chart 4). Given the interconnection of the Northwestern area in 2005, the values reported in the chart for 1996 through 2004 do not include aforementioned area, which fact explains the higher values of maximum coincidental demand as of that year.

Chart 4

Interconnected System: maximum coincidental demand, 1997-2007

(MW)

Period	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
January	19,848	20,961	21,746	23,191	24,329	24,943	24,789	25,566	28,110	29,070	30,292
February	19,991	21,168	22,467	23,833	24,620	24,696	25,652	25,980	28,488	29,554	30,187
March	20,230	21,565	22,509	24,500	24,670	25,403	26,403	26,543	29,019	30,151	31,524
April	19,608	21,760	22,697	23,674	25,254	25,738	25,815	26,265	29,273	30,533	31,024
May	19,881	22,028	23,191	24,511	24,885	26,152	27,433	27,282	30,380	31,116	31,686
June	20,331	22,205	23,321	23,162	24,729	25,633	26,325	26,742	30,919	31,547	32,577
July	19,837	21,620	22,485	24,276	24,347	24,852	25,602	26,016	29,736	31,040	31,217
August	20,575	21,773	22,828	24,494	24,946	25,882	25,748	26,717	30,318	31,130	32,156
September	21,002	21,837	23,421	25,207	25,267	25,403	25,530	26,402	31,268	31,057	32,218
October	20,843	21,697	22,778	24,487	25,660	25,450	25,439	27,275	30,278	31,015	32,021
November	20,846	21,776	23,189	24,378	25,092	25,151	25,840	26,682	29,652	30,422	31,202
December	21,367	21,987	23,596	25,075	25,598	25,582	25,998	27,197	29,867	30,366	31,232
Maximum annual	**21,367**	**22,205**	**23,596**	**25,207**	**25,660**	**26,152**	**27,433**	**27,282**	**31,268**	**31,547**	**32,577**
Increase (%)	6.7	3.9	6.3	6.8	1.8	1.9	4.9	-0.6	14.6	0.9	3.3
Load factor (%)	76.3	78.4	77.6	77.4	77.4	78.1	76.3	79.0	78.0	80.0	80.0

Source: CFE.

As to the load factor, indicating the behavior of average electric power demand with respect to the maximum demand registered in the same time interval, in 2007 this factor was maintained at levels similar to

those of 2006, reflecting certain degree of uniformity in load behavior. A load factor close to the unit means more intensive and continuous use of power-consuming systems and equipment connected to the grid.

1.1.3.2 Gross demand by operative area

Gross demand analysis[3] by operative area allows for the identification of minimum, intermediate and maximum consumption in SIN, registered during specific periods. Hence the relevance of the magnitude of maximum demands in each operative region[4] and of maximum coincidental demand.

In 2007, the SIN area with the largest increase with respect to the previous year in maximum demand has been the Northwestern region with 4.9%. Between 1997 and 2007, the Peninsular and Northern regions presented the largest annual average growth rates with 5.6% and 4.9%, respectively. Maximum demands were registered in the Central, Western and Northeastern regions due to the urban and industrial concentration in these areas (see chart 5).

[3] Together with load curve analysis.
[4] Regardless of the instant they occur.

Chart 5

SEN[5]: gross demand by operative area, 1997-2007

(MW)

Area	Load	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	aagr (%) 1997-2007
	P	1,937	2,163	2,231	2,421	2,516	2,660	2,720	2,853	2,997	3,113	3,130	4.9
North	M	1,407	1,520	1,597	1,723	1,806	1,859	1,896	1,963	2,083	2,140	2,216	4.6
	B	1,290	1,378	1,457	1,569	1,649	1,682	1,715	1,667	1,782	1,831	1,894	3.9
	P	4,307	4,662	4,759	5,245	5,558	5,676	5,688	6,148	6,068	6,319	6,586	4.3
Northeast	M	3,128	3,351	3,615	3,874	3,933	4,062	4,106	4,256	4,410	4,590	4,688	4.1
	B	2,867	3,061	3,363	3,571	3,574	3,706	3,756	3,797	3,936	4,090	4,184	3.9
	P	5,209	5,472	5,702	6,062	6,157	6,345	6,632	6,523	7,047	7,106	7,437	3.6
Western	M	3,916	4,164	4,435	4,732	4,701	4,827	4,999	5,157	5,449	5,621	5,891	4.2
	B	3,631	3,875	4,155	4,438	4,379	4,491	4,638	4,364	4,618	4,775	5,016	3.3
	P	6,447	6,884	7,181	7,439	7,700	7,737	7,874	8,047	8,287	8,419	8,606	2.9
Central	M	4,202	4,406	4,616	4,885	5,048	5,141	5,252	5,394	5,608	5,767	5,931	3.5
	B	3,706	3,859	4,050	4,321	4,462	4,567	4,672	4,049	4,262	4,371	4,505	2.0
	P	4,528	4,797	4,954	5,058	5,291	5,373	5,434	5,425	5,684	5,882	5,786	2.5
Eastern	M	3,125	3,330	3,444	3,633	3,657	3,801	3,891	3,954	4,133	4,275	4,375	3.4
	B	2,815	3,006	3,111	3,318	3,296	3,453	3,550	3,430	3,615	3,703	3,842	3.2
	P	737	805	839	908	971	985	1,043	1,087	1,174	1,268	1,275	5.6
Peninsular	M	509	555	593	654	703	729	776	801	824	881	953	6.5
	B	459	499	539	597	644	673	718	636	658	703	763	5.2
	P	2,182	2,195	2,217	2,365	2,496	2,457	2,491	2,606	2,872	2,916	3,059	3.4
Northwest	M	1,392	1,415	1,464	1,526	1,575	1,534	1,596	1,668	1,770	1,823	1,897	3.1
	B	1,217	1,243	1,298	1,340	1,371	1,331	1,399	1,417	1,515	1,540	1,602	2.8
	P	1,329	1,393	1,491	1,695	1,698	1,699	1,823	1,856	1,909	2,095	2,208	5.2
Baja California	M	813	842	927	1,048	1,087	1,081	1,211	1,170	1,195	1,266	1,287	4.7
	B	699	720	803	905	952	945	1,076	966	984	1,039	1,051	4.2
	P	170	181	186	204	224	215	214	234	264	284	307	6.1
Baja California Sur	M	114	117	125	132	136	136	141	152	166	183	197	5.6
	B	102	103	111	116	116	118	125	122	135	149	161	4.6
	P	19	19	20	21	22	22	22	24	24	25	28	4.0
Small systems	M	9	9	9	10	11	11	12	12	13	14	15	5.7
	B	6	8	7	8	9	9	9	10	10	10	12	6.7

P= peak load M= mean load B= base load (average of minimum daily demand).

Source: CFE

1.1.3.3 Demand behavior by hour and station

A system's global load is constituted by a large number of individual loads of different classes (industrial, residential, commercial, etc.). The respective instants of connection and disconnection of these loads are random, but the power required within a given period by the set of loads follows a certain pattern that depends on the rhythm of activities in the regions served by the electricity system.

The introduction of hourly fees for industrial customers and the summer time system have lead to changes in consumption, reflected in the reduction of loads during peak demand hours, with the resulting benefit of an improved use of capacities.

[5] Does not include local self-supply and export.

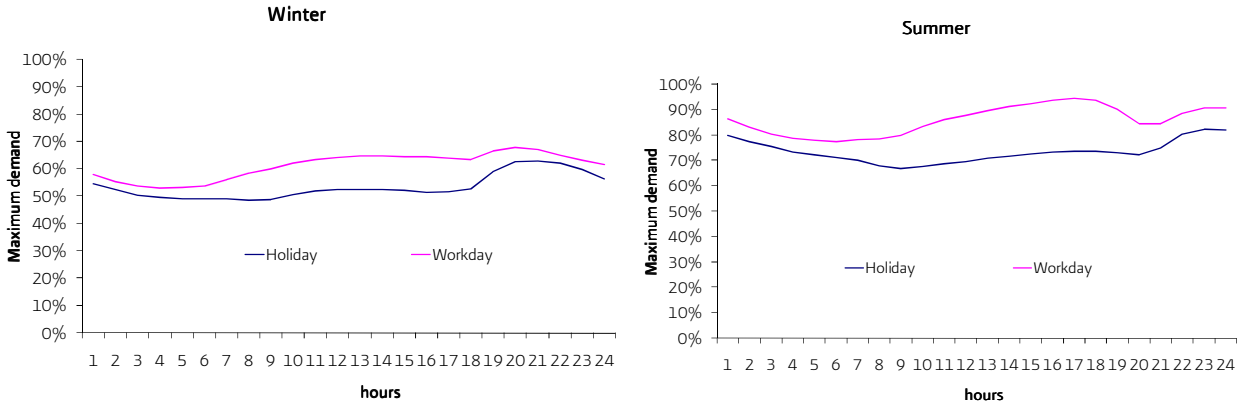
Graph 5 shows typical load curves in the country's north and south areas, corresponding to working and non-working days, for the winter and summer of 2007. They show the relative magnitude of hourly loads with respect to the maximum annual electric power demand. It is evident that load profiles depend on the geographic region, time of the year and type of day.

Graph 5

Typical hourly load curves with respect to maximum demand

Operative areas of the North, 2007

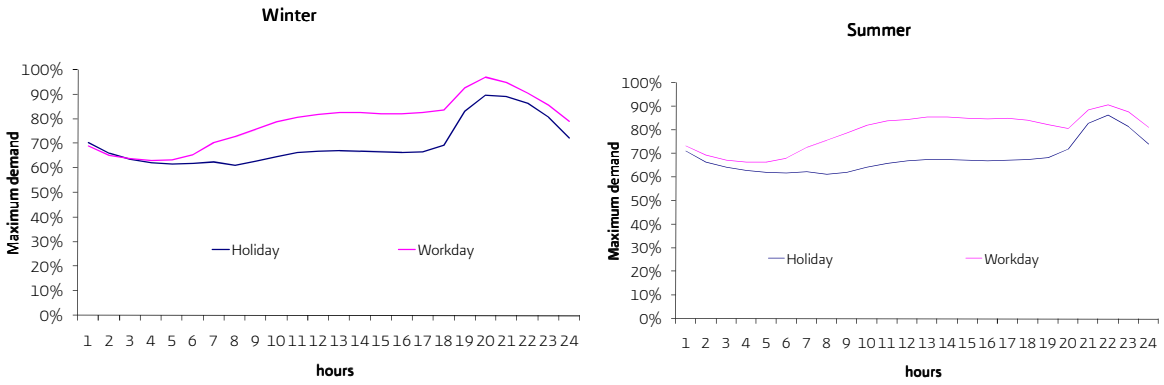
(average of the Northern, Northwestern and Northeastern areas)



Typical hourly load curves with respect to maximum demand

Operative areas of the South, 2007

(average of the Western, Eastern, Central and Peninsular areas)



Source: CFE.

1.1.4 Fee structure and subsidy policy

Fees for electric power supply and sale are classified according to their use and tension level into the following categories:

- Domestic: 1, 1A, 1B, 1C, 1D, 1E, 1F and High-Consumption Domestic (DAC for its Spanish acronym)
- Public services: 5, 5-A and 6
- Agriculture: 9, 9M, 9-CU and 9-N
- Temporary: 7
- General low-tension: 2 and 3
- General medium-tension: O-M, H-M and H-MC
- General high-tension: HS, HS-L, HT and HT-L
- Medium-tension backup: HM-R, HM-RF and HM-RM
- High-tension backup: HS-R, HS-RF, HS-RM, HT-R, HT-RF and HT-RM
- Interruptible service: I-15 and I-30

Electricity fees are subject to monthly adjustments, with the exception of agricultural fees 9-CU and 9-N, which are adjusted on an annual basis.

General usage medium-tension (MT) and high-tension (AT) fees, backup service fees and interruptible service fees, as well as the domestic high-consumption fee DAC and the temporary fee are adjusted through an automatic monthly adjustment procedure reflecting fuel price variations and inflation. The remaining fees (domestic, public services and agricultural) are adjusted using fix factors.

Fix factors are authorized through specific agreements and are related to the estimates of expected inflation evolution.

Monthly variations in the inflation component are estimated using a weighted average of Producer Price Indexes from seven indexes selected from the Producer Price System of the Bank of Mexico. These indexes correspond to six divisions of the manufacture industry[6] and to the large construction division.

According to the type of tension supplied, the commercial sector is constituted by customers paying general low-tension fees and fee 7, and the industrial sector is integrated by customers paying general and backup service fees, both medium and high-tension.

As seen in graph 6, with the exception of the agricultural fee, average electricity prices in all sectors tend to increase as a result of fuel price increases and inflation, reflected in the automatic monthly adjustment of fees subject to this regime.

[6] Wood and related products industry, chemical substances, oil, rubber and plastic, non-metallic mineral products, basic metal industries, metallic products, machinery and equipment, as well as other manufacture industries.

In this sense, the highest mean prices are observed in the commercial sector, showing an ascending tendency since 2002 (see graph 6). Likewise, mean prices in the industrial sector (large industry and medium businesses) have been increasing in a sustained manner as of that year. Mean prices in the residential sector in turn have shown slight variations as of 2002. Mean prices in the agricultural sector are the lowest and this sector has registered less variations with respect to the other sectors.

On the other hand, electricity fee subsidies are defined as the difference between the price of electricity paid by consumers and the average cost of supply. Subsidies to CFE fees are financed through accounting transfers using resources obtained from utilization. In this way, the Federal Government reimburses to the company the subsidies transferred to its consumers through utilization that CFE is bound to pay to the government. However, since 2002, the amount of subsidies has been higher than utilization, hence there is insufficient utilization with respect to subsidies, which affects the organisms' patrimony. In the case of LFC, the government performs direct transfers to the company to cover its operation deficit and the subsidies granted to consumers.

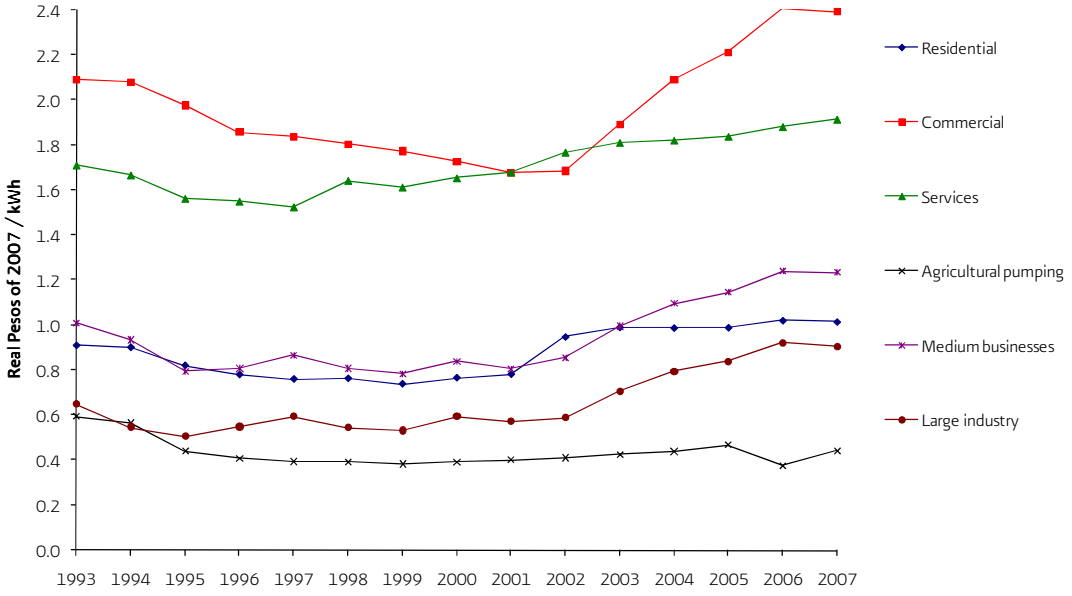
According to the legal framework that regulates electricity fees, such fees should cover costs and promote efficient consumption. However, currently only a small portion of residential users pay the marginal cost of electricity services, thus the current fee system does not allow for cost recovery.

As a result of the application of the fee policy in force, in 2008 the amount of subsidies granted by the Federal Government to final CFE consumers through electricity fees is expected to reach 86,834 million pesos, a figure that is 29.4% higher in real terms than the 2007 figure. For 2008, subsidies granted to final LFC consumers are estimated at 46,397 million pesos, a figure that is 11.5% higher than the 2007 figure.

Graph 6

Mean electric power prices by user type, 1993-2007

(pesos of 2007/kWh)



Source: CFE.

1.1.5 Electric power interconnections and foreign trade

The National Electricity System (SEN) is interconnected with the exterior through permanently operated interconnections and interconnections used only in emergencies. The reason for the existence of the latter is that it is technically impossible to join large systems with small lines, as there is a risk of system instability from one or another country.

Electric power foreign trade takes place through nine interconnections between the USA and Mexico and one interconnection between Mexico and Belize. Their capacity and operating tension varies. Five of them operate in emergencies, that is, when supply is affected by distortions or disturbances, as well as in circumstances that require the restoration of systems in cases of blackouts on both side of the Mexico-US border. Electric power for import or export comes from public service, without considering foreign trade undertaken by permit-holders.

Electric power trade is carried out through SEN and two regional reliability councils in the USA[7], operating through asynchronous links[8]. WECC covers an approximate surface of 1.8 million square miles (4.7 million km^2), and it is therefore the largest and most diverse of councils integrating the organization of North American Electric Reliability Corporation (NERC). WECC is linked to SEN in Baja California through two main substations located in California (Miguel and Imperial Valley) by means of a synchronous permanent interconnection. There is another interconnection in the zone of Ciudad Juárez, Chihuahua, with the Insurgentes and Rivereña substations, interconnected with two substations on the US side in the area of El Paso, Texas. The latter is synchronous and operates only in emergencies with a tension level of 115 kV and a transmission capacity of 200 MW. It is important to point out that the largest electric power foreign trade flows with the USA take place through SEN-WECC interconnections.

Interconnections between both systems in the Baja California area allow for a capacity of 800 MW for lines with tension levels of 230 KV (see map 3). WECC members in the USA are located in the states of California, Arizona, Nuevo México and a small part of Texas; the CFE system has interconnections in Baja California, Sonora and Chihuahua.

On the other hand, SEN has interconnection with another regional US council, the Electric Reliability Council of Texas, or ERCOT. The interconnection type of this council is for emergencies only, with the exception of the asynchronous interconnection between the Piedras Negras, Coahuila, and Eagle Pass, Texas, substations. Although their purpose is to provide electric power exchange in emergency situations, according to the type of asynchronous interconnection they may also be operated on a permanent basis. Operating tension for this system is 138 kV and its transmission capacity is 36 MW.

CFE and ERCOT share 1,200 km of borders for electric power exchange and consider the rest of interconnection lines in the north of the country. US systems that maintain contact with CFE are: American Electric Power Texas Central Company and American Electric Power Texas North Company, while on Mexico's side it is Chihuahua, Coahuila, Nuevo León and Tamaulipas states. On the south border, interconnection with Belize operates permanently since the system in that country is small and does not generate instability issues for SEN.

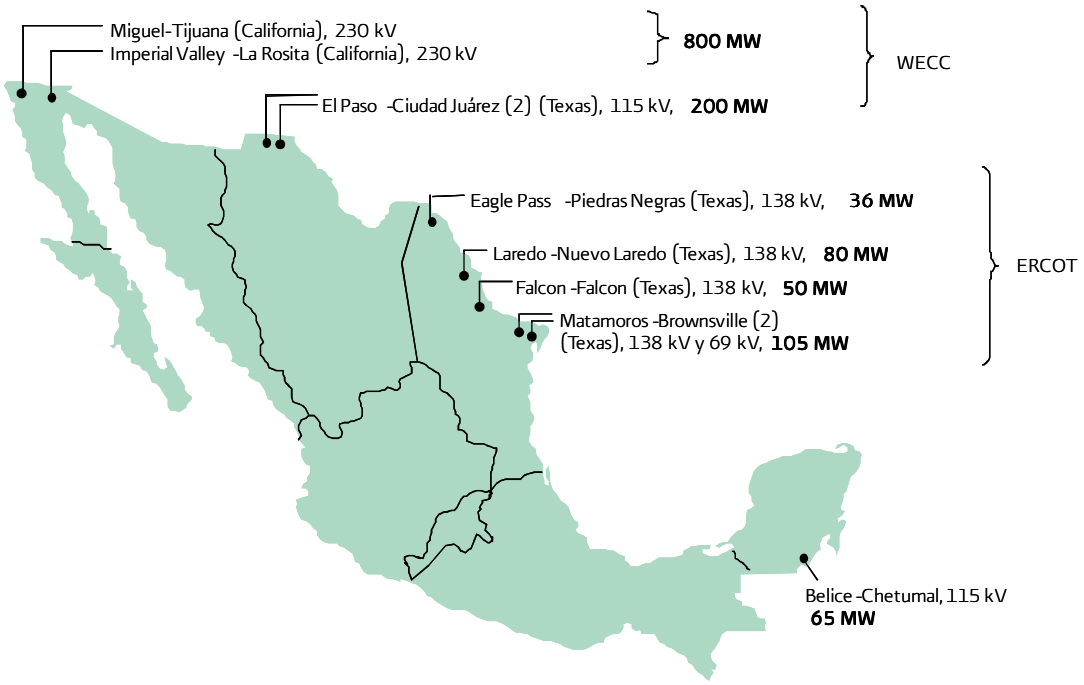
In 2007, transmission capacity and infrastructure for foreign trade has remained constant with regard to the previous year. Electric power exports in 2007 increased by 11.7% when compared to 2006, while imports registered a decrease of 245 GWh. Net electric power foreign trade balance was 1,174 GWh (see chart 6). The Baja California system operates the largest energy flows to the exterior, with a share of 83.5% in total exports.

[7] The North American Electric Reliability Corporation (NERC) is integrated by eight regional electric reliability councils in the USA: Electric Reliability Council of Texas (ERCOT), Florida Reliability Coordinating Council (FRCC), Midwest Reliability Organization (MRO), Northeast Power Coordinating Council (NPCC), Reliability*First* Corporation (RFC), Southeastern Electric Reliability Council (SERC), Southwest Power Pool (SPP) and Western Electricity Coordinating Council (WECC).

[8] Asynchronous links consist in direct current technology, with which the frequency variation among councils does not affect or "contaminates" energy interchange.

Map 3

International links and interconnections, 2007



WECC: Western Electricity Coordinating Council.
ERCOT: Electric Reliability Council of Texas.
Source: CFE.

Chart 6

Electric power foreign trade, 1997-2007

(GWh)

Federal entity	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Exports											
Chiapas[1]	-	-	-	-	-	-	-	-	1	2	2
Baja California[2]	17	45	31	66	112	164	765	770	1,037	1,072	1,211
Tamaulipas[3]	6	-	-	2	1	-	-	-	-	16	13
Quintana Roo[4]	28	31	100	127	158	180	188	236	253	209	225
Total	**51**	**76**	**131**	**195**	**271**	**344**	**953**	**1,006**	**1,291**	**1,299**	**1,451**
Imports											
Baja California[2]	406	480	646	927	82	311	45	39	75	514	266
Sonora[5]	3	3	4	4	4	5	5	6	6	6	6
Chihuahua[6]	1,101	1,022	7	129	235	189	21	2	6	3	3
Tamaulipas[3]	-	2	2	9	6	26	-	-	-	1	3
Total	**1,510**	**1,507**	**659**	**1,069**	**327**	**531**	**71**	**47**	**87**	**523**	**277**
Net balance export-import	-1,459	-1,431	-528	-874	-56	-187	882	959	1,204	776	1,174

[1] Guatemala.
[2] Coral Power L. L. C., San Diego Gas & Electric and Sempra Energy Solutions.
[3] Central Power & Light (CPL) (USA).
[4] Belize Electricity Board (Belize).
[5] Sasabe Trico Electric Cooperative and Santa Cruz (UNS Electric) (USA).
[6] Rio Grande Cooperative Inc. and American Electric Power (USA).
Source: CFE.

1.2 Structure of the National Electricity System (SEN)

As to the final destination of electric power generated, SEN is made up by two sectors: public and private. The public sector is integrated by CFE, LFC and centrals constructed by Independent Power Producers (PIE); the latter deliver the entire electric power they generate to CFE for public electricity service purposes. On the other hand, the private sector includes co-generation, self-supply, own usage and export modes. Among these modes, self-supply has a strong presence in diverse sectors, such as the industrial, commercial and the services sectors, where important increases have been registered in installed capacity during the last years.

In general terms, SEN infrastructure consists of the following phases: generation, transformation and transmission in high tension, distribution in medium and low tension, as well as sales to final users, including measuring and invoicing processes.

1.2.1 SEN's installed capacity

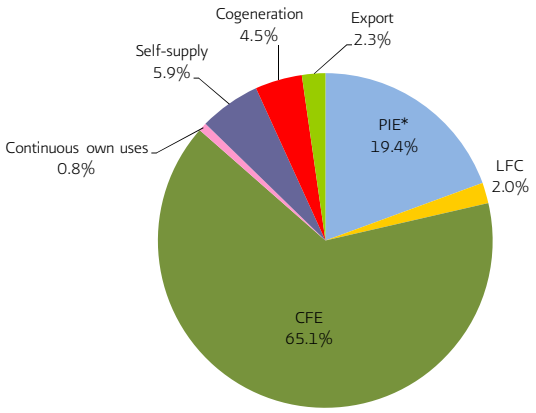
In 2007, national installed capacity increased to 59,008 MW, 51,029 MW[9] out of which correspond to public service (including independent production) and 7,980 MW correspond to permit-holders[10]. National electric power capacity by December 2007, including exports, increased by 4.7% when compared to 2006. From the total capacity installed, the increase of effective capacity contracted by CFE to independent producers stands out, increasing from 10,387 MW to 11,457 MW with the start of operations of the Tamazunchale plant, located in San Luis Potosí, with an effective capacity of 1,135 MW. As to self-supply in the last year, 135 new permits have been granted and, except for three permits that together represent 255 MW of authorized capacity, most permits are for low-capacity (below 10 MW) granted to the services sector for electric power generation in peak hours. In terms of percentage share, by the end of 2007 CFE represented 65.1% and LFC, 2.0% of the total installed capacity (see graph 7). Independent power producers registered a share of 19.4%[11]. Self-supply and co-generation in the private sector contribute with 5.9% and 4.5%, respectively, while installed capacity for electricity export represents 2.3%.

[9] Considering an installed capacity of 1,174 MW in LFC.
[10] Self-supply, co-generation, continuous own usage and export.
[11] This share corresponds to 11,457 MW of net effective capacity contracted by CFE, destined entirely to public service.

Graph 7

Domestic effective installed capacity, 2007

59,008 MW



* Considering the net effective capacity contracted by CFE.
Source: CFE and CRE.

1.2.2 Installed capacity in public service

By December 2007, installed capacity in public service registered a 2,260-MW variation when compared to 2006, as a result of the start of operation of new plants and modifications performed in other already operating plants.

From the total of newly added capacity, 1,135 MW correspond to the independent production plant of Tamazunchale. Other projects that started during the last year were the El Cajón hydroelectric plant with 750 MW, the La Venta II wind-electric plant with 83 MW, as well as eight gas turbine plants within the distributed generation project of LFC with 32 MW each, representing an additional capacity of 256 MW.

On the other hand, the Río Bravo (Emilio Portes Gil) thermoelectric plant underwent modifications to integrate combined cycle from two steam units of 37.5 MW (Units 1 and 2) and a gas turbine unit (unit 4) with 145.1 MW; with this, the plant currently has a combined cycle with a capacity of 211.1 MW. To achieve this, it was necessary to remove the boiler corresponding to steam cycles and integrate it into the gas turbine with the help of a heat exchanger which, due to the modified configuration of the cycle upon the removal of the boiler, resulted in steam units with an effective capacity of 33 MW each. As to capacity modifications, additions and reductions have been registered in different units, among which the 65-MW reduction of contracted capacity with the PIE Bajío plant stands out (see chart 7).

Chart 7

Additions, modification and removals, 2007

Plant	Capacity (MW)	Unit	Technology	Start of commercial operations	Location
Total	**2,259.9**				
Additions	**2,483.7**				
Ecatepec (LFC)	32.0	1	TG	January - 4	Mexico
Remedios (LFC)	32.0	1	TG	January - 4	Mexico
Victoria (LFC)	32.0	1	TG	January - 4	Mexico
Villa de las Flores (LFC)	32.0	1	TG	January - 4	Mexico
La Venta II	83.3	98 U's	EOL	January - 5	Oaxaca
Cuautitlán (LFC)	32.0	1	TG	January - 30	Mexico
Coyotepec (LFC)	32.0	1	TG	January - 30	Mexico
Coyotepec (LFC)	32.0	2	TG	January - 30	Mexico
El Cajón (Leonardo Rodríguez Alcaine)	375.0	2	HID	March - 1	Nayarit
El Cajón (Leonardo Rodríguez Alcaine)	375.0	1	HID	June - 1	Nayarit
Baja California Sur I	41.9	2	CI	June - 11	Baja California Sur
Tamazunchale (PIE)	1,135.0	1	CC	June - 21	San Luis Potosí
Holbox	0.8	8	CI	July - 1	Quintana Roo
Holbox	0.8	9	CI	July - 1	Quintana Roo
Vallejo (LFC)	32.0	1	TG	August - 9	Mexico
Santa Rosalía	1.6	9	CI	October - 1	Baja California Sur
Santa Rosalía	1.6	10	CI	October - 1	Baja California Sur
Santa Rosalía	1.6	11	CI	October - 1	Baja California Sur
Río Bravo (Emilio Portes Gil)*	33.0	1	CC	October - 5	Tamaulipas
Río Bravo (Emilio Portes Gil)*	33.0	2	CC	October - 5	Tamaulipas
Río Bravo (Emilio Portes Gil)*	145.1	4	CC	October - 5	Tamaulipas
Modifications	**-3.7**				
Holbox	-0.5	4	CI	January - 1	Quintana Roo
Holbox	-0.5	5	CI	January - 1	Quintana Roo
La Villita	10.0	2	HID	January - 1	Michoacán
Lerma (Tepuxtepec) (LFC)	7.0	2	HID	January - 1	Michoacán
Bajío (El Sáuz) PIE	-65.0	1	CC	March - 8	Guanajuato
Francisco Pérez Ríos (Tula)	22.8	3	TC	June - 1	Hidalgo
Francisco Pérez Ríos (Tula)	22.8	4	TC	July - 1	Hidalgo
El Sáuz	2.0	3	CC	August - 1	Querétaro
Santa Rosalía	-0.8	3	CI	October - 1	Baja California Sur
Santa Rosalía	-0.6	4	CI	October - 1	Baja California Sur
Santa Rosalía	-1.0	7	CI	October - 1	Baja California Sur
Guerrero Negro	-2.0	4	CI	October - 1	Baja California Sur
Guerrero Negro	-2.0	5	CI	October - 1	Baja California Sur
La Villita	10.0	3	HID	November - 1	Michoacán
Baja California Sur I	-5.9	1	CI	December - 1	Baja California Sur
Shut down	**-220.1**				
Río Bravo (Emilio Portes Gil)*	-37.5	1	TC	October - 4	Tamaulipas
Río Bravo (Emilio Portes Gil)*	-37.5	2	TC	October - 4	Tamaulipas
Río Bravo (Emilio Portes Gil)*	-145.1	4	TG	October - 4	Tamaulipas
Transfers					
Santa Rosalía to Vizcaino	12.5	1	TGM		Baja California Sur

Notes:
* Production unit process reconfigured in 2007 for combined cycle operation.
CC = Combined cycle TG = Gas turbine TGM = Mobile gas turbine TC = Conventional thermoelectric
HID = Hydroelectric PIE = Independent Power Producer EOL = Wind-electric
Source: CFE.

Regarding technologies based on the use of natural gas, (mainly combined cycle and gas turbine), during the last year they reached a share 38.2% in total capacity, while plants using fuel-oil and diesel reduced their share by an average 1.2% when compared to 2006, contributing 25.6% to the total. Coal represented 9.2% of installed capacity and renewable energy sources (including hydroelectric plants) represented 24.3%. Finally, nuclear-electric capacity contributed 2.7% of the total capacity for public service.

Chart 8

Effective public service capacity by plant type, 1997-2007

(MW)

Year	Alternative sources					Hydrocarbons					Total
	Hydraulic	Geothermal-electric	Wind-electric	Nuclear	Coal	Conventional Thermoelectric	Combined cycle*	Gas turbine	Internal combustion	Dual	
1997	10,034	750	2	1,309	2,600	14,282	1,942	1,675	121	2,100	34,815
1998	9,700	750	2	1,309	2,600	14,282	2,463	1,929	120	2,100	35,256
1999	9,618	750	2	1,368	2,600	14,283	2,463	2,364	118	2,100	35,666
2000	9,619	855	2	1,365	2,600	14,283	3,398	2,360	116	2,100	36,697
2001	9,619	838	2	1,365	2,600	14,283	5,188	2,381	143	2,100	38,519
2002	9,608	843	2	1,365	2,600	14,283	7,343	2,890	144	2,100	41,177
2003	9,608	960	2	1,365	2,600	14,283	10,604	2,890	143	2,100	44,554
2004	10,530	960	2	1,365	2,600	13,983	12,041	2,818	153	2,100	46,552
2005	10,536	960	2	1,365	2,600	12,935	13,256	2,599	182	2,100	46,534
2006	10,566	960	2	1,365	2,600	12,895	15,590	2,509	182	2,100	48,769
2007	11,343	960	85	1,365	2,600	12,865	16,662	2,831	217	2,100	51,029

* Includes independent power production.
Source: CFE.

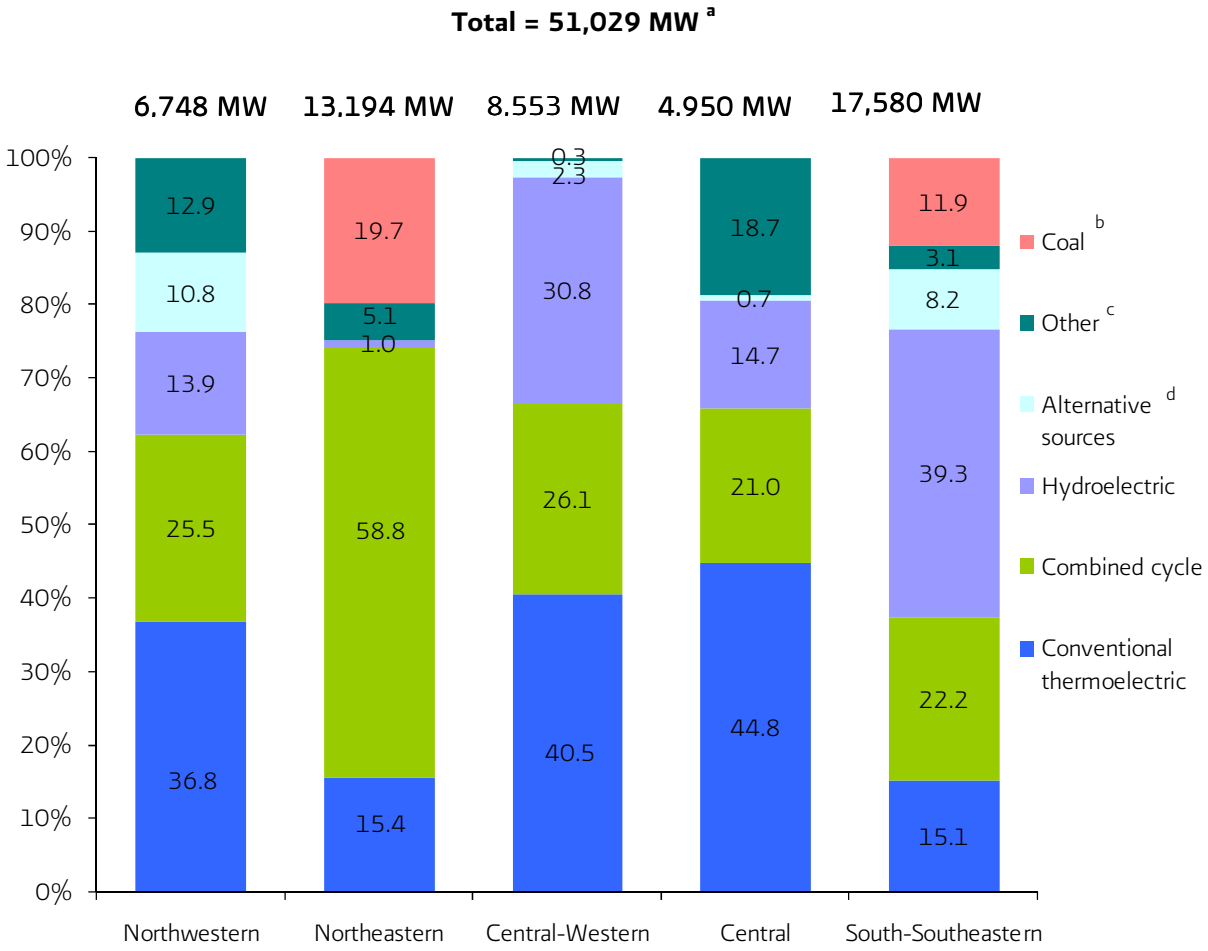
1.2.2.1 Installed electric power production capacity for the public sector by region

Installed capacity for the public sector by regions is distributed throughout the entire national territory depending on the availability of resources, infrastructure and the location of points of demand, among other factors. The South-Southeastern region, with the country's main hydroelectric plants in Chiapas and Guerrero as well as with important thermoelectric plants in the north part of Veracruz and the Laguna Verde nuclear-electric plant, in 2007 concentrated 34.5% of the total, followed by the Northeastern region with 25.9% (see graph 8). Oaxaca state possesses the first wind-electric developments, namely La Venta I and II, with 85 MW.

Graph 8

Distribution of domestic installed effective capacity of each region by technology type, 2007

(MW and percentage share)



[a] Includes 3 MW of mobile plants.
[b] Includes dual power plant.
[c] Includes gas turbine and internal combustion plants.
[d] Includes geothermal, wind and nuclear plants.
Source: CFE.

1.2.2.1.1 Northwestern region

This region registered an installed capacity increase of 34 MW during 2007, reaching 6,748 MW. The greatest addition corresponds to unit 2 of the internal combustion plant known as Baja California Sur I with

41.9 MW, while unit 1 of the same plant reduced its capacity by 5.9 MW. It is important to point out that capacity increase in the region from one year to the other includes the movement, transfer and temporary stay of mobile gas turbine units, thus these types of variations may occur in the coming years, depending on regional demand and on transmission infrastructure, among other factors.

1.2.2.1.2 Northeastern region

No new capacity was added in the region during 2007. However, three units of the Río Bravo (Emilio Portes Gil) thermoelectric plant have been reclassified and integrated into a combined cycle with 211 MW of capacity.

1.2.2.1.3 Central-Western region

In the Central-Western region, main capacity additions correspond to the start of operations of the Tamazunchale combined cycle plant (under the PIE mode) with 1,135 MW in San Luis Potosí and the El Cajón hydroelectric plant with 750 MW in Nayarit. Several smaller capacity modifications were made to hydroelectric plants in Michoacán as well. On the other hand, with the conclusion of a contract, 65 MW capacity supplied by the Bajío (PIE) combined cycle plant was withdrawn from public service. In view of these additions, capacity modifications and withdrawals, variation in this region with respect to 2006 represented 1,849 MW, reaching by the end of 2007 a total installed capacity of 8,553 MW.

1.2.2.1.4 Central region

The Central region had a variation of 302 MW in 2007 with respect to the previous year. During the last year, capacity increased by 256 MW due to the start of operations of eight gas turbine plants within LFC's distributed generation project, each with 32 MW, as well as due to the capacity increase resulting from the modification and rehabilitation of units 3 and 4 of the Tula thermoelectric plant.

1.2.2.1.5 South-Southeastern region

Given the availability and diversity of easily-exploitable primary energy sources, among other factors, the region with the highest installed capacity in the country is the South-Southeastern region with 17,580 MW; outstanding is the great hydroelectric capacity that in 2007 registered 6,913 MW[12], as well as the Laguna Verde nuclear-electric plant with 1,365 MW, the dual Petacalco plants on the coast of Guerrero and several combined-cycle plants in the area of Tuxpan, Veracruz. During this year, the only capacity addition

[12] Figure that, when compared to the Northwestern region, exceeds total capacity (6,748 MW).

corresponds to the La Venta II wind-electric plant, with the installation of 98 air-generators with a capacity of 0.85 MW each, representing a total of 83.3 MW added in the region (see chart 9).

Chart 9

Evolution of effective installed capacity by region and technology, 1997-2007

(MW)

Region	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	aagr (%) 1997-2007
Total	**34,815**	**35,255**	**35,666**	**36,697**	**38,519**	**41,177**	**44,554**	**46,552**	**46,534**	**48,769**	**51,029**	**3.9**
Northwestern	**4,927**	**5,060**	**5,211**	**5,309**	**6,196**	**6,205**	**6,952**	**6,922**	**6,673**	**6,714**	**6,748**	**3.2**
Hydraulic	941	941	941	941	941	941	941	941	941	941	941	0.0
Conventional thermoelectric	2,895	2,895	2,895	2,895	2,895	2,895	2,895	2,895	2,525	2,485	2,485	-1.5
Combined cycle	-	-	-	-	725	734	1,481	1,493	1,718	1,720	1,720	n.a.
CFE	-	-	-	-	496	496	496	496	721	723	723	n.a.
PIE	-	-	-	-	229	238	985	997	997	997	997	n.a.
Gas turbine	383	515	665	665	768	768	768	716	584	663	663	5.6
Internal combustion	89	90	90	88	137	137	137	146	174	174	209	8.9
Geothermal	620	620	620	720	730	730	730	730	730	730	730	1.6
Wind	-	-	1	1	1	1	1	1	1	1	1	n.a.
Northeastern	**6,515**	**7,037**	**7,322**	**7,772**	**8,443**	**10,013**	**11,308**	**11,854**	**12,086**	**13,203**	**13,194**	**7.3**
Hydraulic	126	126	126	126	126	126	126	126	126	126	126	0.0
Conventional thermoelectric	2,789	2,789	2,789	2,789	2,789	2,789	2,789	2,789	2,111	2,111	2,036	-3.1
Combined cycle	578	1,099	1,099	1,550	2,220	3,659	4,954	5,449	6,447	7,765	7,765	29.7
CFE	578	1,099	1,099	1,550	1,973	1,973	1,973	1,973	1,973	2,169	2,169	14.1
PIE	-	-	-	-	248	1,687	2,982	3,477	4,475	5,596	5,596	n.a.
Gas turbine	423	423	708	708	708	839	839	890	802	602	668	4.7
Coal	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	0.0
Central-Western	**5,653**	**5,775**	**5,776**	**5,781**	**5,805**	**6,520**	**6,605**	**6,727**	**6,724**	**6,704**	**8,553**	**4.2**
Hydraulic	1,880	1,880	1,881	1,881	1,881	1,881	1,881	1,873	1,878	1,857	2,634	3.4
Conventional thermoelectric	3,466	3,466	3,466	3,466	3,466	3,466	3,466	3,466	3,466	3,466	3,466	0.0
Combined cycle	218	218	218	218	218	810	793	1,174	1,166	1,161	2,233	26.2
CFE	218	218	218	218	218	218	218	597	601	601	603	10.7
PIE	-	-	-	-	-	592	575	577	565	560	1,630	n.a.
Gas turbine	-	122	122	122	146	275	275	24	24	24	24	n.a.
Internal combustion	1	1	1	1	1	1	1	1	1	1	1	0.0
Geothermal	88	88	88	93	93	88	190	190	190	195	195	8.3
Central	**4,445**	**4,111**	**4,067**	**4,067**	**3,940**	**4,296**	**4,311**	**4,607**	**4,607**	**4,649**	**4,950**	**1.1**
Hydraulic	1,073	739	695	695	695	684	684	714	714	729	729	-3.8
Conventional thermoelectric	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,174	2,174	2,174	2,220	-1.1
Combined cycle	482	482	482	482	382	489	489	1,038	1,038	1,038	1,038	8.0
CFE	482	482	482	482	382	489	489	1,038	1,038	1,038	1,038	8.0
Gas turbine	374	374	374	374	374	623	623	640	640	672	928	9.5
Geothermal	42	42	42	42	15	25	40	40	40	35	35	-1.8
South-Southeastern	**13,120**	**13,120**	**13,142**	**13,623**	**14,131**	**14,140**	**15,375**	**16,439**	**16,440**	**17,496**	**17,580**	**3.0**
Hydraulic	6,014	6,014	5,976	5,976	5,976	5,976	5,976	6,876	6,877	6,913	6,913	1.4
Conventional thermoelectric	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	0.0
Combined cycle	664	664	664	1,148	1,643	1,651	2,886	2,886	2,886	3,906	3,906	19.4
CFE	664	664	664	664	664	672	672	672	672	672	672	0.1
PIE	-	-	-	484	979	979	2,214	2,214	2,214	3,234	3,234	n.a.
Gas turbine	372	372	372	372	385	385	385	548	548	548	548	3.9
Internal combustion	1	1	1	1	2	2	3	3	3	3	4	17.2
Dual	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	0.0
Wind	2	2	2	2	2	2	2	2	2	2	85	49.0
Nuclear	1,309	1,309	1,368	1,365	1,365	1,365	1,365	1,365	1,365	1,365	1,365	0.4
Mobile plants[1]	**153**	**151**	**149**	**145**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**-32.3**

[1] Mobile internal combustion plants.

Notes: Totals may not match due to the rounding-up of figures.

Source: CFE.

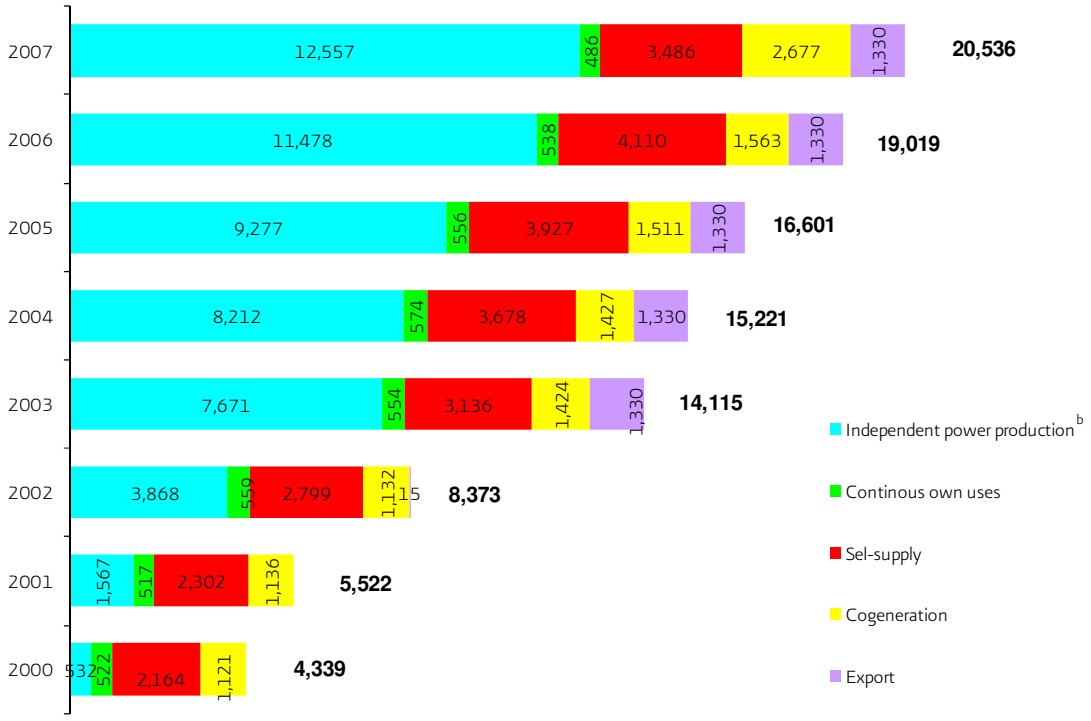
1.2.3 Installed capacity for electric power production by permit-holders

Domestic installed capacity of permit-holders in 2007 increased by 8.0% with respect to 2006. 61% of the capacity is produced by independent producers[13], who generated the greatest growth, followed by self-supply (see graph 9).

Graph 9

Installed capacity for electric power production by permit-holders, by mode [a], 2000-2007

(MW)



[a] Does not include operation capacity that attends to maximum import demand.
[b] Refers to the capacity authorized in operations reported by CRE permit-holders.
Source: CRE.

[13] Corresponds only to the capacity authorized in the permits.

1.2.4 Domestic electric power production

In 2007, total electric power production increased to 263,386 GWh, to which CFE and LFC contributed 60.7%; independent power producers, 27.6%; self-supply, 4.6%; co-generation, 4.4%; export, 2.4%; and continuous own usage, 0.4%.

1.2.4.1 Electric power production for the public sector by plant type

In 2007, total electric power production for the public service ascended to 232,552 GWh (see graph 10), representing a 3.3-% increase when compared to the previous year. Consistently with the capacity increase with respect to 2006, electric power production based on combined-cycle technology had the greatest dynamism in absolute terms, increasing production by 11,610 GWh, mainly as a result of the start of operations of the Tamazunchale (PIE) plant.

In relative terms, wind-electric power production registered the highest growth, increasing from 45 GWh in 2006 to 248 GWh in 2007, with the start of operations of La Venta II, while fuel-oil-based thermoelectric production was reduced by –4.7%, due to the withdrawal of production units; such is the case of steam units 1 and 2 of the Río Bravo (Emilio Portes Gil) plant with 37.5 MW each, to be integrated with a gas cycle to form a combined cycle.

Hydrocarbon-based electric power production[14] represents 67.1% of total electric power production. In 2007, the gap between the production of combined-cycle plants (102,674 GWh) and electric power production of fuel-oil and/or gas (steam) plants, gas turbine plants and internal combustion plants (53,287 GWh) continued to increase. The share of these plants has decreased from 51.6% in 1997 to 22.9% in 2007, as a result of a greater distribution from combined-cycle plants and the continuous withdrawal of production units that operate with fuel-oil. The share of coal-electric plants and of the dual plant in total production is 13.5%.

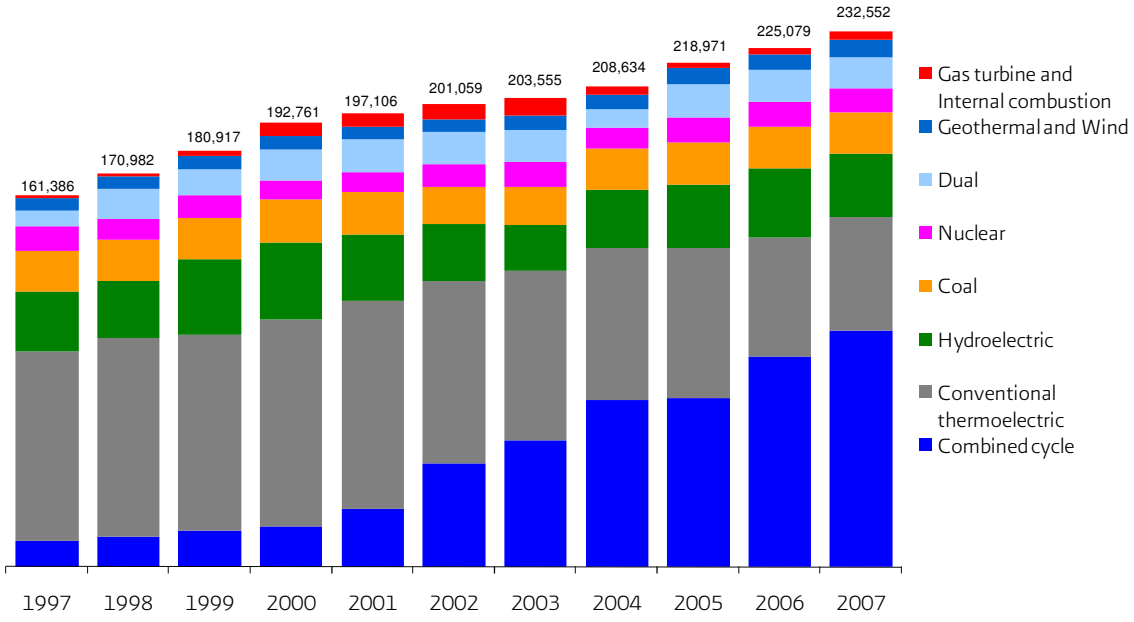
As to plants using alternative energy sources[15], regardless of the 13.7-% increase of electric power produced by geothermal and wind plants, electricity production was reduced as a result of a decrease of electricity generated by hydroelectric and nuclear-electric plants. In total, electricity coming from alternative sources reached 45,115 GWh, representing 19.4% of the total generated for public service in the country. The percentage share of each source with respect to the total is the following: hydroelectric plants 11.6%, geothermal and wind energy plants 3.3% and nuclear-electric plants 4.5%.

[14] Natural gas, fuel-oil and diesel.
[15] Hydroelectric, geothermal, nuclear and wind plants.

Graph 10

Gross public service production by plant type, 1997-2007

(GWh)



Source: CFE.

1.2.4.2 Electric power production by source

The use of diverse energy sources for electricity production mainly depends on their availability and safe supply. The technology and technical configuration of production plants depend on these and other factors. As to public service, conventional thermoelectric plants use fuel-oil and/or natural gas, combined-cycle plants use natural gas[16], gas turbine plants consume natural gas or diesel, dual plants consume coal and fuel-oil, and most internal combustion plants consume diesel.

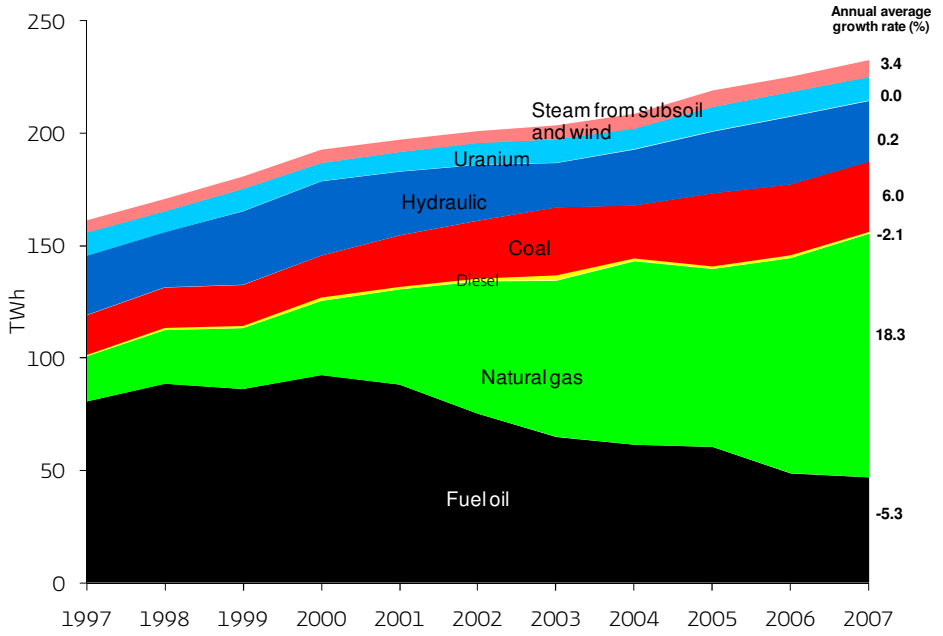
The most dynamic fuel for electric power production is natural gas. In 1997, production based on natural gas was 12.5%; 10 years later it was 46.7% of the total production, representing an annual average growth rate of 18.3%. On the other hand, fuel-oil based electric power production share decreased from 49.9% to 20.1% in public service production, that is, an annual average decrease of -5.3% (see graph 11).

[16] Notwithstanding the common use of natural gas, combined-cycled plants may use diverse fuels, such as diesel, synthetic gases from coal gasification, biomass or solid and liquid refining residues, as well as mixtures of natural gas and other combustible gases (for example syngas).

Graph 11

Gross production in public service by energy source type, 1997-2007

(TWh)



Source: CFE.

The behavior observed in Graph 11 is the result, among other factors, of the dynamic construction and start of commercial operations of new combined-cycle plants as well as of the re-powering of thermoelectric plants, replacing fuel-oil by natural gas. The objective is to exploit the advantages of natural gas over other fossil fuels for electric power generation, the achievement of lower pollutant emission levels and higher combustion efficiency.

1.2.4.3 Electric power production by permit-holders

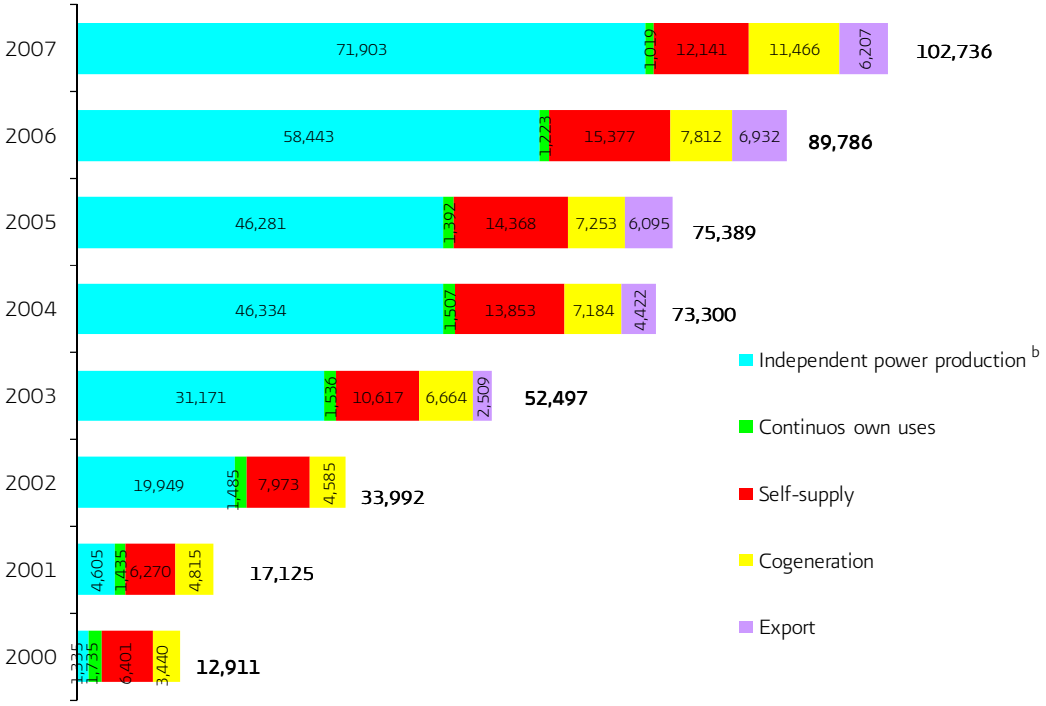
The maximum authorized electric power production capacity is established in the permits granted by the Energy Regulating Commission (CRE for its Spanish acronym). Effective production may vary and may be below the authorized capacity.

Electric power production by permit-holders in 2007 amounted to 102,736 GWh, registering an increase by 14.4% with respect to the previous year, due mainly to production increases through co-generation and independent power production, representing 46.8% and 23.0%, respectively (see graph 12).

Graph 12

Annual electric power production by permit-holders, by mode, 2000-2007 [a]

(GWh)



[a] Does not include import electricity.

[b] Refers to the production reported by CRE permit-holders.

Source: CRE.

In 2007, the co-generation mode reported an increase of 46.8% in generation, reaching 11,466 GWh, due to the shift of several Pemex permit-holders from self-supply to co-generation. The continuous own usage mode decreased by 204 GWh due to the withdrawal of permits that use low-efficiency technology.

1.3 Power balance of the National Electricity System

The Power balance describes, by means of an accounting balance logic, the evolution of electric power supply and demand at domestic levels during the last years. The balance demonstrates the important presence of combined-cycle technology in total generation, as well as the increasing energy flow for remote self-supply (see chart 10). The rest of the items have already been analyzed in the above sections.

Chart 10

Electric power balance of the National Electricity System, 1997-2007

(GWh)

Concept	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	aagr 1997-2007 (%)
Total power generation	**163,198**	**173,309**	**182,454**	**194,641**	**198,476**	**203,767**	**210,154**	**217,793**	**228,270**	**235,471**	**243,522**	4.1
National Public Service	**161,386**	**170,982**	**180,917**	**192,761**	**197,106**	**201,059**	**203,555**	**208,634**	**218,971**	**225,079**	**232,552**	3.7
Conventional thermoelectric	82,103	86,206	85,104	89,891	90,395	79,300	73,743	66,334	65,077	51,931	49,482	-4.9
Dual	7,001	12,692	11,234	13,569	14,109	13,879	13,859	7,915	14,275	13,875	13,375	6.7
Combined cycle	11,233	13,183	15,526	17,752	25,377	44,765	55,047	72,267	73,381	91,064	102,674	24.8
Gas turbine[1]	657	1,087	2,077	5,228	5,456	6,394	6,933	2,772	1,358	1,523	2,666	15.0
Internal combustion[1]	460	314	382	420	467	555	751	610	780	854	1,139	9.5
Hydroelectric	26,430	24,616	32,713	33,075	28,435	24,862	19,753	25,076	27,611	30,305	27,042	0.2
Coal	17,575	17,956	18,251	18,696	18,567	16,152	16,681	17,883	18,380	17,931	18,101	0.3
Nuclear	10,456	9,265	10,002	8,221	8,726	9,747	10,502	9,194	10,805	10,866	10,421	0.0
Geothermoelectric	5,466	5,657	5,623	5,901	5,567	5,398	6,282	6,577	7,299	6,685	7,404	3.1
Wind	4	5	6	8	7	7	5	6	5	45	248	52.8
Import	**1,510**	**1,507**	**659**	**1,069**	**327**	**531**	**71**	**47**	**87**	**523**	**277**	-15.6
Service by private companies	**303**	**819**	**878**	**811**	**1,043**	**2,176**	**6,528**	**9,112**	**9,212**	**9,869**	**10,693**	42.8
Self-supply, cogeneration and surplus[2]	303	819	878	811	1,043	2,176	6,528	9,112	**9,212**	**9,869**	**10,693**	42.8
Total uses and sales	**163,198**	**173,309**	**182,454**	**194,641**	**198,476**	**203,767**	**210,154**	**217,792**	**228,270**	**235,471**	**243,522**	4.1
Domestic sales without export	**130,254**	**137,209**	**144,996**	**155,349**	**157,204**	**160,203**	**160,384**	**163,509**	**169,757**	**175,371**	**180,469**	3.3
Industrial sector	77,981	82,088	87,234	93,755	93,255	94,942	94,228	96,613	99,720	103,153	106,633	3.2
Residential sector	29,644	31,690	33,369	36,127	38,344	39,032	39,861	40,733	42,531	44,452	45,835	4.5
Commercial sector	9,871	10,496	10,945	11,674	12,167	12,509	12,808	12,908	12,989	13,210	13,388	3.1
Agricultural sector	7,649	7,743	7,997	7,901	7,465	7,644	7,338	6,968	8,067	7,959	7,804	0.2
Services sector	5,109	5,192	5,450	5,891	5,973	6,076	6,149	6,288	6,450	6,596	6,809	2.9
Export	**51**	**76**	**131**	**195**	**271**	**344**	**953**	**1,006**	**1,291**	**1,299**	**1,451**	39.9
Losses	**24,379**	**25,912**	**27,364**	**28,483**	**30,083**	**30,920**	**33,084**	**34,901**	**37,418**	**39,600**	**40,504**	5.2
Own generation, transmission and distribution uses[3]	**8,460**	**9,453**	**9,170**	**9,859**	**10,059**	**10,474**	**10,559**	**10,514**	**11,139**	**10,264**	**11,252**	2.9
Self-supply to remote loads[4]	**54**	**659**	**794**	**755**	**859**	**1,827**	**5,174**	**7,862**	**8,665**	**8,937**	**9,846**	68.4

[1] Includes fix and mobile units.
[2] For remote self-supply.
[3] Includes portage for export.
[4] Includes own usage for transmission and distribution, plus statistical adjustments.
Source: CFE.

Electric power losses include non-technical and technical losses in the transmission and distribution grid. In 2007, this item represented 17.4% of public service generation. Non-technical losses mainly arise out of the illicit use of public electricity services in several directions: growth of the informal commercial sector, irregular human settlements as well as payment evasion.

1.4 SEN's transmission and distribution capacity

SEN's transmission and distribution infrastructure allows for the transformation, transmission, distribution and commercialization of electric power throughout the country. This infrastructure is operated by control areas in charge of preserving the system's reliability and integrity. Control areas supervise that electric power supply and demand are balanced at any given time.

In 2007, the transmission grid increased by 13,092 km with respect to 2006, in such a way that 90.7% of SEN infrastructure correspond to CFE lines while the rest belongs to LFC. Thank to this, SEN's transmission and distribution grid reached 786,151 km. Considering CFE lines, the transmission grid is

composed in 6.1% by 400-kV and 230-kV lines, 6.2% by 161-kV to 69-kV lines and 47.9% by 34.5-kV to 2.4-kV lines. 42.2% of SEN corresponds to low-tension lines, underground lines and LFC lines.

1.4.1 Transmission and distribution grid structure

The transmission grid is integrated by CFE and LFC, and is classified according to tension levels, as shown below.

1.4.1.1 Comisión Federal de Electricidad (Federal Electricity Commission or CFE)

- **Trunk transmission grid**.- Integrated by transmission lines and very high-tension power substations (400 kV and 230 kV) to conduce large amounts of energy among remote regions. They are fed by production plants and supply power to sub-transmission grids and to the facilities of industrial users. During 2007, these lines increased by 1,009 km, reaching a total of 48,019 km.

- **Sub-transmission grids**.- They have regional coverage and use high-tension lines (69 kV to 161 kV). They provide power to medium-tension distribution grids and to the loads of users connected in high-tension. This infrastructure registered an increase of 1,117 km, reaching a total of 48,465 km.

- **Medium and low-tension distribution grids**.- They supply power transmitted in a range of 220 V kV to 34.5 kV in relatively small zones. In 2007, medium-tension line length had the most important increase, 7,308 km, while low-tension lines increased by 2,680 km. Their joint length amounts to 616,306 km.

1.4.1.2 Luz y Fuerza del Centro

- **LFC grid**.- Its total length amounts to 73,361 km at 6.6-kV to 400-kV tension levels, including underground lines, plus low-tension distribution lines (220 volts or 240 volts).

The transmission capacity of links depends on the system's operation points and on available power generation. The grid's design considers the magnitude and geographic dispersion of loads and power-generation locations. The maximum power supported by a link depends on the thermal limitations of conductors, on the acceptable voltage limits of the ends and on the safety margin that allows for the preservation of the system's integrity and stability in case of the unforeseen disconnection of a line or generation unit. The two latter are factors that frequently restrict maximum power among the grid's links.

1.4.2 Evolution of the national transmission and distribution grid

In 2007, the national transmission and distribution grid (see chart 11) was integrated by 96,484 km of lines between 400 kV and 69 kV; 376,991 km of 34.5-kV to 2.4-kV lines; 239,315 km of low-tension lines; 73,361 km belonging to LFC; and 19,031 km of underground lines belonging to CFE. Between 1997 and 2007, the national transmission and distribution grid was expanded by 179,695 km.

The lines with the highest expansion degree in the grid are 13.8 kV lines that increased by 58,865 km during the period. The second place is for LFC lines that increased by 45,828 km during the same period.

Chart 11

Transmission, sub-transmission and low-tension lines, 1997-2007

(kilometers)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	aagr 1997-2007 (%)
National Electricity System	**606,456**	**622,718**	**637,377**	**651,995**	**661,863**	**674,300**	**727,075**	**746,911**	**759,552**	**773,059**	**786,151**	**2.6**
Comisión Federal de Electricidad[1]	578,923	594,715	608,773	622,718	632,025	643,807	658,067	676,690	688,420	700,676	712,790	2.1
400 kV	11,908	12,249	12,399	13,165	13,695	14,503	15,999	17,831	18,144	19,265	19,855	5.2
230 kV	19,375	20,292	21,224	21,598	22,644	24,058	24,776	25,886	27,147	27,745	28,164	3.8
161kV	456	456	456	508	516	614	470	486	475	475	547	1.8
138 kV	1,171	1,176	1,018	1,029	1,051	1,086	1,340	1,358	1,369	1,398	1,418	1.9
115 kV	32,003	33,405	34,151	34,971	36,199	38,048	38,773	40,176	40,847	42,177	43,292	3.1
85 kV	185	185	185	186	186	140	140	140	141	141	141	-2.7
69 kV	3,487	3,459	3,490	3,441	3,360	3,381	3,364	3,245	3,241	3,157	3,067	-1.3
34.5 kV	55,638	57,135	58,996	60,300	61,756	62,725	63,654	64,768	66,287	67,400	69,300	2.2
23 kV	22,056	22,765	23,323	23,756	24,663	25,826	26,366	27,435	27,940	28,568	29,095	2.8
13.8 kV	219,254	226,922	233,232	239,748	246,304	251,771	257,462	264,595	269,390	273,249	278,119	2.4
6.6 kV	429	428	428	428	429	429	429	429	411	411	411	-0.4
4.16 kV	157	69	67	60	49	49	49	16	16	16	16	-20.4
2.4 kV	102	103	93	94	94	98	98	61	62	39	50	-6.9
Low tension	205,902	208,765	211,969	215,369	221,079	221,079	225,147	230,264	232,950	236,635	239,315	1.5
Underground lines[2]	6,800	7,306	7,742	8,065	9,039	9,039	9,737	12,443	14,447	16,626	19,031	10.8
Luz y Fuerza del Centro	27,533	28,003	28,604	29,277	29,838	30,493	69,008	70,221	71,132	72,383	73,361	10.3

[1] Includes underground lines as of 2001.
[2] Kilometers of lines included in CFE total.
Source: CFE.

As to substations and transformers, in 2007 installed capacity reached 248,694 Megavolt Amperes (MVA), representing an increase of 3.5% when compared to the previous year. From this installed capacity, 141,688 MVA correspond to transmission substations and 76,340 MVA correspond to CFE distribution substations, while 30,666 MVA correspond to LFC substations (see chart 12).

Chart 12

Installed capacity of substations and transformers, 2000-2007

(MVA)

Substations	2000	2001	2002	2003	2004	2005	2006	2007
National Electricity System	**184,753**	**197,656**	**209,584**	**217,774**	**225,615**	**234,530**	**240,202**	**248,694**
CFE	164,916	173,305	183,783	191,711	198,508	205,773	210,488	218,028
Distribution	57,070	59,749	64,076	66,638	69,667	71,066	73,494	76,340
Transmission	107,846	113,556	119,707	125,073	128,841	134,707	136,994	141,688
LFC	19,837	24,351	25,801	26,063	27,107	28,757	29,714	30,666

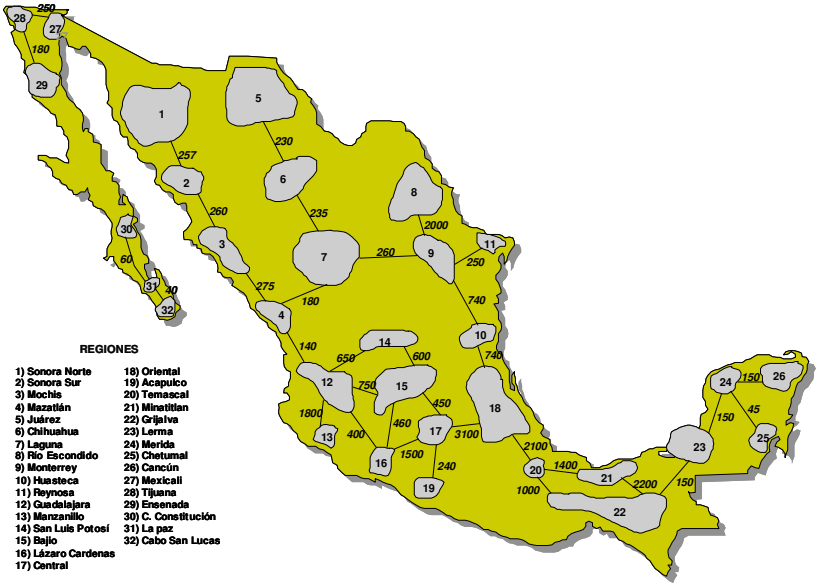
Source: CFE and LFC.

As to the evolution of the transmission grid, it must be clarified that CFE used to divide the country into 32 regions to coordinate the national transmission grid, hence to control electric power delivery in the entire country. With time, this division has been displaced by the expansion of the transmission grid, resulting in 50 new regions that include all currently operating lines (see map 4).

Map 4

Transmission capacity among SEN regions, 1996-2007

1996



2007

Source: CFE.

Chapter two

Outlook on the domestic electricity sector for 2008-2017

When undertaking the electricity sector's planning, electricity demand and consumption estimates for the medium and long terms are fundamental inputs for the dimensioning and design of an optimum power generation and transmission capacity expansion plan in order to satisfy the population's electricity-related needs, offering quality, reliability and stability. This chapter presents electricity demand and consumption projections, as well as capacity and fuel requirement programs, electricity self-supply and transmission programs required to satisfy rising electricity demand during the next 10 years.

2.1 Domestic electric power consumption forecast for 2008-2017

Domestic electric power consumption for the 2008-2017 timeframe is expected to grow at an annual rate of 3.3%. Consumption is expected to increase by 71.9 TWh, from 209.7 TWh in 2008 to 281.5 TWh in 2017 (see graph 13).

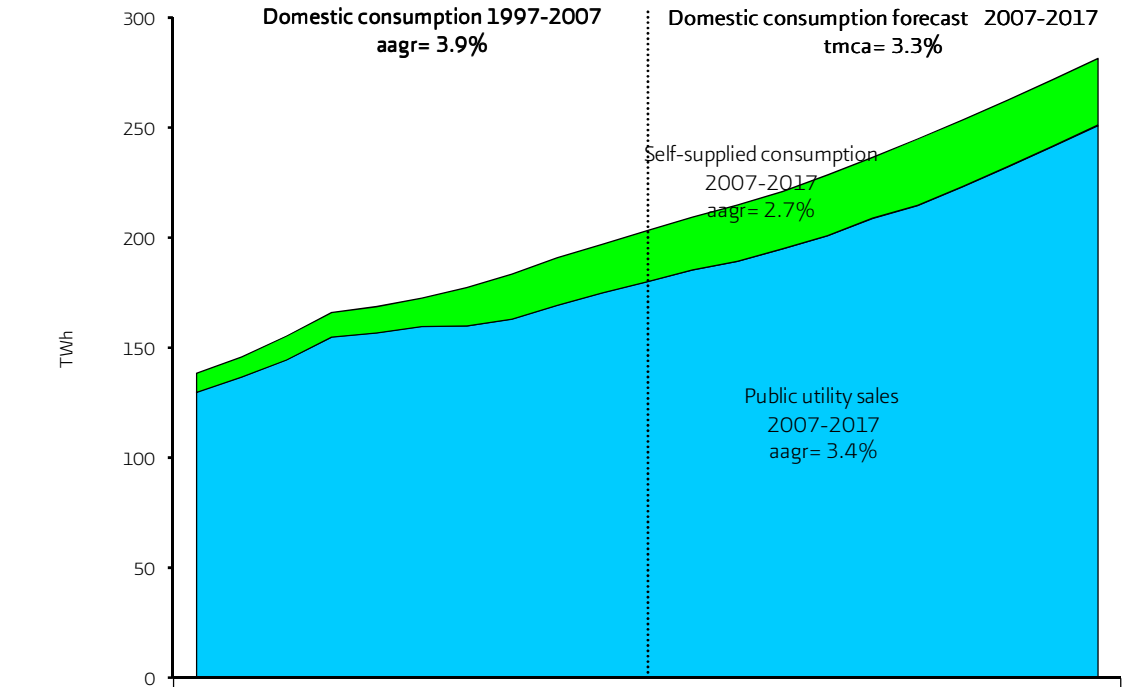
This growth will mainly be driven by public utility sales, expected to increase at an average annual rate of 3.4%. Sales by user type may be distinguished within this item, being the industrial sector the main consumer with 59.1% of domestic sales in 2007, and expected to maintain a share of 59.8% by the end of the period.

Self-supply estimates also consider projects scheduled to start operations in the next few years. This is the case of the coal-fired GDC Generadora (432 MW), using coal acquired from the country's northeastern region, and of the open-season wind power projects with 1,479 MW of capacity for remote self-supply in the Tehuantepec Isthmus.

Graph 13

Domestic electric power consumption, 1997-2017

(TWh)



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Self-supply	9	9	11	11	12	13	17	20	22	22	23.1	23.8	25.5	25.9	27.4	27.4	30.1	30.1	30.1	30.1	30.1
Public utility sales	130	137	145	155	157	160	160	164	170	175	180.	185.	189.	195.	201.	209.	215.	223.	232.	241.	251.
Domestic consumption	139	146	156	166	169	173	178	184	191	197	203.	209.	215.	221.	228.	236.	245.	253.	262.	272.	281.

Notes:
Public utility sales forecasts include electricity to be delivered to partners of open-season permit-holders (5.5 TWh), since they have not yet been defined.
The sum of partial amounts may not match totals due to the rounding-up of figures.
Source: Comisión Federal de Electricidad.

Though electricity sales growth has been rather small in recent years, domestic sales are expected to present increasing trends as a result of a dynamic national economy and of the population's increasing household-related requirements.

In the residential, commercial and services sectors, joint average annual growth rate during the 2007-2017 timeframe is expected to reach 3.4% (see chart 13).

Sales to the agricultural sector shall increase by an average annual rate of 1.6%, representing the lowest rate among sectors.

Chart 13

Average annual electricity consumption growth rate

Planning scenario

(average annual growth rate)

	Forecast 2008-2017	
	1997-2007 %	2007-2017 %
Domestic consumption	**3.9**	**3.3**
Self-supplied consumption	10.2	2.7
Public utility sales	3.3	3.4
Normal development	4.0	3.4
Residential	4.5	3.7
Commercial	3.1	3.2
Services	2.9	1.8
Agriculture	0.2	1.6
Industrial	3.2	3.5
Medium businesses	4.7	3.7
Large industry	0.9	3.1

Source: Comisión Federal de Electricidad.

As mentioned above, the industrial sector concentrates the highest share in domestic sales. Sales levels in this sector are expected to grow at an average annual rate of 3.5% (see chart 14). This variation is due mainly to the dynamics projected for medium-sized businesses, expected to increase by 3.7%, while the large industry shall register a growth of 3.1%. Exports are likely to remain at a constant level of 1,451 GWh.

On the other hand, an important increase of small-capacity permits has been registered in the area of self-supply in recent years, granted for electricity generation purposes in the commercial and services sectors, in response to the elevated costs faced by companies when acquiring electricity as public utility during peak seasons.

Chart 14

Total public utility sales by sector, 2007-2017

(GWh)

Sector	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	aagr (%) 2007-2017
Domestic Total	**181,920**	**187,268**	**191,106**	**196,851**	**202,776**	**210,723**	**216,466**	**225,109**	**234,084**	**243,382**	**252,882**	**3.3**
Domestic sales	180,469	185,817	189,655	195,400	201,325	209,272	215,015	223,658	232,633	241,931	251,431	3.4
Residential	45,835	47,393	49,322	51,417	53,450	55,447	57,449	59,445	61,476	63,541	65,623	3.7
Commercial	13,388	13,689	14,037	14,499	14,980	15,477	15,991	16,523	17,078	17,658	18,263	3.2
Services	6,809	6,864	7,014	7,127	7,253	7,384	7,522	7,666	7,813	7,964	8,120	1.8
Industrial	106,632	109,686	110,735	113,732	116,914	122,139	125,141	131,033	137,192	143,632	150,259	3.5
Medium businesses	67,799	70,172	72,515	74,696	77,367	80,291	83,372	86,629	90,055	93,809	97,648	3.7
Large industry	38,833	39,514	38,220	39,036	39,547	41,848	41,769	44,404	47,137	49,823	52,611	3.1
Agricultural pumping	7,804	8,184	8,547	8,626	8,730	8,825	8,913	8,990	9,075	9,136	9,167	1.6
Export	1,451	1,451	1,451	1,451	1,451	1,451	1,451	1,451	1,451	1,451	1,451	0.0

aagr: annual average growth rate.
Source: Comisión Federal de Electricidad.

2.2.1 Regional electricity market analysis

The regional electricity market analysis is performed with the help of statistical trend studies, projections based on service requests by large consumers and through annual surveys carried out by CFE. The analysis contributes to the estimation of electricity required in each region in order to determine the capacity and location of new power generation plants, as well as to achieve the optimal expansion of the transmission grid, in accordance with the needs of the country's consumption centers.

Estimates of total electricity sales in the next 10 years show that the Northeastern region will reach the highest annual average growth rate with 4.6% (see chart 15). This increase is explained mainly by the growth expected in Nuevo León and Tamaulipas states. Sales in the South-Southeastern region are expected to increase by an annual average of 3.9%, followed by the Northwestern region with 3.4%. The region with the lowest growth percentage rate will be the Central region, with 1.8% between 2007 and 2017.

Chart 15

Total public utility sales by region, 2007-2017

(GWh)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	aagr (%) 2007-2017
Domestic Total	**180,469**	**185,817**	**189,655**	**195,400**	**201,325**	**209,272**	**215,015**	**223,658**	**232,633**	**241,931**	**251,431**	**3.4**
Northwestern	25,145	26,215	27,501	28,616	29,845	31,129	30,955	32,064	33,148	34,212	35,252	3.4
Northeastern	43,644	45,301	46,864	49,116	51,476	54,449	57,118	59,858	62,731	65,685	68,746	4.6
Central-Western	41,708	42,843	43,426	44,564	45,732	47,310	48,253	50,310	52,439	54,638	56,926	3.2
Central	43,350	43,653	43,507	43,805	44,090	44,903	45,843	47,104	48,501	50,018	51,585	1.8
South-Southeastern	26,512	27,684	28,231	29,156	30,026	31,320	32,677	34,147	35,633	37,189	38,727	3.9
Small Systems	110	120	127	142	155	160	169	175	181	188	195	5.9

aagr: annual average growth rate.
Source: Comisión Federal de Electricidad.

2.2.2 Gross demand by operative area

Gross demand is the power at which electricity is to be supplied in a given moment. It is integrated by public utility demand, and demand by self-supply and cogeneration plants requiring transmission and backup services. This energy demand is satisfied by the public power generation fleet and by the private sector via transmission lines.

For the planning of SEN regarding demand satisfied by private entities, only remote self-supply demand is considered in view of the transmission and backup services required by the former, without taking into account local self-supply as it is not connected to SEN. Chart 16 includes the figures corresponding to gross demand by area, represented in three categories: maximum annual demand, medium demand and base demand.

In our country, the Central region is the control area with the highest demand, having registered a maximum demand of 8,606 MW in 2007. On the other hand, relevant annual increases in peak load are expected in the areas of Baja California Sur, with 6.5%, and the peninsular area with an average 5.6% between 2007 and 2017. In 2007, peak load magnitude in the first area was 307 MW, while in the remaining area it was 1,275 MW.

Chart 16

Estimated gross demand by load type and control area, 2007-2017

(MW)

Control area		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	aagr (%) 2007-2017
	P	3,130	3,328	3,474	3,620	3,738	3,892	3,995	4,122	4,280	4,418	4,556	3.8
North	M	2,216	2,279	2,357	2,465	2,568	2,674	2,745	2,832	2,941	3,035	3,130	3.5
	B	1,894	2,014	2,102	2,191	2,262	2,355	2,417	2,494	2,590	2,673	2,757	3.8
	P	6,586	6,780	6,910	7,062	7,363	7,749	8,090	8,465	8,876	9,313	9,718	4.0
Northeast	M	4,688	4,833	4,947	5,013	5,095	5,363	5,599	5,858	6,144	6,445	6,726	3.7
	B	4,184	4,307	4,390	4,486	4,678	4,923	5,139	5,378	5,639	5,916	6,174	4.0
	P	7,437	8,069	8,180	8,351	8,621	8,923	9,292	9,694	10,152	10,568	11,008	4.0
West	M	5,891	6,043	6,214	6,457	6,707	6,942	7,229	7,542	7,899	8,222	8,564	3.8
	B	5,016	5,442	5,517	5,632	5,815	6,018	6,267	6,538	6,847	7,128	7,425	4.0
	P	8,606	8,700	8,837	8,974	9,090	9,210	9,344	9,564	9,806	10,076	10,364	1.9
Central	M	5,931	5,981	6,023	6,058	6,118	6,198	6,287	6,433	6,593	6,773	6,964	1.6
	B	4,505	4,554	4,626	4,698	4,758	4,821	4,891	5,006	5,133	5,275	5,425	1.9
	P	5,786	6,181	6,357	6,548	6,750	6,971	7,203	7,461	7,731	8,026	8,317	3.7
East	M	4,375	4,512	4,603	4,769	4,959	5,121	5,292	5,482	5,680	5,897	6,110	3.4
	B	3,842	4,104	4,221	4,348	4,482	4,629	4,783	4,954	5,134	5,329	5,523	3.7
	P	1,275	1,375	1,464	1,543	1,628	1,720	1,813	1,907	2,002	2,102	2,203	5.6
Peninsular area	M	953	1,009	1,064	1,112	1,178	1,244	1,311	1,380	1,448	1,521	1,593	5.3
	B	763	823	876	923	974	1,029	1,085	1,141	1,198	1,258	1,318	5.6
	P	3,059	3,156	3,289	3,404	3,543	3,694	3,913	4,009	4,150	4,275	4,380	3.7
Northwest	M	1,897	1,937	2,007	2,086	2,206	2,300	2,436	2,496	2,584	2,662	2,727	3.7
	B	1,602	1,653	1,722	1,783	1,855	1,935	2,049	2,100	2,173	2,239	2,294	3.7
	P	2,208	2,208	2,345	2,466	2,557	2,646	2,733	2,828	2,918	3,007	3,106	3.5
Baja California	M	1,287	1,348	1,418	1,499	1,556	1,611	1,663	1,721	1,776	1,830	1,890	3.9
	B	1,051	1,051	1,116	1,174	1,217	1,259	1,301	1,346	1,389	1,431	1,478	3.5
	P	307	344	368	389	411	436	462	486	516	546	575	6.5
Baja California Sur	M	197	213	232	247	261	276	293	308	327	346	364	6.4
	B	161	180	192	203	215	228	242	254	270	286	301	6.5
	P	28	30	32	35	38	40	41	42	44	45	47	5.3
Small systems	M	15	16	17	20	21	22	23	24	25	25	26	5.8
	B	12	13	14	15	17	17	18	18	19	20	20	5.3

P= Peak load M= Medium load B= Base load.
aagr: annual average growth rate.
Source: Comisión Federal de Electricidad.

2.3 Expansion of the National Electricity System (SEN for its Spanish acronym)

The planning of the electricity system's expansion responds to the electric power consumption and demand estimates for the next ten years. The program considers capacities in the construction or bidding process phases as well as additional capacity, which refers to future capacity put out to bid, depending on scheduled start-up dates.

The planning of additional capacity, required to satisfy electricity demand projected for the next years, is performed based on the technical and economic assessment of different project schemes, selecting power

generation and transmission projects that imply the lowest total cost in the long term. The capacity expansion program considers each project's maturation time, starting with the planning of a new power plant, the bidding process, contracting and construction, and ending with the start of its commercial operation, i.e. an average of four to six years. Transmission projects require three to five years prior to the new infrastructure's start of operations.

The program also considers other elements, including the power generation system's configuration (unit withdrawals, self-supply and cogeneration projects, etc.) and the main transmission grid. Analysis is performed for three systems: the National Interconnected System (SIN for its Spanish acronym), Baja California and Baja California Sur.

On the other hand, regarding the different alternatives assessed throughout the planning, recent studies have revealed the technical and economic convenience of interconnecting the Baja California area with SIN through an asynchronous link. This interconnection would offer, among other benefits, the possibility of sharing SIN's power generation resources for the satisfaction of peak demand in the Baja California system, During off-peak periods in Baja California, it would allow for exporting surplus capacity and base energy (geothermal and combined cycle) to SIN, benefiting from the diversity of demand in these two systems.

The interconnection would contribute to the reduction of total power generation and production infrastructure investment costs. Moreover, the Baja California-SIN link will create new opportunities for power and energy transactions with diverse power companies in western USA, using existing links with electricity systems in California. This interconnection system is scheduled to start operations in 2013.

The possibility of interconnecting the Baja California Sur system with SIN is currently being assessed. An important benefit would be postponing or even calling off power generation projects that imply the use of technologies with high investment and operating costs, in addition to the environmental benefits represented by this alternative.

2.3.1 Reserve capacity

Reserve capacity is defined as the difference between the system's effective power generation capacity and peak or maximum demand during a specific period. According to this concept, to satisfy electricity demand, the system's capacity must be larger than the maximum annual demand. Factors such as effective plant capacities, plant availability and grid alignment are therefore important in determining the reliability of electricity supply.

The importance of reserve capacity lies mainly in the reliability of electricity supply due to the following reasons:

- Electricity must be produced in the moment it is demanded, that is, it cannot be stored.
- The system's capacity is subjected to reductions as a consequence of scheduled plant downtimes for maintenance purposes and due to force majeure events such as defects, downgrading, and weather-related phenomena, etc.

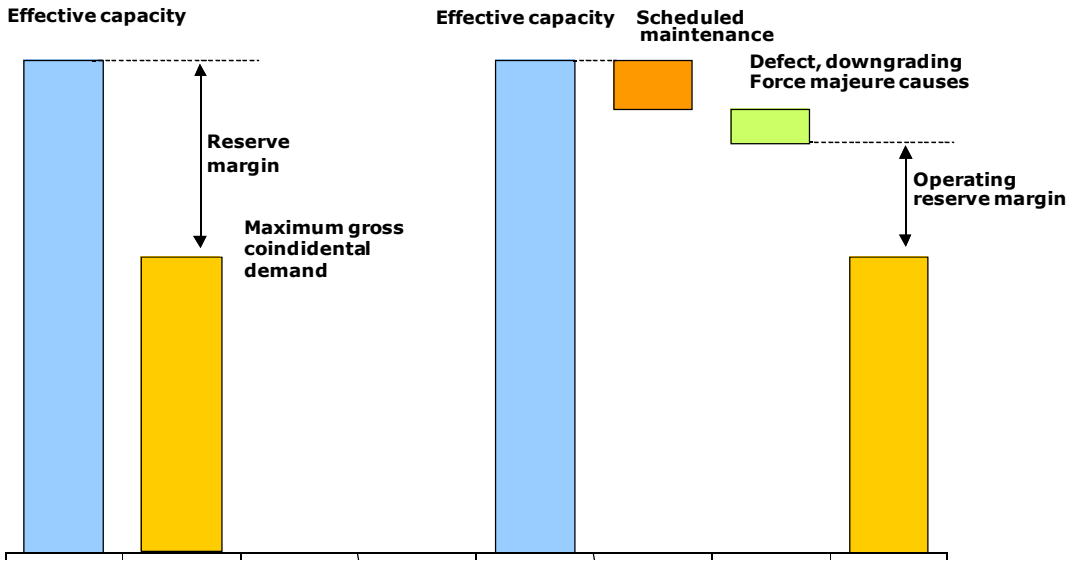
Reserve capacity is measured through the so-called reserve margin (RM), defined as the difference between gross capacity and maximum coincidental demand of the electricity system, expressed as a percentage of maximum coincidental demand. The operating reserve margin (ORM) is another indicator of

reserve capacity, and is defined as the difference between the gross effective capacity available and the gross maximum coincidental demand expressed as a percentage of the latter (see graph 14). The deterministic method has been accepted to calculate reserve margin and operating reserve margin for the national electricity system, based on the average availability values of power generation plants and on the seasonal behavior of demand[17].

The composition of the power generation fleet is dynamic, since new plants with technologies offering greater availability indexes are incorporated each year, resulting in the higher equivalent availability of units.

Graph 14

Reserve margin (MR) and operating reserve margin (ORM)



Source: Comisión Federal de Electricidad.

The minimum value adopted for ORM in the planning of the National Interconnected System is 6%; the corresponding RM is obtained from this value.

On the other hand, in the case of isolated systems like the Baja California peninsula, reserve margin is determined separately based on load and peak demand curves. Therefore, for the Baja California system, the minimum accepted reserve capacity value (after subtracting capacity that is not available due to maintenance activities) is: a) the capacity of the larger unit or b) 15% of the peak demand (see Chart 17 and Graph 15),

[17] In November 2004, CFE prepared a document called *Reserve margin diagnosis* for its Board of Directors, which determines – based on the variation of power generation fleet availability - that ORM is the criterion to be observed in power generation planning.

whichever is higher. For the Baja California Sur system, the minimum reserve capacity value is the total capacity of the two larger power generation units.

Chart 17

Reserve margin of the Baja California System

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Installed capacity (MW)	2,206.0	2,450.0	2,615.0	2,777.0	2,797.0	3,077.0	3,077.0	3,077.0	3,357.0	3,303.0	3,517.0
Interconnection to SIN (MW) [1]	-	-	-	-	-	300.0	300.0	300.0	300.0	300.0	300.0
Import from the USA (MW)	333.0	246.0	220.0	163.0	246.0	-	-	-	-	-	-
Total capacity (MW) [2]	2,539.0	2,696.4	2,835.0	2,941.0	3,043.0	3,377.0	3,377.0	3,377.0	3,657.0	3,603.0	3,817.0
Demand (MW) [3]	2,208.0	2,345.0	2,466.0	2,557.0	2,646.0	2,733.0	2,828.0	2,918.0	3,007.0	3,106.0	3,198.0
Capacity reserve (MW)	331.0	352.0	370.0	383.6	397.0	645.0	549.0	460.0	651.0	498.0	619.0
Reserve margin (%) [4]	15.0	15.0	15.0	15.0	15.0	23.6	19.4	15.8	21.6	16.0	19.4

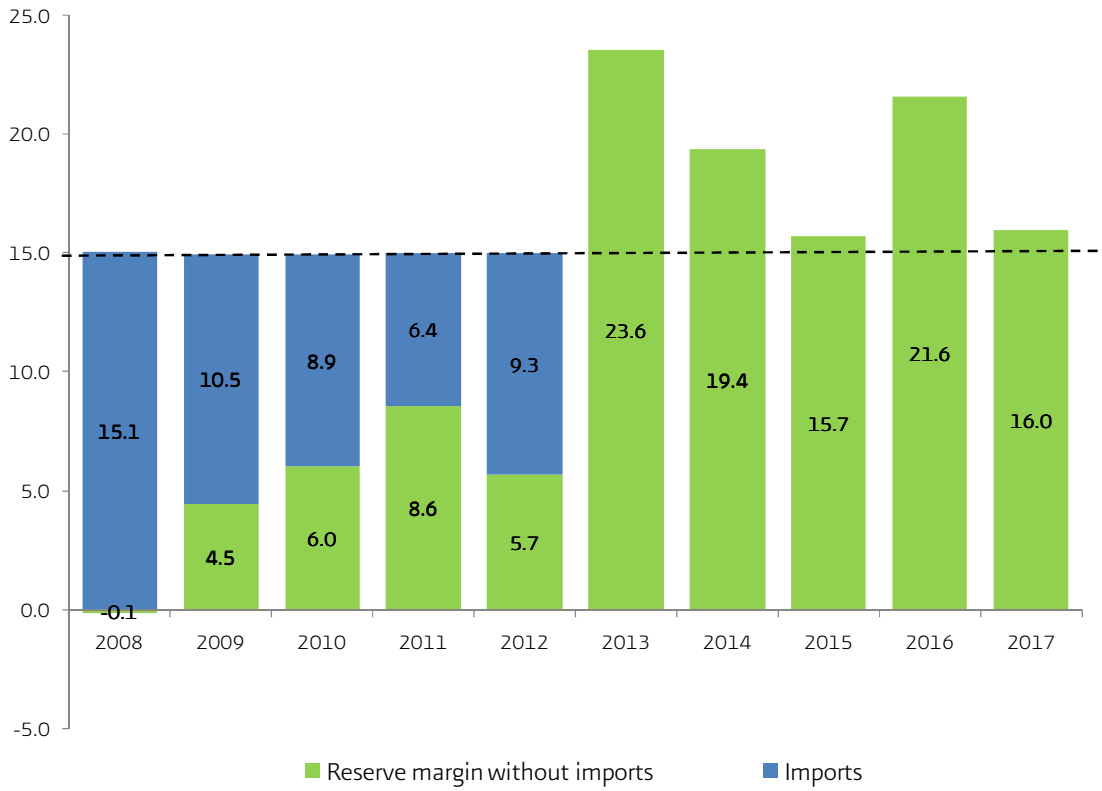
[1] As of 2013, the Baja California system will be interconnected with the National Interconnected System (SIN) through a 300-MW capacity transmission link.
[2] Considering energy import in the summer, as well as seasonal downgrading.
[3] Does not include export.
[4] Reserve criterion: 15% of the maximum demand.
Source: Comisión Federal de Electricidad.

As seen in chart 17, in Baja California more than 300 MW of capacity were imported in the summer months of 2008, and this deficit is expected to continue through 2012. In order to guarantee supply reliability and system safety, it will be necessary to import an average of 250 MW during the summer months of these coming years. The transmission limit of the Baja California system's links with the California system is 400 MW.

Graph 15

Reserve margin in the Baja California control area

(%)



Source: Comisión Federal de Electricidad.

In 2007, SIN's reserve margin was 43.3% and its ORM was 24.3%. Both will remain high between 2008 and 2013. Reserve margins are difficult to adjust due to the time required by a power generation project from its planning through its start-up, as well as due to the service life of existing plants. As of 2014, RM will decrease to 29.2% and ORM, to 8.3%; both will remain at levels close to 27% and 6%, respectively, throughout the rest of the planning timeframe (see graph 16).

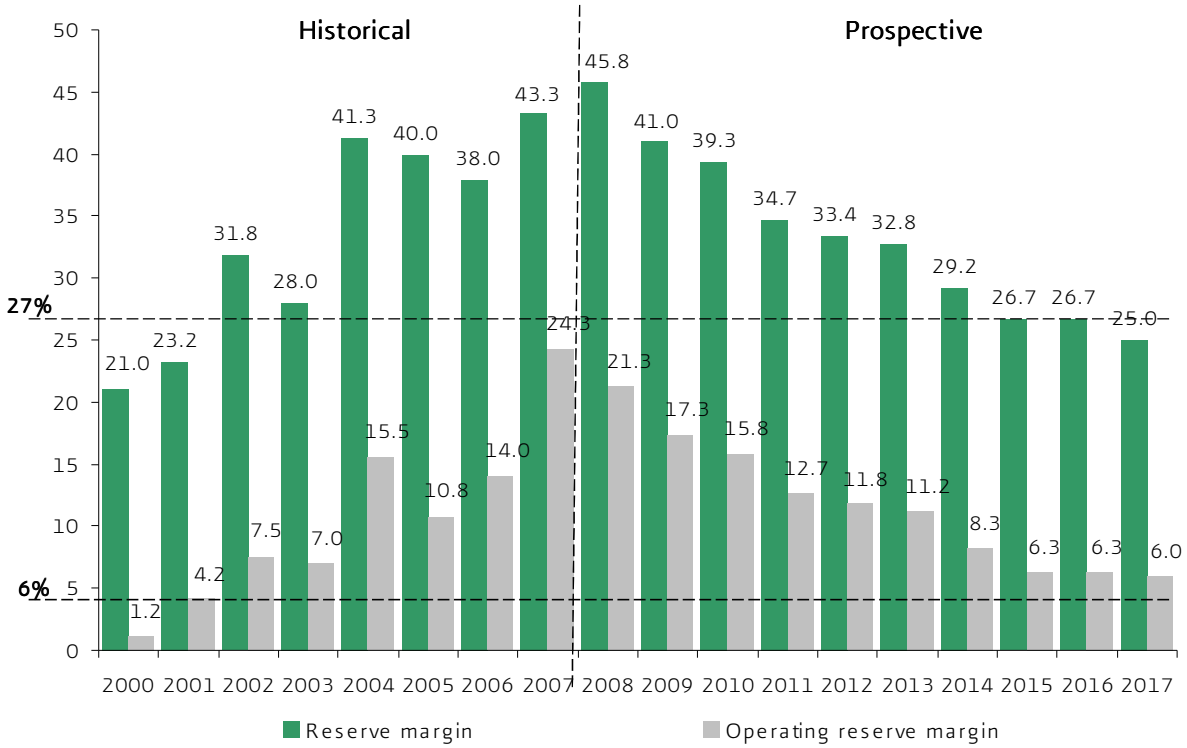
To gradually adjust reserve margin to the desired values, the start-up dates of projects that are not yet in the bidding or construction process have been rescheduled.

In the short term, based on electricity demand growth estimates, deficits are expected in the country's Northern and Central areas, thus the start of operations of the Agua Prieta II, Norte II, Norte III, Noreste and Valle de México II and III projects becomes a priority. This is due to the fact that there are regions where maximum demand exceeds installed capacities during specific periods of the year (usually in the summer), creating electric power flow and voltage support requirements from other regions via the corresponding transmission links. Regardless of SIN's reserve margin level, these links have transmission capacity restrictions as well, generating bottlenecks or a need to import electricity, as in the case of Baja California.

Graph 16

Interconnected System: reserve margin and operating reserve margin

(%)



Source: Comisión Federal de Electricidad.

Every year, as part of the planning process, the scheduled start-up dates of power generation projects are systematically reviewed based on the changes in the country's economic expectations directly affecting electricity demand estimates. In this sense, adjustments have been made to add capacity in order to comply with the capacity reserve criteria as much as possible.

2.3.2 Basic considerations in the planning of the electricity system

One of the basic premises for the preparation of the 2008-2017 expansion plan is to consider the diversification of electric power generation sources, oriented at the assessment and inclusion of renewable energy sources within the project portfolio for the planning timeframe.

On the other hand, in order to diversify natural gas supply sources for power plants, CFE has considered the alternative of importing liquefied natural gas (LNG), and the installation of storage and regasification terminals on the coasts of the Gulf of Mexico, in the Western part of the country and on the Baja California peninsula.

For the central part of the country, described as an energy-importing area, combined-cycle projects have been foreseen as of 2013. They have a strategic role in the expansion of SEN, since they will substantially improve the reliability and quality of energy supply in this region.

The strategies to diversify power generation sources include the Salamanca phase I and II projects, which could be developed as conventional combined-cycle or cogeneration projects, making the most of the temperature of gases resulting from the combustion that takes place in the gas turbines for the production of steam required in oil-refining processes. Within this context, it is important to mention that the *2007-2012 Energy Program by Sectors* establishes the strategies and lines of action to be followed for the efficient development of the electricity sector. This is the case of Objective II.2 "Balanced primary energy source portfolio", that includes the indicators and goals to be achieved for compliance (see chart 18).

Chart 18

Indicator of Objective II.2 of the 2007-2012 Energy Program by Sectors

Indicator name	Measuring unit	Base line (2006)		Goal for 2012	
Electricity generation capacity through primary energy source	Percentage	Fuel oil	29	Fuel oil	20
		Natural gas	36	Natural gas	41
		Coal	9	Coal	10
		Large hydroelectric	17	Large hydroelectric	17
		Small hydroelectric	4	Small hydroelectric	3
		Other renewable	2	Other renewable	6
		Nuclear	3	Nuclear	3

Source: *2007-2012 Sectorial Energy Program,* Sener.

2.3.3 Expansion program

The expansion program for SEN is integrated by the planning of public utilities (CFE and LFC) and the projection of the capacity expansion of self-supply and cogeneration permit-holders. The capacity additions of permit-holders within the regulatory framework in force allow for the use of electricity generation potential in several sectors and in different industrial branches that by the nature of their processes offer energy-saving possibilities and cost mitigation on the one hand, and allow different user types to diversify electricity supply sources on the other.

Between 2009 and 2017, the public service expansion program will require the addition of 14,794 MW of capacity, 3,520 MW of which is capacity already committed or under construction; 10,795 MW are additional capacity in projects that have not yet been put out for bid, and 479 MW are additional capacity in rehab and modernization projects. All in all, 14,315 MW[18] will be added to public service capacity during aforementioned period (see chart 19).

[18] Does not include the rehab and modernization of 479 MW

A net additional remote self-supply and cogeneration capacity of 2,490 MW is estimated on the other hand, considering both private and public sector projects, more specifically Pemex and its cogeneration project at Nuevo Pemex with 258 MW of remote self-supply, and the open-season wind power projects (see chart 20).

By 2017, obsolete and inefficient capacities equal to 4,749 MW will be withdrawn from the public electricity supply service (see graph 17).

Chart 19

Capacity expansion program for SEN, 2008-2017

(MW)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Total	**70**	**1,192**	**1,689**	**2,656**	**2,471**	**1,076**	**1,165**	**1,834**	**2,366**	**2,766**	**17,284**
Public utility	40	745	1,689	1,075	2,471	1,076	733	1,834	2,366	2,766	14,794
Comisión Federal de Electricidad	40	585	1,689	1,075	2,471	1,076	733	1,834	2,366	2,165	14,033
Capacity under construction or bidding process	-	535	1,370	228	1,227	-	-	-	-	-	3,360
Additional capacity	-	-	-	807	1,214	1,076	733	1,834	2,366	2,165	10,194
Repairs and modernization (RM)	40	50	319	40	30	-	-	-	-	-	479
Luz y Fuerza del Centro	-	160	-	-	-	-	-	-	-	601	761
Self-supply and cogeneration[1]	30	447	-	1,581	-	-	432	-	-	-	2,490

[1] Remote self-supply.
Source: Comisión Federal de Electricidad.

Chart 20

Self-supply and cogeneration projects[1]

2008-2017

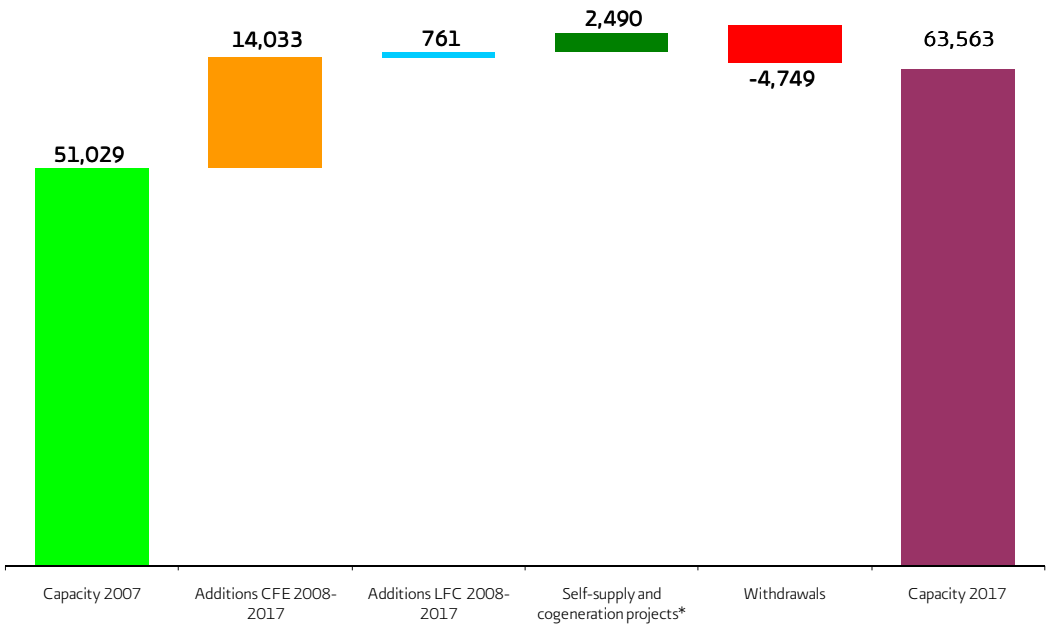
Additions	Year	MW	Modifications	Year	MW
	2008				
Parques Ecológicos de México		30			
	2009				
Eurus		248			
Parques Ecológicos de México		50			
Hidroeléctrica Cajón de Peña		1			
Eoliatec del Istmo		22			
BII NEE STIPA Energía Eólica		26			
Eléctrica del Valle de México		52			
Fuerza Eólica del Istmo (1ra Etapa)		49			
	2011			**2011**	
Pemex Nuevo Pemex		258	Pemex[2]		-156
Open season					
Fuerza Eólica del Istmo (2nd stage)		49			
Preneal México		393			
Desarrollos Eólicos Mexicanos		226			
Gamesa Energía		285			
Eoliatec del Pacífico		159			
Eoliatec del Istmo		141			
Unión Fenosa		226			
	2014				
GDC Generadora		432			
Subtotal		**2,646**		**Subtotal**	**-156**
Total projects		**2,490**			

[1] Remote self-supply capacity.
[2] Portage replaced by the Nuevo Pemex cogeneration project.
Source: Sener, Pemex, CFE.

Graph 17

National Electricity System: 2008-2017 expansion program

(MW)



* Only considers remote self-supply.
Source: CFE and LFC.

2.3.3.1 Capacity in construction or bidding

Capacity already committed or in construction, considered in this outlook, will increase to 3,520 MW; this figure is composed by 3,360 MW corresponding to CFE and 160 MW, to LFC, and is scheduled to start operations during the 2009-2012 timeframe.

The expansion program including power generation projects in the construction or bidding phase is integrated by 1,436 MW of combined cycles. The Carboeléctrica del Pacífico plant shall start operations in 2010 with a 678-MW gross capacity; the Cerro Prieto V geothermal-electric plant, in 2011 with 107 MW; the La Yesca hydroelectric plant, in 2012 with 750 MW, among others (see chart 21).

Regarding the bidding scheme, 669 MW of capacity in the construction or bidding phase will be considered under the scheme known as Independent Power Production (IPP); 2,691 MW will be under the scheme of Financed Public Work (FPW) and 160 MW will take place through budget investment.

After 2007, when the Baja California Sur II, La Venta II, El Cajón and Tamazunchale plants started operations, considering the then-existing reserve margin, no new plants have been scheduled for start-up in 2008; it is not until 2009 when the combined-cycle Baja California (Presidente Juárez) plant, the San Lorenzo turbogas-to-combined-cycle conversion plant in Puebla, Phase I of the Baja California II turbogas plant, as well as five gas turbines for distributed power generation owned by LFC will start commercial operations.

The geographic distribution of capacity in the construction or bidding phase owned by CFE is shown on Map 5. In the case of the Pacific coast, the Carboeléctrica del Pacífico plant shall possess a gross capacity of 678 MW. There will be two plants on the northern border, namely Baja California (277 MW) and Agua Prieta II (477 MW), the latter consisting of a combined-cycle plant integrated with a 10-MW solar field. On the other hand, the La Venta III and Oaxaca I wind power plants will be operating in the Tehuantepec Isthmus, jointly contributing to the diversification of the country's power generation fleet with 203 MW, as well as the two phases of the Humeros geothermal-electric project in Puebla with a joint capacity of 51 MW.

In the case of the LFC project, distributed power generation is understood as the generation of electricity through small-scale plants installed close to or at the same site of end consumption, thus they do not require the same transformation, transmission and distribution infrastructure as centralized power generation, in which case electricity production takes place in one or several plants with large installed capacity, and the electricity generated is transformed, transmitted and distributed among a large number of users. The LFC project consists in 14 natural gas-fired turbogas plants, with an installed capacity of 32 MW each, to contribute a total of 448 MW to SEN. In December 2008, there were nine operating plants and the five remaining are expected to start operations during 2009.

Chart 21

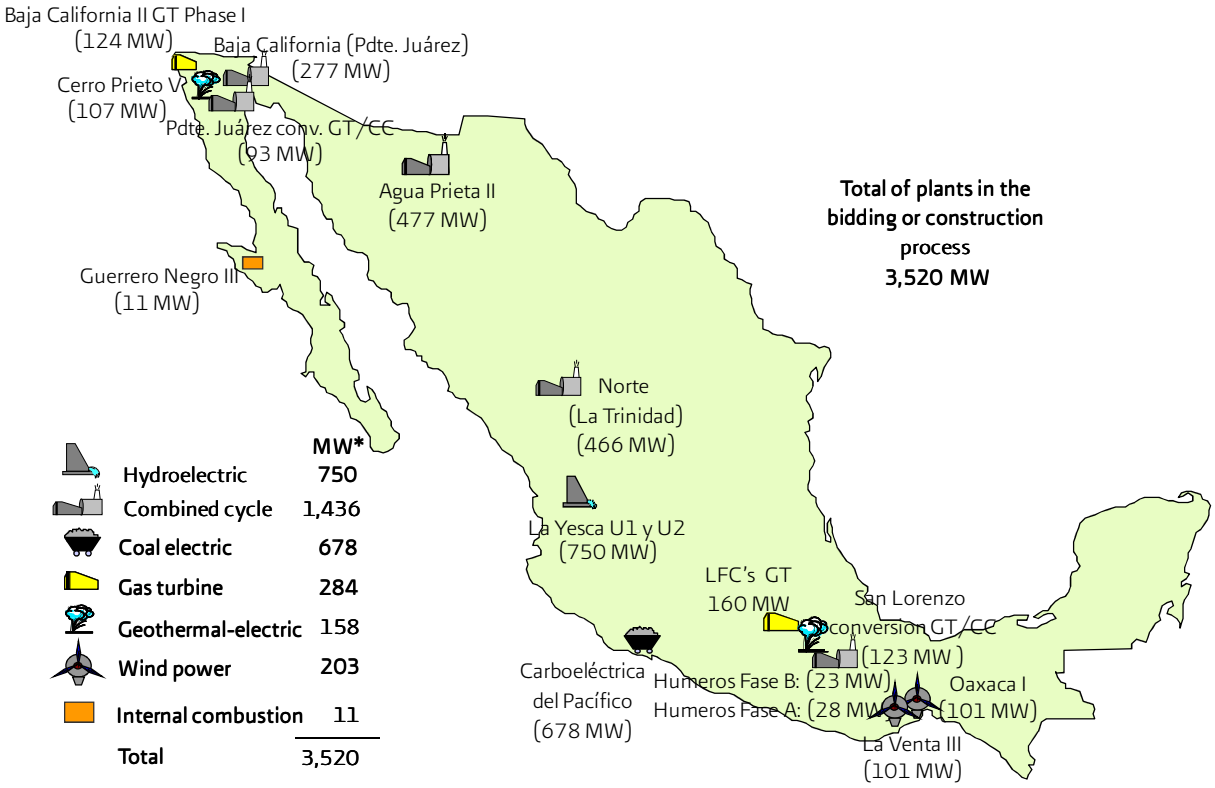
Power generation projects in the construction or bidding process, 2009-2012[1]

Project	Location	Technology	Bid date	Bid mode	Gross capacity (MW)			
					2009	2010	2011	2012
Total annual					**695**	**1,370**	**228**	**1,227**
Accrued					**695**	**2,065**	**2,293**	**3,520**
Projects under construction								
San Lorenzo conversión GT/CC	Puebla	CC	2005	OPF	123			
Baja California (Pdte. Juárez)	Baja California	CC	2006	OPF	277			
Norte (La Trinidad)	Durango	CC	2005	PIE		466		
Carboeléctrica del Pacífico	Guerrero	COAL	2003	OPF		678		
La Yesca U1 y U2	Nayarit	HYD	2007	OPF				750
Generación distribuida LyFC	DF, Edo. de México	GT			160			
Subtotal					**560**	**1,144**	**0**	**750**
Projects in the bidding process								
La Venta III	Oaxaca	WIND	2008	PIE		101		
Guerrero Negro III	Baja California Sur	IC	2008	OPF	11			
Baja California II GT Fase I	Baja California	GT	2008	OPF	124			
Humeros fase B	Puebla	GEO	2008	OPF		23		
Presidente Juárez conversión GT/CC	Baja California	CC	2008	OPF			93	
Humeros fase A	Puebla	GEO	2008	OPF			28	
Cerro Prieto V	Baja California	GEO	2008	OPF			107	
Agua Prieta II [2]	Sonora	CC	2007	OPF				477
Oaxaca I	Oaxaca	WIND	2008	PIE		101		
Subtotal					**135**	**226**	**228**	**477**

HYD: Hydroelectric CC: Combined cycle IC: Diesel-fired internal combustion WIND: Wind power COAL: Coal-fired
GT: Gas turbine PIE: Independent Power Producer OPF: Financed Public Work
Note: Figures may not be exact matches due to rounding-up.
[1] Includes LFC.
[2] Third bid call; includes 10 MW of solar field.
Source: Comisión Federal de Electricidad and Luz y Fuerza del Centro.

Map 5

Power plants in the construction or bidding process, 2009-2012



*Figures are rounded up to integers, thus totals may not be exact matches.
Source: CFE and LFC.

2.3.3.2 Additional capacity

The projects within the Capacity Requirement Program (CRP) for the 2008-2017 timeframe to be put out to bid according to their scheduled start-up date will start commercial operations as of 2011 with the Oaxaca II-IV (304 MW) and Baja California Sur III (Coromuel) (43 MW) wind power plants and the re-powering of unit 1 of the Manzanillo I thermoelectric plant to operate as a combined-cycle plant (460 MW).

The uncommitted additional capacity for the 2008-2017 planning timeframe contemplates the installation of 10,795 MW between 2011 and 2017 (see chart 22). This capacity may be installed under different investment schemes, either through private participation in bids for independent power production or under financed public works.

Regarding the location and technology of uncommitted projects, the law provides for the possibility of private entities to propose a location other than the scheduled location, and the type of technology to be used in power generation projects, even if this implies additional transmission to reach the preferred

interconnection point, and the alternative interconnection points specified by CFE in the bid bases. With this, other options will be available to benefit from electric power with the lowest total cost in the long term, having the quality and reliability required by public service.

To achieve the goals and objectives of the electricity sector's expansion program, the Mexican government and other stakeholders will make use of the financial resources foreseen by the conventions and treaties signed by Mexico, as well as of international financing programs, clean development mechanisms or other economic tools designed or implemented prior to and during the program.

More specifically, the projects contemplated in this program that by their nature contribute to the reduction of greenhouse gas emissions will require the resources obtained from the sale of these reductions on the international coal market in order to become economically viable and progress from their scheduling through their execution until their start-up.

Regarding the technologies considered for additional capacity requirements, combined-cycles represent 69.5%, i.e. 7,500 MW, of the total capacity to be installed between 2011 and 2017, followed by the assignment of the so-called free capacity, for which technology has not yet been specified. This capacity amounts to 1,355 MW, that is, 12.6% of the total additional capacity for the same period. Also, as part of a policy to diversify energy sources, this capacity will be assigned to different technologies allowing for the use of diverse fuels. This would be the way to prevent dependency on a single fuel type. The remaining 17.9% of uncommitted capacity corresponds to different technologies, mainly coal electric, hydroelectric, wind and geothermal. To achieve this diversification, 700 MW of new capacity based on coal electric technology will be installed, as well as 304 MW of wind electric and 75 MW of geothermal technology (see map 6).

Chart 22

Additional capacity requirements, 2011-2017

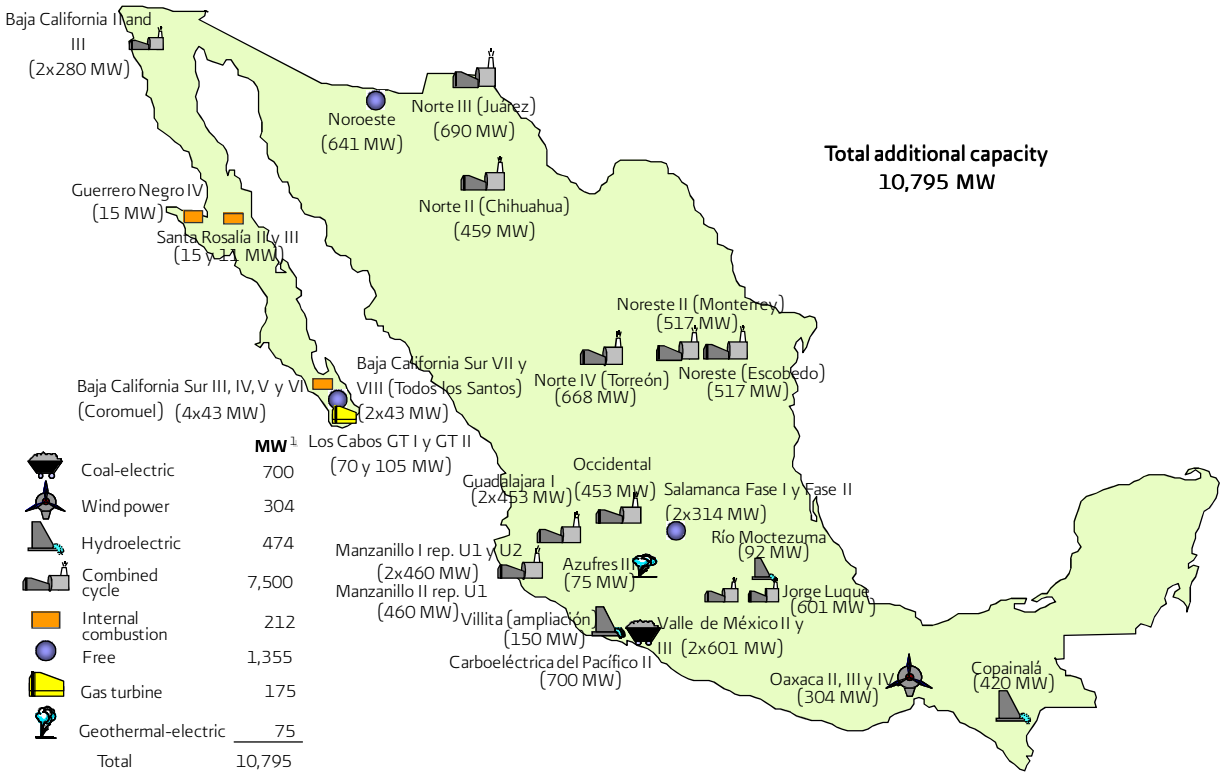
(project financing scheme still to be defined)

Project	Location	Technology	Gross capacity (MW)						
			2011	2012	2013	2014	2015	2016	2017
Total annual			**807**	**1,214**	**1,076**	**733**	**1,834**	**2,366**	**2,766**
Accrued			**807**	**2,021**	**3,096**	**3,829**	**5,663**	**8,029**	**10,795**
Oaxaca II, III y IV	Oaxaca	WIND	304						
Baja California Sur III a VI (Coromuel)	Baja California Sur	IC	43		43	43	43		
Manzanillo I repotenciación U1 y U2	Colima	CC	460	460					
Baja California III y II	Baja California	CC		280				280	
Norte II (Chihuahua)	Chihuahua	CC		459					
Santa Rosalía II y III	Baja California Sur	IC		15	11				
Guerrero Negro IV	Baja California Sur	IC			15				
Valle de México II y III	Estado de México	CC			601		601		
Norte III (Juárez)	Chihuahua	CC				690			
Salamanca Fase I y Fase II	Guanajuato	FREE			314			314	
Guadalajara I	Jalisco	CC					453		
Río Moctezuma	Hidalgo, Querétaro	HYD			92				
Villita ampliación	Michoacán	HYD					150		
Noreste (Escobedo)	Nuevo León	CC					517		
Los Cabos GT I y GT II	Baja California Sur	GT					70		105
Azufres III	Michoacán	GEO						75	
Manzanillo II repotenciación U1	Colima	CC							460
Noreste II (Monterrey)	Nuevo León	CC						517	
Occidental	Jalisco	CC						453	
Baja California Sur VII a IX (Todos Santos)	Baja California Sur	FREE						86	
Noroeste	Sonora	FREE						641	
Norte IV (Torreón)	Coahuila	CC							668
Copainalá	Chiapas	HYD							232
Carboeléctrica del Pacífico II	Guerrero	COAL							700
Jorge Luque	Estado de México	CC							601

HYD: Hydroelectric; CC: Combined cycle; IC: Diesel-fired internal combustion; WIND: Wind power;
GEO: Geothermal-electric; COAL: Coal electric ; GT: Gas turbine;
Note: Figures are rounded up to integers, thus totals may not be exact matches.
Source: Comisión Federal de Electricidad.

Map 6

Additional capacity requirements, 2011-2017[19]



*Figures are rounded up to integers, thus totals may not be exact matches.
Source: Comisión Federal de Electricidad.

As part of the sector's planning process, capacity requirement programs and plant start-up dates are reviewed on a regular basis. Based on capacity reserve criteria and on electricity demand growth expectations as well as on the corresponding budget authorizations, decisions are made on whether to delay, modify or, if applies, cancel projects (see chart 23). Bidding process results also influence project start-up dates. This is the case of the Agua Prieta II project, which had to be delayed and is currently in the third bid call phase.

[19] Projects put out for bidding on different dates.

Chart 23

Comparison of Capacity Requirement Programs, 2007 and 2008

CRP from September 20, 2007				CRP from November 13, 2008			
Project	MW	Month	Year	Project	MW	Month	Year
La Venta III	101	May	2009	La Venta III	101	Jul	2010
Presidente Juárez Conversión GT/CC	93	Apr	2010	Presidente Juárez Conversión GT/CC	93	Feb	2011
Baja California Sur III (Coromuel)	43	Apr	2010	Baja California Sur III (Coromuel)	43	Apr	2011
Cerro Prieto V	107	Apr	2010	Cerro Prieto V	107	Mar	2011
Humeros	51	Apr	2010	Humeros Fase B	23	Nov	2010
				Humeros Fase A	28	Mar	2011
Oaxaca I, II, III y IV	406	Ago	2010	Oaxaca I	101	Dec	2010
				Oaxaca II, III y IV	304	Sep	2011
Norte II (Chihuahua)	652	Apr	2011	Norte II (Chihuahua)	459	Apr	2012
Baja California III	280	Apr	2011	Baja California III	280	Apr	2012
Agua Prieta II	641	May	2011	Agua Prieta II	477	Apr	2012
Manzanillo I rep U1	460	Jul	2011	Manzanillo I rep U1	460	Sep	2011
Valle de México II	601	Sep	2011	Valle de México II	601	Sep	2013
Baja California Sur IV (Coromuel)	43	Apr	2011	Baja California Sur IV (Coromuel)	43	Apr	2013
Noreste (Monterrey)	736	Apr	2012	Noreste (Escobedo)	517	Apr	2015
Manzanillo I rep U2	460	Apr	2012	Manzanillo I rep U2	460	Sep	2012
Valle de México III	601	Ago	2012	Valle de México III	601	Sep	2015
Norte III (Juárez)	672	Apr	2013	Norte III (Juárez)	690	Apr	2014
Río Moctezuma	114	Apr	2013	Río Moctezuma	92	Apr	2013
Manzanillo II rep U1	460	Apr	2013	Manzanillo II rep U1	460	Apr	2017
Baja California Sur V (Coromuel)	43	Apr	2013	Baja California Sur V (Coromuel)	43	Apr	2014
Baja California II (Ensenada)	280	Apr	2013	Baja California II	280	Apr	2016
Noreste II (Sabinas)	700	Apr	2014	Noreste II (Monterrey)	517	Apr	2016
Manzanillo II rep U2	460	Apr	2014	Manzanillo II rep U2	460	Apr	2018
Guadalajara I	645	Apr	2014	Guadalajara I	453	Apr	2015
Topolobampo I	700	Apr	2014	After 2018			
Valle de México IV	601	Apr	2014	After 2018			
Baja California Sur VI (Coromuel)	43	Apr	2014	Baja California Sur VI (Coromuel)	43	Apr	2015
Villita Ampliación	150	Apr	2014	Villita Ampliación	150	Apr	2015
Baja California Sur GT I (Los Cabos)	36	Apr	2015	Los Cabos GT I	70	Apr	2015
Norte IV (Torreón)	661	Apr	2015	Norte IV (Torreón)	668	Apr	2017
Tamazunchale II	750	Apr	2015	After 2018			
La Parota U1	300	Apr	2015	La Parota U1	300	Apr	2018
Guadalajara II	645	Apr	2015	Occidental	453	Apr	2016
Baja California Sur VII y VIII (Todos Santos)	86	Apr	2015	Baja California Sur VII y VIII (Todos Santos)	86	Apr	2016
Carboeléctrica del Pacífico II	700	Apr	2015	Carboeléctrica del Pacífico II	700	Apr	2017
La Parota U2	300	Jul	2015	La Parota U2	300	Jul	2018
La Parota U3	300	Oct	2015	La Parota U3	300	Oct	2018
Occidental (Salamanca)	650	Apr	2016	Salamanca Fase I	314	Apr	2013
				Salamanca Fase II	314	Apr	2016
Central I (Tula)	889	Apr	2016	After 2018			
Topolobampo II	700	Apr	2016	After 2018			
Baja California Sur IX (Todos Santos)	43	Apr	2016	Baja California Sur IX (Todos Santos)	43	Apr	2018
Noreste III (Sabinas)	700	Apr	2016	Noreste III (Sabinas)	700	Apr	2018

Source: Comisión Federal de Electricidad.

It is worth mentioning that the Law on the Use of Renewable Energies and the Financing of Energy Transition came into effect on November 28, 2008, with the purpose of regulating and fostering the use of renewable energy sources, of diversifying primary energy sources and contributing to the strengthening of national energy security.

According to aforementioned law, renewable energy sources include wind energy, solar radiation, water movement in natural or artificial courses; all forms of sea energy, geothermal reservoir heat and bio-energy sources.

To achieve its purposes, the law establishes the National Strategy for Energy Transition and Sustainable Energy Usage as a mechanism aimed at promoting the use, development and investment of renewable energy sources and energy efficiency. The strategy provides for a resource fund for the financing of energy transition and the use of renewable energy.

For 2009, 2010 and 2011, respectively, the Mexico's Congress has foreseen three billion pesos to be destined to said fund, allowing for an increase of additional capacity within the national electricity system.

2.3.3.3 Capacity withdrawal program

The capacity withdrawal program is based on the operating costs and service life of power generation units. These criteria allow for evaluating the convenience of keeping certain plants operating. The emission level and efficiency of older plants are also important factors to be considered. Bearing this in mind, this planning contemplates the withdrawal of 4,749 MW of public service capacity during the next ten years.

It is important to point out that the program is not definitive, since in order to operate with greater efficiency and competitiveness margins, CFE evaluates - depending on aforementioned criteria and on the specific issues in each case - which units and plants must cease operations, must undergo rehabilitation or be modernized.

The most relevant withdrawals will take place between 2013 and 2017 (see chart 25 and graph 18). Without considering annual withdrawals, by the end of 2017, the total electric power capacity for public service shall amount to 61,074 MW (see chart 24).

Chart 24

Expected evolution of public service installed capacity, 2008-2017

(MW)

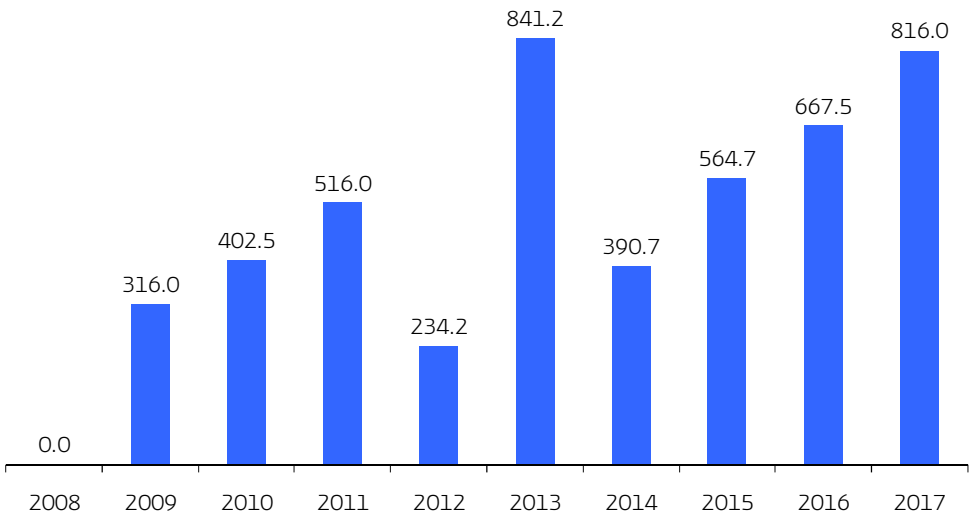
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Capacity by December of each year	**51,069**	**51,498**	**52,784**	**53,343**	**55,580**	**55,814**	**56,156**	**57,425**	**59,124**	**61,074**
Capacity by December 2007	51,029	51,029	51,029	51,029	51,029	51,029	51,029	51,029	51,029	51,029
Accrued CFE additions	40	625	2,314	3,389	5,860	6,935	7,668	9,502	11,868	14,033
Accrued LFC additions	-	160	160	160	160	160	160	160	160	761
Accrued withdrawals	-	316	719	1,235	1,469	2,310	2,701	3,265	3,933	4,749

Note: Does not include local or remote self-supply.
Source: Comisión Federal de Electricidad.

Graph 18

Capacity withdrawal program, 2008-2017

(MW)



Source: Comisión Federal de Electricidad.

Chart 25

Withdrawal program, 2008-2017 (gross capacity)

(MW)

2008						2009					
Plant	Unit	Type	MW	Month	Area	Plant	Unit	Type	MW	Month	Area
						Salamanca	2.0	CT	158.0	June	Western
						Salamanca	1.0	CT	158.0	June	Western
Sum of withdrawals			**0.0**			**Sum of withdrawals**			**316.0**		
2010						**2011**					
Plant	Unit	Type	MW	Month	Area	Plant	Unit	Type	MW	Month	Area
Nonoalco	1 y 2	GT	64.0	February	Plant	Cerro Prieto I	1 y 2	GEO	75.0	February	Baja California
Lerma (Campeche)	2.0	CT	37.5	June	Peninsular	Lerma (Campeche)	3 y 4	CT	75.0	April	Peninsular
Felipe Carrillo Puerto	1 y 2	CT	75.0	June	Peninsular	Jorge Luque	1 y 2	CT	64.0	June	Plant
Dos Bocas	3 y 4	CC	126.0	September	Eastern	Jorge Luque	3.0	CT	80.0	June	Plant
Dos Bocas	6.0	CC	100.0	September	Eastern	Lechería	1, 2 y 3	GT	96.0	June	Plant
						Lechería	4.0	GT	42.0	June	Plant
						Nonoalco	3 y 4	GT	84.0	June	Plant
Sum of withdrawals			**402.5**			**Sum of withdrawals**			**516.0**		
2012						**2013**					
Plant	Unit	Type	MW	Month	Area	Plant	Unit	Type	MW	Month	Area
Dos Bocas	1 y 2	CC	126.0	March	Eastern	Santa Rosalía	9 y 10	IC	3.2	April	Isolated system
Dos Bocas	5.0	CC	100.0	March	Eastern	Salamanca	3.0	CT	300.0	April	Western
Santa Rosalía	5,7	IC	3.8	November	Isolated system	Valle de México	1, 2 y 3	CT	450.0	November	Plant
Santa Rosalía	3, 4 y 6	IC	4.4	November	Isolated system	Valle de México	2 y 4	GT	56.0	November	Plant
						Valle de México	3.0	GT	32.0	November	Plant
Sum of withdrawals			**234.2**			**Sum of withdrawals**			**841.2**		
2014						**2015**					
Plant	Unit	Type	MW	Month	Area	Plant	Unit	Type	MW	Month	Area
FranICsco Villa	4 y 5	CT	300.0	April	Northern	Altamira	3 y 4	CT	500.0	April	Northeastern
Los Cabos	1.0	DGT	30.0	November	Baja California Sur	Punta Prieta II	1.0	CT	37.5	November	Baja California Sur
Los Cabos	2.0	DGT	27.4	November	Baja California Sur	Los Cabos	3.0	DGT	27.2	November	Baja California Sur
Cd. ConstitulCón	1.0	DGT	33.2	November	Baja California Sur						
Sum of withdrawals			**390.7**			**Sum of withdrawals**			**564.7**		
2016						**2017**					
Plant	Unit	Type	MW	Month	Area	Plant	Unit	Type	MW	Month	Area
C. Rodríguez Rivero (Guaymas II)	1.0	CT	84.0	April	Northwestern	Fco. Pérez Ríos (Tula)	1 y 2	CC	138.0	January	Plant
C. Rodríguez Rivero (Guaymas II)	3.0	CT	158.0	April	Northwestern	Fco. Pérez Ríos (Tula)	3.0	CC	100.0	January	Plant
Salamanca	4.0	CT	250.0	April	Western	Samalayuca	1 y 2	CT	316.0	April	Northern
Azufres	1 a 6 y 9	GEO	35.0	April	Western	Gómez PalaICo	1 y 2	CC	118.0	April	Northern
Punta Prieta II	2.0	CT	37.5	November	Baja California Sur	Gómez PalaICo	3.0	CC	82.0	April	Northern
La Paz	1.0	DGT	18.0	November	Baja California Sur	Mexicali	1.0	DGT	26.0	November	Baja California
La Paz	2.0	DGT	25.0	November	Baja California Sur	Mexicali	2 y 3	DGT	36.0	November	Baja California
Tijuana	1 y 2	GT	60.0	November	Baja California						
Sum of withdrawals			**667.5**			**Sum of withdrawals**			**816.0**		
		Total				**4,748.8**					

CT: Conventional thermoelectric CC: Combined cycle GT: Gas turbine IC: Internal combustion GEO: Geothermal-electric DGT: Diesel gas turbine

Source: Comisión Federal de Electricidad.

2.3.3.4 Evolution of installed capacity by statistical region

During the 2007-2017 timeframe, public service electricity generation capacity will experience a net increase of 10,045 MW, from 51,029 MW to 61,074 MW. The region with the highest increase will be the Central-Western region, where total capacity will register net additions of 3,168 MW, due to the formidable increase in the installation of combined-cycle and hydroelectric plants in this region. In contrast, the Central region will be the one with the lowest amount of additions during the period, with only 1,023 MW (see chart 26).

Northwestern region

In this region, installed capacity is expected to increase by 2,077 MW, mainly through combined cycles with the installation of the Baja California (Presidente Juárez) (277 MW), Baja California III and II (280 MW each) and Agua Prieta II plants with 477 MW. 107 MW of geothermal-electric capacity will also be installed, corresponding to the Cerro Prieto V plant.

Northeastern region

In 2007, the Northeastern region concentrated the highest regional installed combined-cycle capacity with 7,765 MW, representing 15.2% of the total domestic capacity installed for public service. A net increase of 3,117 MW is forecasted for the 2008-2017 timeframe, to reach 10,882 MW by the end of aforementioned period. The strong presence of independent power producers makes the region a strategic geographic area regarding power generation and natural gas consumption.

In this region, more specifically 30 km to the northeast of Durango, the Norte (La Trinidad) plant is being constructed under the IPP scheme, with scheduled start of operations in 2010, and a gross capacity of 466 MW, using natural gas as fuel and treated sewage water for the cooling and utilities system.

On the other hand, the Carbón II and Río Escondido coal-electric plants in Coahuila have a joint capacity of 2,600 MW, and no capacity increase is scheduled for them.

Central-Western region

Just like in the Outlook for the 2007-2016 timeframe, the expansion program for this region contemplates adding the highest capacity, equal to 3,168 MW, between 2008 and 2017. Another relevant growth will take place in hydroelectric power generation capacity, increasing by 1,080 MW, driven by the start-up of the La Yesca plant and by the expansion project of the Villita plant.

On the other hand, and as a result of the capacity withdrawal program, by 2017 a capacity decline of 866 MW will be observed in fuel-oil-fired thermoelectric plants.

Central region

In the Central region, planned capacity additions will take place through the Valle de México II and III, as well as the re-powering of the Jorge Luque plant projects, with a capacity of 601 MW each. Slight increase is also expected in geothermal-electric capacity with the Humeros project in Puebla, representing 51 MW, scheduled to start operations in 2010 in the first phase and in 2011, in the second phase. On the other hand, LFC, as already mentioned, will contribute 160 MW with 5 units to start operations during 2009, concluding therewith this distributed power generation project representing a total of 448 MW.

South-Southeastern region

The South-Southeastern region concentrates the greatest diversity of electricity-generating technologies in the country. The abundance of natural resources, both renewable and fossil, is one of the main reasons explaining such diversification. The region expects net capacity additions of 1,747 MW during the 2008-2017 timeframe. In addition to the La Venta III wind power plant that will start operations in 2010, the region will also benefit from the installation of 1,378 MW of coal electric capacity that could use both advanced technology, as in the case of supercritical boilers, and gasification integrated with combined cycles, known for being clean and efficient combustion technologies.

The Carboeléctrica del Pacífico plant, located on the estate of the Plutarco Elías Calles (Petacalco) plant, in Guerrero state, is currently under construction. The project contemplates a gross capacity of 678 MW, including a steam turbo-generator, a supercritical steam generator and a surface condenser as its main equipment. In addition, two units of the Laguna Verde nuclear-electric plant in Veracruz are undergoing rehab and modernization, to increase the plant's capacity by 269.2 MW, reaching 1,634 MW by 2010.

Chart 26

Installed capacity evolution by technology and region

(MW)

Type	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Northwestern Subtotal	**6,748**	**6,748**	**7,160**	**7,160**	**7,328**	**8,091**	**8,157**	**8,109**	**8,157**	**8,782**	**8,825**
Hydraulic	941	941	941	941	941	941	941	941	941	941	941
Combined cycle	1,720	1,720	1,997	1,997	2,090	2,847	2,847	2,847	2,847	3,127	3,127
Gas turbine	663	663	787	787	787	787	787	697	739	636	679
Internal combustion	209	209	220	220	263	269	334	377	420	420	420
Wind	1	1	1	1	1	1	1	1	1	1	1
Free	-	-	-	-	-	-	-	-	-	727	727
Fuel oil	2,485	2,485	2,485	2,485	2,485	2,485	2,485	2,485	2,447	2,168	2,168
Coal-electric	-	-	-	-	-	-	-	-	-	-	-
Geothermal	730	730	730	730	762	762	762	762	762	762	762
Northeastern Subtotal	**13,194**	**13,194**	**13,194**	**13,660**	**13,660**	**14,149**	**14,149**	**14,539**	**14,556**	**15,073**	**15,225**
Hydraulic	126	126	126	126	126	126	126	126	126	126	126
Combined cycle	7,765	7,765	7,765	8,231	8,231	8,690	8,690	9,380	9,897	10,414	10,882
Gas turbine	668	668	668	668	668	668	668	668	668	668	668
Free	-	-	-	-	-	-	-	-	-	-	-
Coal-electric	2,600	2,600	2,600	2,600	2,600	2,930	2,930	2,930	2,930	2,930	2,930
Fuel oil	2,036	2,036	2,036	2,036	2,036	1,436	1,436	1,136	636	636	320
Fluidized bed boiler	-	-	-	-	-	300	300	300	300	300	300
Central-Western Subtotal	**8,553**	**8,593**	**8,327**	**8,377**	**8,877**	**10,087**	**10,101**	**10,101**	**10,704**	**11,261**	**11,721**
Hydraulic	2,634	2,674	2,724	2,774	2,814	3,564	3,564	3,564	3,714	3,714	3,714
Combined cycle	2,233	2,233	2,233	2,233	2,693	3,153	3,153	3,153	3,606	4,059	4,519
Gas turbine	24	24	24	24	24	24	24	24	24	24	24
Free	-	-	-	-	-	-	314	314	314	628	628
Internal combustion	1	1	1	1	1	1	1	1	1	1	1
Coal-electric	-	-	-	-	-	-	-	-	-	-	-
Fuel oil	3,466	3,466	3,150	3,150	3,150	3,150	2,850	2,850	2,850	2,600	2,600
Geothermal	195	195	195	195	195	195	195	195	195	235	235
Central Subtotal	**4,950**	**4,950**	**5,233**	**5,192**	**4,854**	**4,854**	**5,009**	**5,009**	**5,610**	**5,610**	**5,973**
Hydraulic[2]	729	729	729	729	729	729	821	821	821	821	821
Combined cycle	1,038	1,038	1,161	1,161	1,161	1,161	1,762	1,762	2,363	2,363	2,726
Gas turbine[3]	928	928	1,088	1,024	802	802	714	714	714	714	714
Free	-	-	-	-	-	-	-	-	-	-	-
Fuel oil	2,220	2,220	2,220	2,220	2,076	2,076	1,626	1,626	1,626	1,626	1,626
Geothermal	35	35	35	58	86	86	86	86	86	86	86
South-Southeastern Subtotal	**17,580**	**17,580**	**17,580**	**18,392**	**18,621**	**18,395**	**18,395**	**18,395**	**18,395**	**18,395**	**19,327**
Hydraulic	6,913	6,913	6,913	6,913	6,913	6,913	6,913	6,913	6,913	6,913	7,145
Combined cycle	3,906	3,906	3,906	3,680	3,680	3,454	3,454	3,454	3,454	3,454	3,454
Gas turbine	548	548	548	548	548	548	548	548	548	548	548
Internal combustion	4	4	4	4	4	4	4	4	4	4	4
Dual	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100
Wind	85	85	85	288	592	592	592	592	592	592	592
Free	-	-	-	-	-	-	-	-	-	-	-
Fuel oil	2,659	2,659	2,659	2,547	2,472	2,472	2,472	2,472	2,472	2,472	2,472
Coal-electric	-	-	-	678	678	678	678	678	678	678	1,378
Nuclear-electric	1,365	1,365	1,365	1,634	1,634	1,634	1,634	1,634	1,634	1,634	1,634
Mobile plants	3	3	3	3	3	3	3	3	3	3	3
Total[1]	**51,029**	**51,069**	**51,498**	**52,784**	**53,343**	**55,580**	**55,814**	**56,156**	**57,425**	**59,124**	**61,074**

[1] Includes CFE, IPP as well as increased rehab and modernization of the Villita and Infiernillo hydroelectric plants and the Laguna Verde nuclear electric plant (479 MW).

[2] The Río Moctezuma Project consists of two hydroelectric plants in the same river basin: Jiliapan and Tecalco in Hidalgo state.

[3] Includes 160 MW of LFC's distributed power generation project.

Due to the rounding-up of figures, totals may not be exact matches.

Source: Comisión Federal de Electricidad.

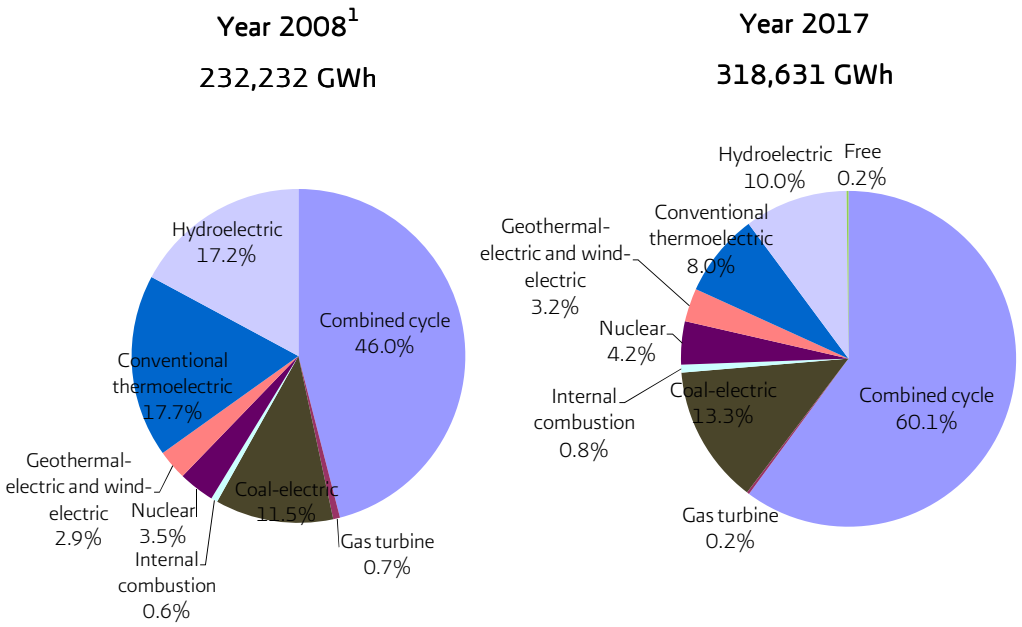
2.3.4 Gross public utility generation, 2008-2017

By the end of 2007, electricity generation for public utility increased to 232,552 GWh, representing a 3.3-% increase with respect to 2006. Electricity generation is expected to rise at an annual average rate of 3.6% between 2008 and 2017, to reach 318,631 GWh by the end of the period (see graph 19).

Graph 19

Gross power generation forecast for public utility by technology type, 2008-2017

(GWh)



[1] Real figures for the January-September period; figures for the rest of the year are estimates.
Source: Comisión Federal de Electricidad.

2.3.5 Fuel consumption for electricity generation purposes

The thermal efficiency of plants, fuel prices, operative minimums and the applicable environmental legislation, among other factors, are considered to calculate fuel requirements for public service electricity generation. The technologies considered in CRP (Capacity Requirement Programs) are the criteria that define the fuel required. According to an energy source diversification strategy, the 2008-2017 expansion program contemplates the possibility of assigning free capacity to different energy sources, such as renewable energy, coal, synthesis gas or syngas, uranium and, in some cases, electricity imports.

Chart 27

Fossil fuel consumption forecast for electricity generation, 2007-2017

	Units	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	aagr % 2007-2017
Fuel-oil	Mm3 / day	31,365.5	25,323.2	23,215.2	21,559.3	18,832.1	18,000.5	14,305.4	15,437.8	17,009.3	15,106.9	14,256.0	-7.6
Natural gas	MMm3 / day	63.5	68.5	70.5	73.4	75.3	79.0	83.0	87.2	92.6	99.0	103.9	5.0
National	MMm3 / day	34.5	33.1	33.7	35.0	33.9	33.7	34.0	35.1	37.0	38.9	43.7	2.4
Import	MMm3 / day	20.4	22.1	23.5	19.8	20.4	21.2	20.5	23.0	25.0	26.1	25.5	2.2
LNG	MMm3 / day	8.5	13.3	13.3	18.6	21.0	24.2	28.5	29.1	30.6	34.0	34.6	15.1
Diesel	Mm3 / day	592.0	653.6	307.2	425.3	327.4	402.0	291.0	258.5	240.0	207.3	307.5	-6.3
Coal	MM ton / year	14.7	10.7	15.5	16.3	16.8	17.5	17.9	18.0	17.9	17.9	18.8	2.5
Petroleum coke	MM ton / year	-	-	-	-	-	0.4	0.6	0.6	0.6	0.6	0.6	n.a.

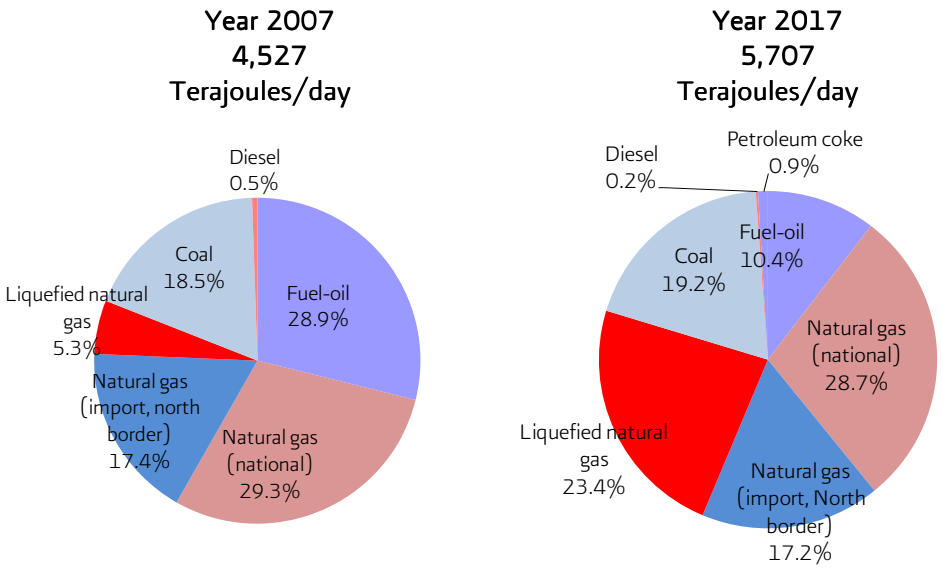
* Observed.
MM: million; M: thousand.
Source: Comisión Federal de Electricidad.

Specifically, the fuel with the greatest increase in use will be natural gas with an annual average of 5.0%, while fuel-oil will have the greatest annual decline with –7.6%, followed by diesel with –6.3%. Coal usage is expected to increase at an annual rate of 2.5%.

As a strategy to contribute to the diversification of the power generation fleet, the current fuel requirement program considers two main technology changes at the following plants: Río Bravo, unit 3 with 300 MW (from fuel-oil to coal, capacity increase to 330 MW) and Altamira, units 1 and 2 with 150 MW (from fuel-oil to coke), to take place as of 2012 in both cases. In the latter, fluidized bed boiler technology is considered in order to achieve clean petroleum coke combustion.

Graph 20

Fossil fuel share in electricity generation 2007-2017, (%)



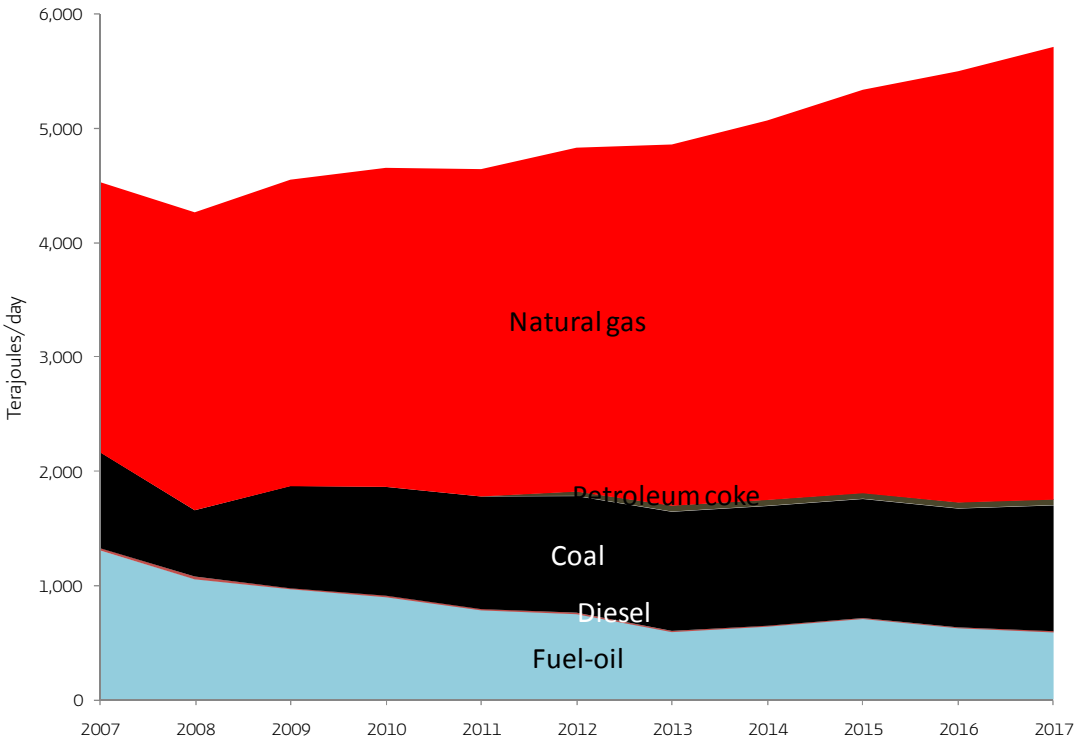
Source: Comisión Federal de Electricidad.

Graph 21 shows fuel usage tendencies throughout the entire period.

Graph 21

Fossil fuel consumption forecast for electricity generation, 2007-2017

(Terajoules/day)



Source: Comisión Federal de Electricidad.

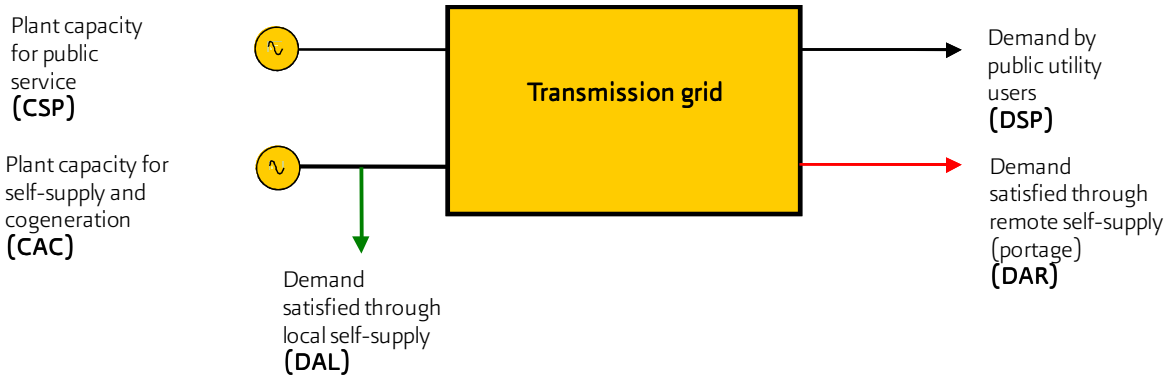
2.4 Self-supply and cogeneration

Self-supply and cogeneration permit-holders have increased their share in recent years, so that they represent a significant capacity within SEN. These projects attend to part of the domestic electricity consumption, and influence the public utility system by requiring transmission and backup services.

Schematically, (see figure 1), the analysis and planning of SEN includes self-supply and cogeneration plants in order to evaluate their impact upon the power-generating system's expansion, given the fact that the geographic location of new self-supply and cogeneration plants, as well as that of their local and remote loads, have an important impact upon the regional reserve margin and the expansion of the transmission grid.

Figure 1

National Electricity System



Source: Comisión Federal de Electricidad.

Regarding supply, the capacity of plants providing public service (CSP for its Spanish acronym) as well as the capacity of self-supply and cogeneration plants (CAC for their Spanish acronym) have both been considered. Regarding demand, the requisites of public service users (DSP for its Spanish acronym) and the demand of self-suppliers and cogenerators have been considered with the following components:

- Remote demand (DAR): corresponds to the loads located at sites far away from power plants, satisfied through the public utility transmission grid.
- Local demand (DAL): corresponds to the load located close to power plants that does not make use of the public utility transmission grid and/or public utility distribution.

In 2007, the greatest capacity installed by permit-holders was concentrated in large self-supply and cogeneration partnerships, such as Iberdrola Energía Monterrey, Tractebel, Termoeléctrica Peñoles, Termoeléctrica del Golfo, Energía Azteca VIII and Enertek. It is also important to specify that Pemex possesses a large capacity authorized for self-supply and cogeneration aimed at the satisfaction of part of its electricity needs.

On the other hand, no other large-scale self-supply projects have been undertaken since 2004. However, the number of permits issued for small-scale self-supply has significantly increased in recent years. As a cost mitigation strategy, many companies in the services sector have chosen to disconnect from the public utility grid in peak hours and generate their own electricity through small-capacity plants, most of them diesel-fired. This type of self-supply is mainly local.

On January 7, 2008, the Ministry of Finance and Public Credit (SHCP) published the Agreement "authorizing the adjustment and modification of electricity supply and sale rates" in the DOF, establishing the following in its Fourth Article: "The provider shall apply a multiplicative adjustment factor of 0.70 to all charges per peak-hour energy kilowatt-hour of the hourly rate" for general medium and high-voltage service. This provision might contribute to the increase of competitiveness among industrial and services companies that use medium and high-voltage electricity, thus to the modification of recently observed decreasing tendency in the number of users that generate electricity in peak hours using diesel with all the negative effects implied.

In terms of installed capacity for remote self-supply, Iberdrola Energía Monterrey with 530 MW, Termoeléctrica Peñoles and Golfo with 230 MW each, as well as Tractebel with 229 MW (see chart 28), stand out.

Upon the end of Pemex's self-supply program, its Nuevo Pemex Project shows the highest degree of feasibility with a 314-MW capacity (see chart 29).

Chart 28

Self-supply and cogeneration capacity evolution*, 2007-2017

(MW)

	2007**	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	**1,657**	**1,687**	**2,134**	**2,134**	**3,715**	**3,715**	**3,715**	**4,147**	**4,147**	**4,147**	**4,147**
Arancia	9	9	9	9	9	9	9	9	9	9	9
Enertek	75	75	75	75	75	75	75	75	75	75	75
Micase	7	7	7	7	7	7	7	7	7	7	7
Iberdrola Energía Monterrey	530	530	530	530	530	530	530	530	530	530	530
Energía Azteca VIII	77	77	77	77	77	77	77	77	77	77	77
Energía y Agua Pura de Cozumel	12	12	12	12	12	12	12	12	12	12	12
Termoeléctrica del Golfo	230	230	230	230	230	230	230	230	230	230	230
Termoeléctrica Peñoles	230	230	230	230	230	230	230	230	230	230	230
Hidroelectricidad del Pacífico	8	8	8	8	8	8	8	8	8	8	8
Impulsora Mexicana de Energía	15	15	15	15	15	15	15	15	15	15	15
Bioenergía de Nuevo León	7	7	7	7	7	7	7	7	7	7	7
Tractebel (Enron)	229	229	229	229	229	229	229	229	229	229	229
Agrogen	6	6	6	6	6	6	6	6	6	6	6
Proveedora de Electricidad de Occidente	19	19	19	19	19	19	19	19	19	19	19
Italaise	1	1	1	1	1	1	1	1	1	1	1
PEMEX Cosoleacaque	12	12	12	12	-	-	-	-	-	-	-
PEMEX Lázaro Cárdenas	6	6	6	6	-	-	-	-	-	-	-
PEMEX Independencia	46	46	46	46	-	-	-	-	-	-	-
PEMEX Petroquímica Morelos	18	18	18	18	-	-	-	-	-	-	-
PEMEX Pajaritos	16	16	16	16	-	-	-	-	-	-	-
PEMEX Escolín	14	14	14	14	-	-	-	-	-	-	-
PEMEX La Venta	17	17	17	17	-	-	-	-	-	-	-
PEMEX Petróleos Mexicanos (Independencia)	6	6	6	6	-	-	-	-	-	-	-
PEMEX Cactus	21	21	21	21	-	-	-	-	-	-	-
Mexicana de Hidroelectricidad Mexhidro	30	30	30	30	30	30	30	30	30	30	30
Generadora Pondercel	15	15	15	15	15	15	15	15	15	15	15
BSM Energía de Veracruz	3	3	3	3	3	3	3	3	3	3	3
Parques Ecológicos de México ***		30	80	80	80	80	80	80	80	80	80
Eurus ***			248	248	248	248	248	248	248	248	248
Hidroeléctrica Cajón de Peña			1	1	1	1	1	1	1	1	1
Eoliatec del Istmo			22	22	22	22	22	22	22	22	22
BII NEE STIPA Energía Eólica			26	26	26	26	26	26	26	26	26
Eléctrica del Valle de México			52	52	52	52	52	52	52	52	52
Fuerza Eólica del Istmo (1ra. Etapa)			49	49	49	49	49	49	49	49	49
Fuerza Eólica del Istmo (2da. Etapa)					49	49	49	49	49	49	49
Preneal México					393	393	393	393	393	393	393
Desarrollos Eólicos Mexicanos					226	226	226	226	226	226	226
Gamesa Energía					285	285	285	285	285	285	285
Eoliatec del Pacifico					159	159	159	159	159	159	159
Eoliatec del Istmo					141	141	141	141	141	141	141
Unión Fenosa					226	226	226	226	226	226	226
PEMEX Nuevo Pemex					258	258	258	258	258	258	258
GDC Generadora								432	432	432	432

* Considering remote self-supply only.
** Existing capacity by December 2007.
*** Operation starting dates of these projects have been updated based on information available by October 2008.
Open season permit-holders have not yet defined loads to be supplied remotely.
Figures are rounded up to integers, thus totals may not be exact matches.
Source: Sener, CFE, Pemex and CRE.

Chart 29

Self-supply and cogeneration capacity evolution*, 2007-2017

(MW)

	2007**	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	**6,270**	**6,599**	**7,050**	**7,058**	**8,865**	**8,865**	**8,865**	**9,345**	**9,345**	**9,345**	**9,345**
Proyectos existentes (sin PEMEX)	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170
PEMEX	2,178	2,178	2,178	2,178	2,178	2,178	2,178	2,178	2,178	2,178	2,178
Arancia	29	29	29	29	29	29	29	29	29	29	29
Enertek	120	120	120	120	120	120	120	120	120	120	120
Micase	11	11	11	11	11	11	11	11	11	11	11
Iberdrola Energía Monterrey	619	619	619	619	619	619	619	619	619	619	619
Energía Azteca VIII	131	131	131	131	131	131	131	131	131	131	131
Energía y Agua Pura de Cozumel	32	32	32	32	32	32	32	32	32	32	32
Termoeléctrica del Golfo	250	250	250	250	250	250	250	250	250	250	250
Termoeléctrica Peñoles	260	260	260	260	260	260	260	260	260	260	260
Hidroelectricidad del Pacífico	9	9	9	9	9	9	9	9	9	9	9
Impulsora Mexicana de Energía	24	24	24	24	24	24	24	24	24	24	24
Bioenergía de Nuevo León	8	8	8	8	8	8	8	8	8	8	8
Tractebel (Enron)	284	284	284	284	284	284	284	284	284	284	284
Agrogen	12	12	12	12	12	12	12	12	12	12	12
Proveedora de Electricidad de Occidente	19	19	19	19	19	19	19	19	19	19	19
Italaise	5	5	5	5	5	5	5	5	5	5	5
Mexicana de Hidroelectricidad Mexhidro	30	30	30	30	30	30	30	30	30	30	30
Generadora Pondercel	65	65	65	65	65	65	65	65	65	65	65
BSM Energía de Veracruz	13	13	13	13	13	13	13	13	13	13	13
Local Futuro		298	298	298	298	298	298	298	298	298	298
MET-MEX Peñoles, S. A. DE C. V.				7	7	7	7	7	7	7	7
Nuevo PEMEX					314	314	314	314	314	314	314
Parques Ecológicos de México ***		30	80	80	80	80	80	80	80	80	80
Eurus ***			250	250	250	250	250	250	250	250	250
Hidroeléctrica Cajón de Peña			1	1	1	1	1	1	1	1	1
Eoliatec del Istmo			22	22	22	22	22	22	22	22	22
BII NEE STIPA Energía Eólica			27	27	27	27	27	27	27	27	27
Eléctrica del Valle de México			52	52	52	52	52	52	52	52	52
Fuerza Eólica del Istmo (1ra. Etapa)			50	50	50	50	50	50	50	50	50
Fuerza Eólica del Istmo (2da. Etapa)					50	50	50	50	50	50	50
Preneal México					396	396	396	396	396	396	396
Desarrollos Eólicos Mexicanos					228	228	228	228	228	228	228
Gamesa Energía					288	288	288	288	288	288	288
Eoliatec del Pacifico					161	161	161	161	161	161	161
Eoliatec del Istmo					142	142	142	142	142	142	142
Unión Fenosa					228	228	228	228	228	228	228
GDC Generadora								480	480	480	480

* Does not include IPP. Considers local and remote self-supply, own usage and surplus.
** Existing capacity by December 2007.
*** Operation starting dates of these projects have been updated based on information available by October 2008.
Figures are rounded up to integers, thus totals may not be exact matches.
Source: Sener, CFE, Pemex and CRE.

Regarding Pemex's remote self-supply, there is the Nuevo Pemex project with a capacity of 314 MW, 258 MW of which will be destined to different work centers of subsidiary organisms. The project will start operations in 2011. The planning also considers the open season self-supply projects based on wind power in the Tehuantepec Isthmus, with a joint capacity of 1,479 MW. In addition to this, the GDC Generadora project

located in the state of Sonora is expected to start operations in 2014, using fluidized bed boiler technology for coal, with a remote self-supply capacity of 432 MW, and generating an average of 2,643 GWh by 2014 (see chart 30).

Chart 30
Electricity generation evolution through self-supply and cogeneration*, 2007-2017
(GWh)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total	**9,846**	**9,855**	**10,917**	**11,605**	**18,138**	**18,138**	**18,138**	**20,781**	**20,781**	**20,781**	**20,781**
Arancia	44	44	44	44	44	44	44	44	44	44	44
Enertek	426	426	426	426	426	426	426	426	426	426	426
Micase	28	28	28	28	28	28	28	28	28	28	28
Iberdrola Energía Monterrey	3,204	3,204	3,204	3,204	3,204	3,204	3,204	3,204	3,204	3,204	3,204
Energía Azteca VIII	412	412	412	412	412	412	412	412	412	412	412
Energía y Agua Pura de Cozumel	23	23	23	23	23	23	23	23	23	23	23
Termoeléctrica del Golfo	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604
Termoeléctrica Peñoles	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603
Hidroelectricidad del Pacífico	38	38	38	38	38	38	38	38	38	38	38
Impulsora Mexicana de Energía	7	7	7	7	7	7	7	7	7	7	7
Bioenergía de Nuevo León	35	35	35	35	35	35	35	35	35	35	35
Tractebel (Enron)	1,493	1,493	1,493	1,493	1,486	1,486	1,486	1,486	1,486	1,486	1,486
Agrogen	19	19	19	19	19	19	19	19	19	19	19
Proveedora de Electricidad de Occidente	70	70	70	70	70	70	70	70	70	70	70
Italaise	2	2	2	2	2	2	2	2	2	2	2
PEMEX Cosoleacaque	65	65	65	65	0	0	0	0	0	0	0
PEMEX Lázaro Cárdenas	7	7	7	7	0	0	0	0	0	0	0
PEMEX Independencia	191	191	191	191	0	0	0	0	0	0	0
PEMEX Petroquímica Morelos	48	48	48	48	0	0	0	0	0	0	0
PEMEX Pajaritos	122	122	122	122	0	0	0	0	0	0	0
PEMEX Escolín	64	64	64	64	0	0	0	0	0	0	0
PEMEX La Venta	45	45	45	45	0	0	0	0	0	0	0
PEMEX Petróleos Mexicanos (Independencia)	35	35	35	35	0	0	0	0	0	0	0
PEMEX Cactus	119	119	119	119	0	0	0	0	0	0	0
Mexicana de Hidroelectricidad Mexhidro	120	120	120	120	120	120	120	120	120	120	120
Generadora Pondercel	19	19	19	19	19	19	19	19	19	19	19
BSM Energía de Veracruz	1	1	1	1	1	1	1	1	1	1	1
Parques Ecológicos de México **		9	215	291	291	291	291	291	291	291	291
Eurus **			482	910	910	910	910	910	910	910	910
Hidroeléctrica Cajón de Peña			7	8	8	8	8	8	8	8	8
Eoliatec del Istmo			54	81	81	81	81	81	81	81	81
BII NEE STIPA Energía Eólica			64	96	96	96	96	96	96	96	96
Eléctrica del Valle de México			126	189	189	189	189	189	189	189	189
Fuerza Eólica del Istmo (1ra. Etapa)			123	185	185	185	185	185	185	185	185
Fuerza Eólica del Istmo (2da. Etapa)					182	182	182	182	182	182	182
Preneal México					1,460	1,460	1,460	1,460	1,460	1,460	1,460
Desarrollos Eólicos Mexicanos					839	839	839	839	839	839	839
Gamesa Energía					1,059	1,059	1,059	1,059	1,059	1,059	1,059
Eoliatec del Pacifico					591	591	591	591	591	591	591
Eoliatec del Istmo					524	524	524	524	524	524	524
Unión Fenosa					839	839	839	839	839	839	839
PEMEX Nuevo Pemex					1,742	1,742	1,742	1,742	1,742	1,742	1,742
GDC Generadora								2,643	2,643	2,643	2,643

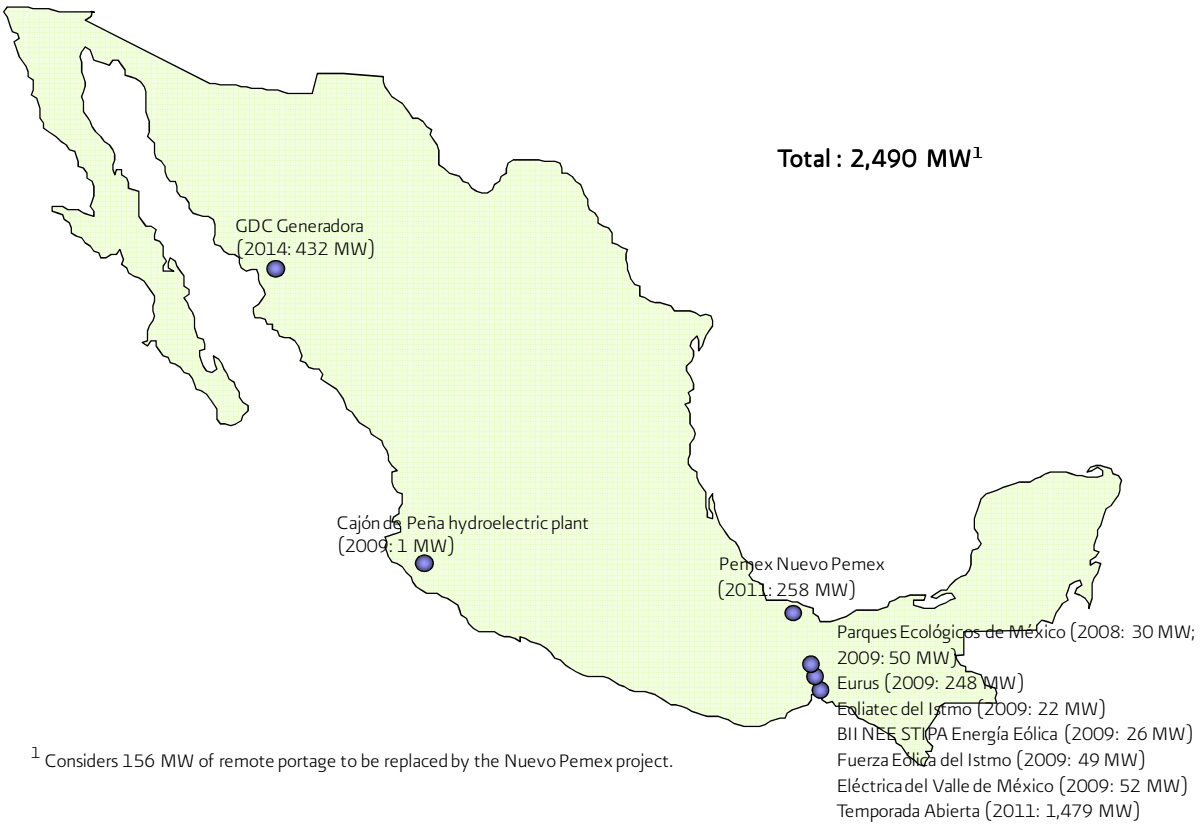
* Does not include IPP. Considers remote self-supply.
** Operation starting dates of these projects have been updated based on information available by October 2008.
Figures are rounded up to integers, thus totals may not be exact matches.
Open season permit-holders have not yet defined loads to be supplied remotely.
Source: Sener, CFE, Pemex and CRE.

The following is the geographic location of new self-supply and cogeneration plants (see map 7).

Map 7

Self-supply and cogeneration projects using the transmission grid, 2008-2017

(remote self-supply capacity)



[1] Considers 156 MW of remote portage to be replaced by the Nuevo Pemex project.

Source: Comisión Federal de Electricidad.

2.5 Evolution of the national transmission grid

The transmission capacity growth required to satisfy expected demand at minimum costs is determined considering the following criteria:

- Security.- capacity to keep generating units operating in a synchronized manner immediately after a critical contingency in generation or transmission.
- Quality.- possibility of maintaining voltage and frequency within acceptable ranges.

- Reliability.- reduction of expected risks of energy supply impossibility due to possible defects in the system's elements.

- Economy.- reduction of the electricity system's operating costs.

Projects to become part of the transmission grid are assessed through probabilistic and deterministic models that allow for the calculation of production costs, of the electric behavior parameters of the grid in a stable and dynamic regime, as well as of reliability indexes.

Based on the current state of the electricity grid and the electricity generation expansion program, a transmission plan has been created for the 2009-2017 timeframe, aiming to integrate 18,579 km of lines into the system at voltage levels of 69 kV to 400 kV, 48,843 MVA at reduction substations and 10,406 MVAr of reactive compensation. The transmission program includes projects already defined through technical and economic feasibility studies for the next five years. For the 2014-2017 timeframe, the definition of the plan is rather uncertain, since there is a possibility of relative changes in regional demand growth as well as adjustments in the location of plants. Map 8 shows possible links between regions, including transmission reinforcements until 2012.

Map 8

SEN: Transmission capacity among regions, 2012

(MW)

Source: Comisión Federal de Electricidad.

As to SIN, several studies have determined the convenience of interconnecting the Baja California area with SIN. Said interconnection will be made through an asynchronous 300-MW capacity link in the first stage, and shall start operations in 2013.

Chart 31 summarizes the transmission capacity expansion of main internal and external links to the control areas of SEN that increase transmission capacity and supply reliability to major consumption centers, for the period between 2008 and 2012. The main transmission lines under construction (400 kV and 230 kV) add up to a total of 4,583- km circuit (see chart 32).

Chart 31

SEN: Transmission capacity expansion 2008-2012

(MW)

Link			Initial capacity 2008	Capacity increase	Total capacity 2012
Region	Region	Voltage kV	MW	MW	MW
Nacozari	Hermosillo	400[1], 230	150	450	600
Los Mochis	Culiacán	400[5], 230	500	100	600
Mazatlán	Culiacán	400[3], 230	750	350	1,100
Mazatlán	Durango	400[2], 230	300	50	350
Mazatlán	Tepic	400	750	350	1,100
Reynosa	Matamoros	400, 230, 138	1,340	290	1,630
Manzanillo	Guadalajara	400, 230	1,700	1,900	3,600
Guadalajara	Tepic	400	1,950	100	2,050
Querétaro	San Luis Potosí	230	200	200	400
Lázaro Cárdenas	Central	400, 115	1,600	600	2,200
Lázaro Cárdenas	Acapulco	400[1], 230, 115	250	400	650
Veracruz	Temascal	230	250	90	340
Temascal	Puebla	400	3,110	140	3,250
Coatzacoalcos	Temascal	400	1,050	240	1,290
Grijalva	Tabasco	400[4], 230	350	950	1,300
Nacozari	Moctezuma	4001	180	120	300
Moctezuma	Chihuahua	400[1], 230	500	50	550
Laguna	Durango	400[1], 230	300	100	400
Río Escondido	Chihuahua	400	350	80	430
Tabasco	Campeche	400[4], 230	260	940	1,200
Campeche	Mérida	400[4], 230, 115	250	600	850
Tijuana	Ensenada	230, 115, 69	220	130	350
Mexicali	S. Luis R. Colorado	230, 161	190	200	390
La Paz	Los Cabos	230, 115	130	110	240
Central	Poza Rica	400	3,500	500	4,000
Central	Puebla	400, 230	1,800	400	2,200

[1] PL isolated at 400 kV, initial operation 230 kV.
[2] PL isolated at 400 kV, initial operation 230 kV. Voltage change in 2007.
[3] PL isolated at 400 kV, initial operation 230 kV. Voltage change in 2009.
[4] PL isolated at 400 kV, initial operation 230 kV. Voltage change in 2010.
[5] PL isolated at 400 kV, initial operation 230 kV. Voltage change in 2012.
Source: Comisión Federal de Electricidad.

Chart 32

SEN: Main transmission lines scheduled for 2009-2013

Transmission line	Voltage (kV)	Number of circuits	Length (km-c)	Start of operations
Total			**4,582.9**	
Tula CT - Jorobas	400	2	26.0	Jun-09
La Trinidad - Jerónimo Ortiz	230	2	38.5	Jul-09
Ixtapa Potencia - Pie de La Cuesta Potencia	400	2	207.7	Nov-09
Lázaro Cárdenas Potencia - Ixtapa Potencia	400	2	74.8	Nov-09
Sabancuy II - Concordia	230	2	87.0	Nov-09
Tula CT - Nochistongo	230	2	44.0	Dic-09
Las Glorias Entq. - Villa de García-Aeropuerto	400	2	34.2	May-10
Eolo - La Ventosa	230	2	60.0	May-10
Cárdenas II - Comalcalco Oriente	230	2	48.0	Jun-10
Seis de Abril - PI Pto. Peñasco	230	2	109.7	Jun-10
Laguna Verde - Jamapa	400	2	165.6	Ago-10
Juile - Cerro de Oro	400	2	154.2	Sep-10
La Ventosa - Juile	400	2	271.6	Sep-10
Malpaso - Macuspana II	400	2	103.3	Sep-10
Tabasco - Escárcega	400	2	177.0	Sep-10
Tabasco Entq. – Km 20 - Santa Lucía	230	2	22.8	Sep-10
Tabasco Entq. - Villahermosa Nte-Macuspana II	230	2	26.0	Sep-10
Tapeixtles Pot. - Tecoman	230	2	46.6	Sep-10
Tula CT - Teotihuacan	230	2	66.0	Sep-10
Edzna Entq. - Escarcega - Ticul	230	2	60.0	Mar-11
Tesistán - Zapopan	230	2	47.2	Mar-11
Cerro Prieto II - Parque Ind. San Luís	230	2	54.0	Abr-11
Regiomontano Entq. - Huinalá-Lajas	400	2	26.8	May-11
Choacahui - PI Guamuchil Dos	400	2	117.0	Jun-11
El Edén Entq. - Villahermosa Nte. - Tabasco	230	2	13.0	Jun-11
Las Américas - PI El Fresnal	400	2	16.8	Oct-11
Nacozari - Hermosillo 5	400	2	201.0	Oct-11
El Fresnal - Cananea	230	2	150.8	Oct-11
Encino II Entq. - Fco. Villa - Chihuahua Nte.	230	2	16.0	Oct-11
Encino II Entq. - Francisco Villa - Ávalos (L1)	230	2	16.0	Oct-11
Las Américas - El Fresnal	230	2	17.4	Oct-11
Siderúrgica - Guadalajara II	230	2	12.0	Dic-11
Nuevo Vallarta Entq. - Tepic II - Vallarta Potencia	230	2	20.0	Abr-12
Angostura - Tapachula Aeropuerto	400	2	193.5	May-12
Jamapa - Dos Bocas	230	2	20.0	May-12
Mezcalapa Switcheo - Cárdenas II	230	1	45.0	May-12
C. D. Los Cabos Entq. - Olas Altas - El Palmar	230	2	40.0	Jun-12
La Jovita Entq. - Presidente Juárez - Ciprés	230	2	22.0	Oct-12
La Jovita Entq. - Presidente Juárez - Lomas	230	2	22.0	Oct-12
San Luís de La Paz II - Las Delicias	230	2	10.0	Feb-13
Victoria - Valle de México	400	2	50.0	Mar-13
Cucapáh - Cerro Prieto III	230	3	20.0	Abr-13
Cucapáh - Pinacate	230	2	390.0	Abr-13
Seis de Abril - Pinacate	230	2	390.0	Abr-13
Campo 28.5 - Cuauhtemoc II	230	1	19.0	May-13
Encino II - Campo 28.5	230	1	125.0	May-13
La Ciénega - Oaxaca Potencia	230	1	26.5	May-13
Temascal II - Oaxaca Potencia	230	2	132.9	May-13
Mexicali II - Tecnológico	230	2	11.0	Jun-13
Santa Ana - Nogales - Aeropuerto	230	2	100.0	Jun-13
Piedras Negras Pot. - Acuña II	230	2	172.0	Jul-13
Tecali - Yautepec Potencia	400	2	118.0	Dic-13
Huatulco Potencia - Pochutla	230	1	69.0	Dic-13
Juchitán II - Salina Cruz I	230	2	76.0	Dic-13

Source: Comisión Federal de Electricidad.

Chart 33

SEN: Transmission capacity of links between regions in peak demand conditions, 2008-2012, (MW)

Link			2008	2009	2010	2011	2012
Region	Region	Voltage			Capacity		
		kV			MW		
Nacozari	Hermosillo	400[1], 230	150	150	300	600	600
Hermosillo	Obregón	230	400	400	400	400	400
Obregón	Los Mochis	400[1], 230	400	400	400	400	400
Los Mochis	Culiacán	400[5], 230	500	500	500	500	600
Mazatlán	Culiacán	400[3], 230	750	900	900	900	1,100
Mazatlán	Durango	400[2], 230	300	300	350	350	350
Mazatlán	Tepic	400	750	850	850	850	1,100
Río Escondido	Nuevo Laredo	400, 230	380	380	380	380	380
Reynosa	Nuevo Laredo	138	80	80	80	80	80
Matamoros	Reynosa	400, 230, 138	1,340	1,340	1,680	1,680	1,630
Río Escondido	Monterrey	400, 230	2,400	2,400	2,400	2,400	2,400
Reynosa	Monterrey	400, 230	1,350	1,350	1,350	1,350	1,350
Monterrey	Huasteca	400	1,100	1,100	1,100	1,100	1,100
Saltillo	Aguascalientes	400	1,150	1,150	1,150	1,150	1,150
Huasteca	Poza Rica	400, 230	1,000	1,000	1,000	1,000	1,000
Valles	San Luis Potosí	400	1,100	1,100	1,100	1,100	1,100
Tamazunchale	Querétaro	400	1,450	1,450	1,450	1,450	1,450
Huasteca	Valles	400	1,100	1,100	1,100	1,100	1,100
Huasteca	Tamazunchale	400	1,200	1,200	1,200	1,200	1,200
Monterrey	Saltillo	400, 230	1,300	1,300	1,300	1,300	1,300
Tepic	Guadalajara	400	1,950	1,950	1,950	1,950	1,950
Manzanillo	Guadalajara	400, 230	1,700	1,700	1,700	2,650	3,600
Guadalajara	Aguascalientes	400	950	950	950	950	950
Guadalajara	Salamanca	400	550	550	550	550	550
Guadalajara	Carapan	400, 230	700	700	700	700	700
Guadalajara	Lázaro Cárdenas	400	480	480	480	480	480
Lázaro Cárdenas	Carapan	400	450	450	450	450	450
Carapan	Salamanca	400, 230	750	750	750	750	750
Aguascalientes	Salamanca	400, 230	1,600	1,600	1,600	1,600	1,600
San Luis Potosí	Aguascalientes	400 ,230	900	900	900	900	900
Querétaro	San Luis Potosí	230	200	200	200	400	400
Salamanca	Querétaro	400, 230	1,300	1,300	1,300	1,300	1,300
Querétaro	Central	400, 230	1,350	1,350	1,350	1,350	1,350
Lázaro Cárdenas	Central	400, 115	1,600	2,200	2,200	2,200	2,200
Lázaro Cárdenas	Acapulco	400[1], 230, 115	250	650	650	650	650
Tijuana	Mexicali	230	520	520	520	520	520
Tijuana	Ensenada	230, 115, 69	200	200	220	350	350
CFE - ACBC	EUA - WECC	230	800	800	800	800	800
Mexicali	San Luis Río Colorado	230, 161	190	190	190	390	390
Villa Constitución	La Paz	115	90	90	90	90	90
La Paz	Los Cabos	230, 115	130	240	240	240	240
Acapulco	Puebla	230	270	270	270	270	270
Poza Rica	Central	400	3,500	3,500	3,500	4,000	4,000
Puebla	Central	400, 230	1,800	2,200	2,200	2,200	2,200
Veracruz	Puebla	400	1,500	1,500	1,500	1,500	1,500
Veracruz	Temascal	230	250	250	340	340	340
Veracruz	Poza Rica	400	600	600	600	600	600
Poza Rica	Puebla	230	310	310	310	310	310
Temascal	Puebla	400	3,110	3,110	3,250	3,250	3,250
Coatzacoalcos	Temascal	400	1,050	1,050	1,290	1,290	1,290
Grijalva	Tabasco	400[4], 230	350	350	1,300	1,300	1,300
Nacozari	Moctezuma	400 [1]	180	180	250	300	300
Juárez	Moctezuma	230	600	600	600	600	600
Moctezuma	Chihuahua	400[1], 230	500	500	500	550	550
Chihuahua	Laguna	230	250	250	250	250	250
Laguna	Durango	400[1], 230	300	300	400	400	400
Durango	Aguascalientes	230	200	200	200	200	200
Laguna	Saltillo	400, 230	300	300	300	300	300
Río Escondido	Chihuahua	400	350	350	350	430	430
Tabasco	Campeche	400[4], 230	260	260	780	780	1,200
Campeche	Mérida	400[4], 230, 115	250	250	580	580	850
Mérida	Cancún	400[5], 230, 115	700	700	700	700	700
Mérida	Chetumal	230, 115	150	150	150	150	150

[1] PL isolated at 400 kV, initial operation 230 kV.
[2] PL isolated at 400 kV, initial operation 230 kV. Voltage change in 2007.
[3] PL isolated at 400 kV, initial operation 230 kV. Voltage change in 2009.
[4] PL isolated at 400 kV, initial operation 230 kV. Voltage change in 2010.
[5] PL isolated at 400 kV, initial operation 230 kV. Voltage change in 2012.
Source: Comisión Federal de Electricidad.

Chart 33 shows the evolution of transmission capacity between links in peak demand conditions. The maximum usage of links is due mainly to maintenance operations at power generation units, the forced withdrawal of generator and/or transmission elements, as well as peak demand conditions in the system.

Chart 34

SEN: Main transformation equipment scheduled for 2009-2013

Substation	Quantity	Equipment	Capacity (MVA)	Transformation ratio	Start of operations
La Higuera Banco 2	4	AT	500	400/230	Abr-09
Xochimilco Banco 2	1	T	50	230/161	Jul-09
Bacum Banco 1	4	AT	300	230/115	Ago-09
Lázaro Cárdenas Potencia Banco 4	3	AT	375	400/230	Nov-09
Cerro de Oro Banco 1	4	T	500	400/115	Mar-10
Centenario Banco 1	1	T	40	230/13.8	Mar-10
Cañada Banco 3	4	T	500	400/115	Abr-10
Mazatlán II Banco 8	4	T	500	400/115	Abr-10
Las Glorias Banco 1 SF6	4	T	500	400/115	May-10
Guadalajara Industrial Banco. 1	4	T	300	230/69	Jun-10
Chapultepec Banco 2	1	T	50	230/34.5	Jun-10
Guadalajara Industrial	1	T	60	230/23	Jun-10
Papantla Banco 1	4	T	500	400/115	Jul-10
Jamapa Bancos 1 y 2	7	AT	875	400/230	Ago-10
Jardín Banco 1 (SF6)	4	AT	300	230/115	Ago-10
La Ventosa Bancos 1, 2 y 3	10	AT	1250	400/230	Sep-10
Tabasco Bancos 1 y 2	7	AT	875	400/230	Sep-10
Ticul II Bancos 2 y 3	7	AT	875	400/230	Sep-10
La Ventosa Bancos 4 y 5	7	T	875	400/115	Sep-10
Tapeixtles Potencia Banco 3	1	T	125	400/115	Sep-10
Edzna Banco 1	4	AT	300	230/115	Mar-11
Amatlán II Banco 3	3	AT	100	230/115	Mar-11
Valle de Puebla Banco 1	1	T	40	230/13.8	Abr-11
Tesistán Banco 5	4	T	500	400/69	May-11
Guerreño Banco 1	4	T	500	400/138	May-11
Derramadero Banco 1	4	T	500	400/115	May-11
Regiomontano Banco 1	4	T	500	400/115	May-11
La Malinche Banco 1	4	AT	300	230/115	May-11
Choacahui Banco 1	4	AT	500	400/230	Jun-11
El Edén Banco 1	4	AT	300	230/115	Jun-11
El Mayo Banco 1	4	AT	300	230/115	Jun-11
Hermosillo Cuatro Banco 4	3	AT	225	230/115	Jun-11
Guaymas Cereso Banco 1	4	AT	133	230/115	Jul-11
Jerónimo Ortiz Banco 3 Ampliación	1	AT	100	400/230	Dic-11
Metrópoli Banco 2	4	AT	300	230/115	Ene-12
Vicente Guerrero II Banco 1	4	AT	133	230/115	Ene-12
Riviera Maya Banco 1	4	AT	500	400/230	Abr-12
Valladolid Banco 2	4	AT	500	400/230	Abr-12
Riviera Maya Banco 2	4	T	500	400/115	Abr-12
Nuevo Vallarta Banco 1	4	AT	300	230/115	Abr-12
Tepic II Banco 1 Sustitución	4	T	500	400/115	May-12
Anáhuac Potencia Banco 2	3	T	225	400/115	May-12
Dos Bocas Banco 7 (SF6)	4	AT	300	230/115	May-12
Comalcalco Pot. Banco 1	4	AT	300	230/115	May-12
Queretaro I Banco 1 Sustitución	4	AT	300	230/115	Jun-12
C. D. Los Cabos Banco 1	4	AT	133	230/115	Jun-12
P.H. Zimapan Banco 2	3	AT	100	230/115	Jun-12
Niños Héroes Banco 3 (SF6)	1	T	100	230/69	Jul-12
Pantepec Banco 2	3	AT	100	230/115	Dic-12
San Luís de La Paz II Banco 2	4	AT	300	230/115	Feb-13
Apatzingan Banco 3	4	AT	133	230/115	Feb-13
Peñasco Potencia Banco 1	4	AT	300	230/115	Abr-13
Cucapáh	3	T	300	230/115	Abr-13
Campo 28.5 Banco 1	4	AT	300	230/115	May-13
Valle de Juárez Banco 4	4	AT	400	230/115	Jun-13
Chihuahua Norte Banco 5	4	AT	400	230/115	Jun-13
Monclova Banco 4	3	AT	100	230/115	Jun-13
Nava Sust. Bancos 1 y 2	4	AT	133	230/138	Jul-13
Ticul Banco 2	3	AT	100.0	230/115	Jul-13
Guadalajara Industrial Banco 3	1	T	60.0	230/23	Sep-13
Huatulco Potencia Banco 1	4	AT	300.0	230/115	Dic-13
Tagolaba Potencia Banco 1	4	AT	300.0	230/115	Dic-13

Source: Comisión Federal de Electricidad.

Chart 35

SEN: Main reactive compensation equipment scheduled for 2009-2013

Substation	Equipment	Voltage (kV)	Capacity (MVAr)	Start of operations
La Higuera MVAr	Reactor	400	175.00	Abr-09
Pie de la Cuesta Potencia MVAr	Reactor	230	21.00	Nov-09
Lázaro Cárdenas Potencia-Donato	Series Compensation	400	505.60	Nov-09
Pitirera-Donato Guerra L1	Series Compensation	400	231.90	Nov-09
Pitirera-Donato Guerra L2	Series Compensation	400	231.90	Nov-09
CEV El Palmar MVAr	Static Var Compensator*	230	50.00/150.00	Mar-10
Escarcega MVAr	Reactor	400	233.31	Sep-10
Ticul II MVAr	Reactor	400	175.00	Sep-10
Juile MVAr	Reactor	400	75.00	Sep-10
Escárcega MVAr	Static Var Compensator*	400	300.00/300.00	Sep-10
La Ventosa CEV	Static Var Compensator*	400	300.00/300.00	Sep-10
CEV Tecnológico MVAr	Static Var Compensator*	230	0.00/200.00	Ene-11
Derramadero MVAr	Reactor	400	75.00	May-11
Choacahui MVAr	Reactor	400	175.00	Jun-11
Hermosillo 5 MVAr	Reactor	230	28.00	Oct-11
Valladolid MVAr	Reactor	400	175.00	Abr-12
Valladolid MVAr	Reactor	400	116.62	Abr-12
Tapachula Potencia MVAr	Reactor	400	100.00	May-12
Pinacate MVAr	Reactor	230	98.00	Abr-13
Huatulco Potencia MVAr	Reactor	230	18.00	Dic-13
45 MVAr Compensation	Capacitor	115	315.00	2009-2013
30 MVAr Compensation	Capacitor	115	660.00	2009-2013
22.5 MVAr Compensation	Capacitor	115	247.50	2009-2013
15 MVAr Compensation	Capacitor	115	585.00	2009-2013
7.5 MVAr Compensation	Capacitor	115	180.00	2009-2013

* Inductive/capacitive.
Source: Comisión Federal de Electricidad.

2.6 Investment requirements of the electricity sector

For the 2009-2017 timeframe, resources required to comply with the national electricity system's expansion program amount to 629,106 million pesos of 2008 (see chart 36). This amount includes investments made in generation, transmission, distribution, maintenance and other areas. It also includes investments to be made under the schemes of financed public works, independent power production and budget investments made by CFE and LFC.

Total investment is composed by 41.2% for power generation, 21.2% for transmission, 23.9% for distribution, 11.8% for maintenance and 1.9% for other types of investments.

From the required total, 33.9% corresponds to Financed Public Work; 8.8% to Independent Power Production; 51.5% to budget works and the remaining 5.9% to financial schemes yet to be defined.

The requirements presented herein correspond to instant investments, excluding financial costs and including an amount for contingencies.

Chart 36

National Electricity System

Investment requirements for 2009-2017 (million pesos of 2008)[1]

(Budget investment, financed public work and independent production)

Concept	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Total	**71,117**	**79,932**	**74,082**	**63,172**	**63,062**	**70,799**	**71,858**	**67,829**	**67,256**	**629,106**
Power generation	**21,210**	**30,115**	**33,337**	**22,966**	**22,455**	**34,930**	**35,735**	**30,584**	**28,104**	**259,436**
Combined cycles (IPP)	1,186	989	4,077	3,531	7,744	12,692	7,881	5,173	508	43,781
Wind power plants (IPP)	1,936	5,579	4,011	-	-	-	-	-	-	11,526
Private investment (FPW)	14,479	19,228	17,913	13,103	6,651	13,233	14,033	17,775	10,001	126,416
Hydroelectric	2,162	2,009	3,050	3,517	3,651	3,446	2,436	1,730	950	22,951
Geothermal-electric and Wind	1,284	2,223	701	-	71	1,000	357	71	1,000	6,707
Combined cycles	3,818	6,938	9,501	6,867	1,777	5,113	3,449	6,721	1,676	45,860
Coal-electric	1,916	884	-	-	218	2,946	7,683	9,253	6,375	29,275
Diesel units	222	1,067	1,046	746	934	728	108	-	-	4,851
Rehab and modernization	5,077	6,107	3,615	1,973	-	-	-	-	-	16,772
*Budget investment**	3,609	4,319	7,336	5,689	5,486	5,077	3,112	3,057	3,148	40,833
Works with scheme yet to be defined	0	0	0	643	2,574	3,928	10,709	4,579	14,447	36,880
Transmission	**14,362**	**17,803**	**14,229**	**14,977**	**14,516**	**12,756**	**14,347**	**14,735**	**15,428**	**133,153**
Private investment (FPW)	8,472	9,712	5,523	5,762	5,890	4,845	5,893	5,656	5,901	57,654
Budget investment*	5,890	8,091	8,706	9,215	8,626	7,911	8,454	9,079	9,527	75,499
Distribution	**25,843**	**22,454**	**16,942**	**16,301**	**17,014**	**13,618**	**12,297**	**12,798**	**13,284**	**150,552**
Private investment (FPW)	7,681	2,844	1,639	1,846	3,259	3,702	2,552	2,762	2,874	29,159
Budget investment*	18,162	19,610	15,303	14,455	13,755	9,916	9,745	10,036	10,410	121,393
Maintenance	**7,816**	**8,163**	**8,158**	**7,837**	**7,926**	**8,294**	**8,224**	**8,398**	**9,111**	**73,926**
Power generation units (IPP)	1,397	1,446	1,518	1,518	1,612	1,612	1,664	1,778	1,934	14,479
Power generation units (CFE and LFC)	6,419	6,717	6,640	6,319	6,314	6,682	6,560	6,620	7,006	59,276
Works with scheme yet to be defined	-	-	-	-	-	-	-	-	171	171
Other budget investments*	**1,886**	**1,397**	**1,416**	**1,091**	**1,151**	**1,201**	**1,255**	**1,313**	**1,328**	**12,039**

* Includes CFE and LFC.

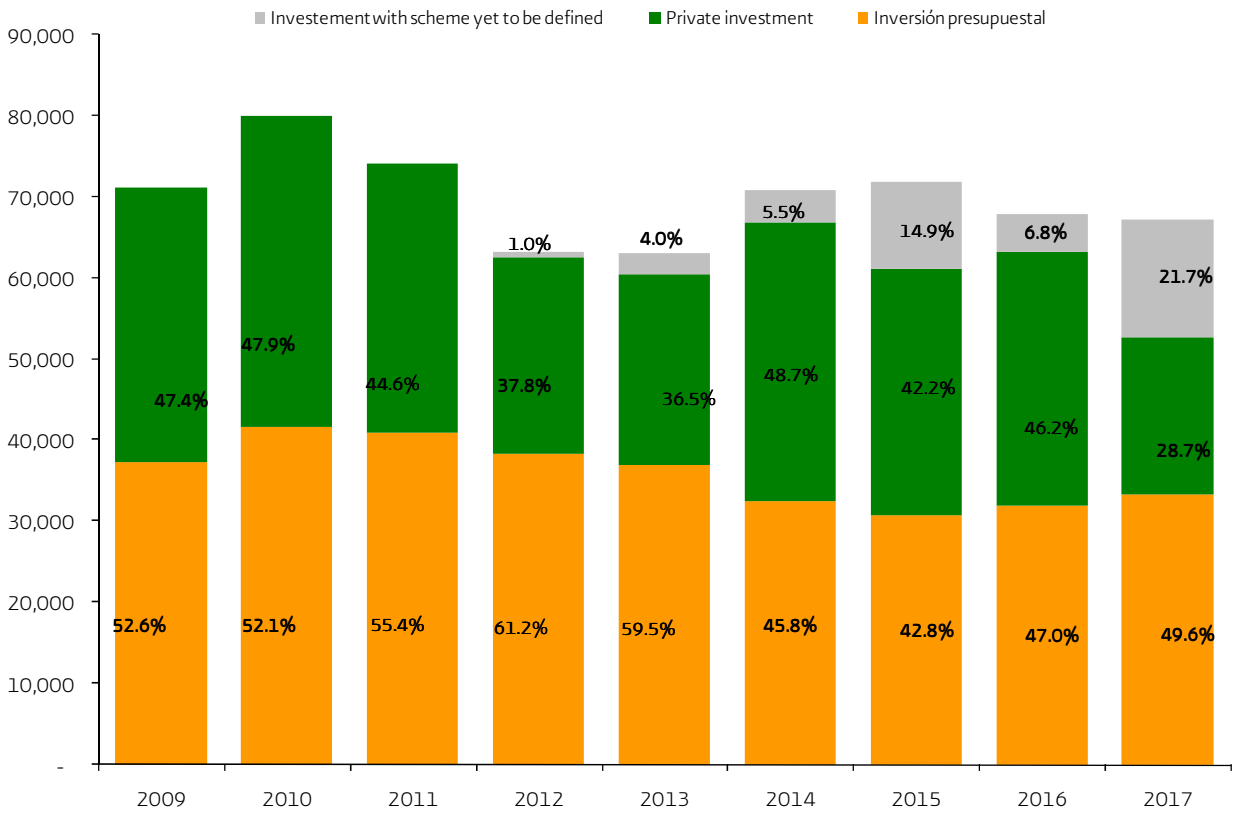
[1] Instant costs of works (excluding financial costs) at constant prices and with contingencies, with data available by November 28, 2008.

Source: Comisión Federal de Electricidad and Luz y Fuerza del Centro.

Graph 22

Investment requirements in the national electricity sector, 2009-2017

(million pesos of 2008)[1]



[1] Instant costs of works (excluding financial costs) at constant prices and with contingencies, with data available by November 28, 2008.
Source: Comisión Federal de Electricidad and Luz y Fuerza del Centro.

2.7 Technical options for the expansion of the electric power generation system

The following is a project portfolio with feasibility studies and cost estimates, considering:

a) Typical projects for commercially available capacities and electric power generation technologies, and

b) Specific projects that require special design to exploit primary resources.

The main physical and economic characteristics of typical projects considered in the analysis of SEN's expansion plan are shown in chart 37.

Chart 37

Characteristics and technical data of typical projects

Plant	Power (MW)	Gross efficiency (%)	Service life (years)	Typical plant factor	Own usage (%)
Conventional thermal	2 x 350	37.58	30	0.75	5.8
	2 x 160	36.39	30	0.65	6.2
	2 x 84	32.45	30	0.65	6.4
	2 x 37.5	30.69	30	0.65	8.3
Gas turbine[1]					
Aero-derivative gas	1 x 42.1	37.11	30	0.125	1.1
Aero-derivative gas	1 x 102.7	39.42	30	0.125	1.5
Industrial gas	1 x 84.3	29.34	30	0.125	1.0
Industrial gas F	1 x 189.6	33.68	30	0.125	0.8
Industrial gas G	1 x 266.6	35.19	30	0.125	0.8
Aero-derivative diesel	1 x 39.8	36.40	30	0.125	0.8
Combined-cycle gas[1]					
1x1 F	1 x 289.7	51.40	30	0.8	2.9
2x1 F	1 x 582.3	51.65	30	0.8	2.8
3x1 F	1 x 874.0	51.76	30	0.8	2.7
1x1 G	1 x 406.5	52.96	30	0.8	2.8
2x1 G	1 x 815.3	53.11	30	0.8	2.7
Internal combustion[2]	1 x 42.2	45.07	25	0.65	3.9
	2 x 18.4	44.18	20	0.65	7.3
	3 x 3.6	37.82	20	0.65	9.1
Coal-electric	2 x 350	37.87	30	0.8	7.2
Supercritical C. without desulfurizer	1 x 700	43.08	30	0.8	6.4
Supercritical C. with desulfurizer	1 x 700	43.08	30	0.8	10.6
Nuclear (ABWR)	1 x 1,356	34.54	40	0.85	4.1

[1] Power and efficiency are determined under ISO conditions: environmental temperature of 15° C, relative humidity of 60% and atmospheric pressure at sea level.
[2] Power and efficiency are determined under ISO 3046/1-1986 conditions: environmental temperature of 25° C, relative humidity of 30% and barometric pressure of 1.0 bar.
Source: Comisión Federal de Electricidad.

Thermoelectric projects currently in the evaluation phase have also been included (see chart 38). These projects represent an additional capacity of 8,839 MW.

Several studies for the selection of sites and assessment of possible environmental impacts are required to make construction feasible. A technical assessment of main inputs (estate availability, interconnection to SEN, water supply, fuel, access infrastructure) is performed to define the location of plants; then comes the economic-financial assessment (investment and operation costs); social assessment; as well as the legal aspects and environmental legislation applicable to each candidate site, always looking for the option considered to be best for the country.

Chart 38

Thermoelectric projects with finished or ongoing site studies

Area	Project	Number of units	Total feasible capacity (MW)	Current status	Remarks
Total SEN			**8,839**		
Baja California	CC Baja California (Presidente Juárez)	1x277	277	Site defined	Sitio CT Presidente Juárez
	Presidente Juárez conversión TG/CC	1x93	93	Site defined	Sitio CT Presidente Juárez
	CC Baja California III (Ensenada)	1x280	280	Ongoing studies	Sitio La Jovita
Baja California Sur	CI Baja California Sur III (Coromuel)	1x43	43	Site defined	Sitio San Francisco
	CI Baja California Sur IV (Coromuel)	1x43	43	Site defined	Sitio San Francisco
	CI Guerrero Negro III	3x3.6	11	Site defined	Sitio Vizcaíno
Northeastern region	CC Noreste (Escobedo)	1x517	517	Ongoing studies	Escobedo, Nuevo León
Northwestern region	CC Agua Prieta II (híbrido)[1]	1x477	477	Site defined	Sitio Las Américas
Northern region	CC Norte II (Chihuahua)	1 X 459	459	Site defined	Sitio El Encino
	CC Norte III (Juárez)	1 X 690	690	Ongoing studies	
Western region	Carboeléctrica del Pacífico	1 X 678	678	Site defined	CT Plutarco Elías Calles
	Manzanillo I repotenciación U1		760	Site defined	CT Manuel Álvarez
	Manzanillo I repotenciación U2		760	Site defined	CT Manuel Álvarez
	Manzanillo II repotenciación U1		760	Site defined	CT Manzanillo II
	Manzanillo II repotenciación U2		760	Site defined	CT Manzanillo II
	Guadalajara I	1 X 453	453	Ongoing studies	Área Parques Industriales
	Occidental	1 X 453	453	Ongoing studies	
Central region	Valle de México II	1 X 601	601	Site defined	CT Valle de México
	Valle de México III	1 X 601	601	Site defined	CT Valle de México
Eastern region	San Lorenzo conversión TG/CC	1 X 123	123	Site defined	TG San Lorenzo, Puebla

[1] Includes 10 MW of solar field.
Source: Comisión Federal de Electricidad.

On the other hand, among the hydroelectric projects in the evaluation stage, La Parota (906 MW) is currently in the design stage and the Ixtayutla (900 MW) and Paso de la Reina (510 MW) projects in Oaxaca are in the feasibility assessment stage (see chart 39).

Chart 39

Hydroelectric projects with pre-feasibility, feasibility and design studies, or ongoing studies

Area	Project	Location	Number of units x power per unit[1]	Total capacity[1] (MW)	Average annual generation (GWh)	Study level[7]
Total				**7,624**	**18,888**	
Eastern	San Juan Tetelcingo	Guerrero	3 x 203	609	1,313	F
Eastern	Xúchiles	Veracruz	2 x 39	78	499	P
Eastern	Sistema Cosautlán	Veracruz	3 x 12	36	151	GV
Eastern	Sistema Pescados	Veracruz	3 x 66	198	940	GV
Eastern	Tenosique (Kaplan)	Tabasco/Chiapas	3 x 140	420	2,328	F
Western	San Cristóbal	Jalisco	2 x 37	74	146	P
Western	Arroyo Hondo	Jalisco	2 x 38	76	220	F
Noreste	PAEB Monterrey	Nuevo León	2 x 100	200	292	F
Eastern	Omitlán	Guerrero	2 x 115	230	789	F
Baja California	PAEB El Descanso	Baja California	2 x 300	600	1,252	P
Northern	Madera	Chihuahua	2 x 138	276	726	F
Western	Las Cruces (Pozolillo)	Nayarit	2 x 240	480	801	F
Eastern	Ixtayutla	Oaxaca	3 x 300	900	1,841	F
Eastern	Paso de la Reina	Oaxaca	2 x 255	510	1,524	F
Eastern	La Parota[2]	Guerrero	3 x 300; 2 x 3	906	1,528	D
Eastern	Copainalá (Kaplan)[3]	Chiapas	3 x 77	232	502	F
Western	Mascota Corrinchis	Jalisco	2 x 17	34	51	P
Western	Mascota El Carrizo	Jalisco	2 x 85	170	445	P
Western	PAEB Agua Prieta	Jalisco	2 x 120	240	310	P
Baja California	PAEB Tecate	Baja California	2 x 300	600	1,252	P
Western	Amuchiltite	Jalisco	2 x 39	78	173	P
Northwestern	Guatenipa	Sinaloa	2 x 87	174	380	P
Northern	Urique	Chihuahua	2 x 95	190	419	P
Northern	Sirupa	Chihuahua	2 x 20	40	85	GV
Western	Puerto Vallarta	Jalisco	2 x 23	46	102	P
Eastern	Rehabilitación Bombaná[6]	Chiapas	-	-	66	
Eastern	Acala[4]	Chiapas	3 x 45	135	310	P
Western	Sistema Río Moctezuma[5]	Hidalgo y Querétaro	2 x 40; 1 x 12	92	444	F

[1] Power at generator outlet.
[2] Power and generation include the mini-plant of the Los Ilamos regulator dam.
[3] Considering the current condition of C. H. Ing. Manuel Moreno Torres (Chicoasén) plant with 2,400 MW installed.
[4] Considering bulb turbine equipment.
[5] Including the Jiliapan and Tecalco projects.
[6] Contributes flow to the Chicoasén dam.
[7] D: design F: feasibility P: pre-feasibility GV: great vision.
Source: Comisión Federal de Electricidad.

Chart 40

Installed capacity increase in hydroelectric projects

Area	Project	Location	Number of units x power per unit[1]	Total capacity[1] (MW)	Average annual generation (GWh)	Study level[4]
Total				**778**	**871**	
Central	Villita Ampliación[2]	Michoacán	2 x 75	150	56	D
Western	Ampliación Santa Rosa	Jalisco	1 x 49	49	41	F
Northwestern	Ampliación Mocúzari	Sonora	1 x 7	7	42	F
Northwestern	Ampliación Oviáchic	Sonora	1 x 6	6	26	F
Central	Ampliación Zimapán[3]	Hidalgo	2 x 283	566	706	D

[1] Power and generation correspond to the capacity increase.
[2] Average annual generation does not consider plant re-powering.
[3] Generation corresponds to peak hours; the CH Ing. Fernando Hiriart Balderrama plant (Zimapán dam) reduces its plant factor from 0.53 to 0.14.
[4] D: design F: feasibility.
Source: CFE.

As to geothermal projects, Cerro Prieto V (107 MW) is in the bidding process. The most feasible wind power projects, La Venta III and Oaxaca I, are currently in the bidding process, while the Oaxaca II-IV projects already have feasibility studies (see chart 41).

Chart 41

Geothermal-electric and wind power project catalogue

Area	Project	Number of units	Power per unit (MW)	Number of units x power per unit (MW)	Federative entity	Average annual generation (GWh)	Study level[1]
Total				**895**		**4,616**	
Geothermal-electric				**388**		**2,763**	
Baja California	Cerro Prieto V	2	53.5	107	Baja California	745	L
Western	Cerritos Colorados 1a etapa	1	26.62	27	Jalisco	186	P
Western	Cerritos Colorados 2a etapa	2	26.62	53	Jalisco	372	P
Eastern	Los Humeros Fase A	1	28	28	Puebla	186	L
Eastern	Los Humeros Fase B	7	3.3	23	Puebla	156	L
Western	Los Azufres III	2	1 X 50 y 1 X 25	75	Michoacán	559	F
Western	Los Azufres IV	2	1 X 50 y 1 X 25	75	Michoacán	558.5	F
Wind power				**507**		**1,853**	
Eastern	La Venta III	78	1.3	101	Oaxaca	361	L
Eastern	Oaxaca I	78	1.3	101	Oaxaca	373	L
Eastern	Oaxaca II	78	1.3	101	Oaxaca	373	F
Eastern	Oaxaca III	78	1.3	101	Oaxaca	373	F
Eastern	Oaxaca IV	78	1.3	101	Oaxaca	373	F

[1] F: feasibility; P: pre-feasibility; L: In the bidding process.
Source: Comisión Federal de Electricidad.