Electricity Sector Outlook
2007-2016

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Electricity Sector Outlook, 2007-2016

This chapter presents electricity consumption and demand estimations from a national, sector and regional approach. It provides the electricity capacity and generation requirements needed to properly face the demand increase estimated for 2007-2016. As explained later on in this chapter, to analyze the expansion of the National Electric System (Sistema Eléctrico Nacional - NES) it is necessary to consider the degree of participation of state-owned companies and of the private sector undertaking self-generation activities.

4.1 Macroeconomic scenarios and basic assumptions

The trend of electricity consumption and demand for the next ten years is estimated upon macroeconomic assumptions and considering the recent evolution of the electricity sector. In addition to estimations based on econometric models, regional studies carried out by CFE are also used, focusing on four main aspects:

1. Analysis of trends and of the behavior of sectors at regional scale.

2. Specific loads of regional and national importance.

3. Annual update of formal service requests and specific regional market research.

4. Electricity capacity and generation estimations of self-supply and cogeneration projects with the greatest probability of implementation.

The analysis of these and other aspects of the electricity market is extremely relevant to create the estimates for the future trend of electricity demand and consumption between 2007 and 2016. This is to obtain elements that will facilitate comprehensive planning for generation, transmission, transformation and distribution capacity expansions for the period analyzed. The following sections detail the assumptions used to estimate the consumption and demand of electricity.

a) Macroeconomic scenarios

Three macroeconomic scenarios are defined for every planning exercise, considering the performance levels of economic activity during the projected period. The variable that encompasses the components of aggregate demand is the Gross Domestic Product (GDP), for which three analytic scenarios are considered: low, high and planning. The latter is used to estimate levels and trends of domestic electricity consumption by sector and region for the period. It is worth mentioning that economic growth estimated for the planning exercise has been subjected to certain adjustments according to the recent evolution of economy, and is thus slightly lower than that of the previous outlook (see chart 1).

b) Electric energy prices

The price of electricity depends on the above-mentioned macroeconomic scenarios as well as on the tariff policies for the coming years. These prices also depend on their components, such as fuel prices and inflation. Moreover, they are related to the scenarios foreseen for the economic activity.

c) Fuel prices

The future trend of fossil fuel prices (constituting the most important part of generation costs) is different on every scenario, both in dollars and in pesos, due to the diverse estimations of inflation and exchange rate indexes.

In the case of natural gas, this Outlook envisages that fuel prices will decrease by –0.7% and –3.0% for the planning and the low scenarios, respectively, while prices in the high scenario will increase by 1.6% during the projected period.

d) Population and housing

Regarding population growth for the next ten years estimated by the National Population Council (CONAPO), projections show an annual average growth rate of 0.9%, and for housing, of 2.8%.

Chart 1

GDP growth comparison, Outlooks 2006-2015 and 2007-2016

Scenarios	2006-2015	2007-2016
Low	2.6	2.4
Planning	3.8	3.6
High	4.3	4.1

Source: Comisión Federal de Electricidad

e) Self-supply and cogeneration projections

Self-supply projections have been determined according to the work of the Self-Supply and Cogeneration Work Group coordinated by the Ministry of Energy (Sener). This Group analyzed self-generation projects with the highest probability of implementation, both by public companies and by the private sector. The Nuevo Pemex, GDC Generadora and the open season wind energy projects in the Tehuantepec Isthmus stand-out due to their installed capacity and strategic relevance.

f) Other assumptions

The deployment of new technologies for the more efficient use of electricity is added to the above elements, as seen in the residential, commercial and industrial environments with the introduction and diffusion of energy-saving equipment and devices. Savings obtained through the application of energy efficiency norms have also been taken into account, as have energy saving programs, like the daylight savings.

4.2 Forecast of domestic electric energy consumption for 2007-2016

Consistent with the recently adjusted economic activity rates considered in the planning of NES, domestic electricity consumption for the period between 2007 and 2016 is expected to grow at an annual rate of 4.8%. The expected increase in consumption is 121 TWh, rising from 197.4 TWh in 2006 to 318.4 TWh in 2016.

This growth will mainly be driven by public utility sales, expected to increase at an annual average rate of 5.1% (see graph 1). Within this item, sales are differentiated by user types, among which the industrial sector is of

utmost relevance due to its majority share in total sales, which in 2006 increased to 58.8%, and are expected to reach 59.8% in 2016.

Regarding self-supplied consumption, ever since two large self-supplying partnerships started operations in the country's Central-Western region in 2004, no new high-capacity projects involving private capital have been considered; however, this 2007-2016 Outlook does take into account the start of operations of the GDC Generadora project with 480 MW and the open season wind energy projects.

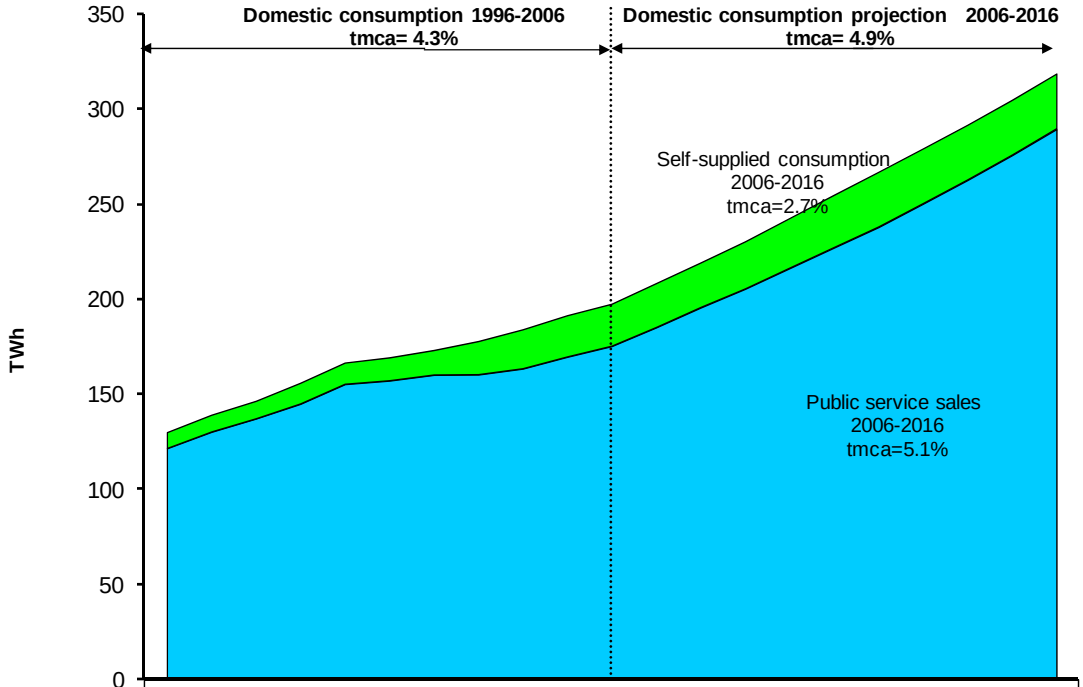
Though expected growth in electric energy sales has been rather low in recent years, internal sales will show an increasing trend resulting from important factors, such as economic growth rate and population growth.

More specifically, the residential, commercial and services sectors - integrating what is known as normal development - will jointly grow by 5.2% per year (see chart 2).

Sales to the agriculture/livestock sector will show an annual mean growth rate of 1.8%, representing the slowest dynamism among all sectors. As already mentioned, the industrial sector concentrates the highest share of domestic sales. Sales levels in the industrial sector are expected to increase at an annual average rate of 5.3% (see chart 3). This variation is due mainly to the dynamics expected from large businesses in the industry, projected to grow by 6.7% between 2006 and 2016, while medium-sized businesses will increase by 4.5%.

Graph 1

Electricity consumption
(planning scenario)



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Self-supplied consumption	8.3	8.8	9.1	10.9	11.1	12.0	12.9	17.4	20.4	21.6	22.0	23.0	23.4	24.7	26.1	27.4	28.7	28.7	28.7	28.7	28.7
Public service sales	121.	130.	137.	145.	155.	157.	160.	160.	163.	169.	175.	185.	195.	205.	216.	227.	238.	250.	262.	275.	289.
Domestic consumption	129.	139.	146.	155.	166.	169.	173.	177.	183.	191.	197.	208.	219.	230.	242.	254.	266.	279.	291.	304.	318.

Source: Comisión Federal de Electricidad

Chart 2

Average growth of electricity consumption

Planning scenario

(aagr)

	Outlook 2007-2016	
	1996-2006 %	2006-2016 %
Domestic consumption	**4.3**	**4.9**
Self-supplied consumption	10.3	2.7
Sales	3.7	5.1
Normal development	4.1	5.2
Residential	4.5	5.2
Commercial	3.5	6.3
Services	2.7	3.0
Agriculture	0.6	1.8
Industrial	3.8	5.3
Medium-size business	5.2	4.5
Large industry	1.7	6.7

Source: Comisión Federal de Electricidad

Chart 3

Public service's total sales by sector, 2006-2016

(GWh)

Sector	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	aagr (%) 2006 - 2016
Total National	**176,670**	**186,518**	**197,017**	**206,856**	**217,742**	**228,629**	**239,386**	**251,657**	**264,143**	**277,204**	**291,027**	**5.1**
Domestic sales	175,371	185,219	195,718	205,557	216,443	227,330	238,087	250,358	262,844	275,905	289,728	5.1
Residential	44,452	46,910	49,852	53,108	56,813	59,992	62,893	65,666	68,396	71,133	73,900	5.2
Commercial	13,210	14,077	15,189	16,435	17,788	18,875	19,889	20,908	21,964	23,072	24,237	6.3
Services	6,596	6,795	6,997	7,210	7,426	7,650	7,880	8,117	8,361	8,613	8,874	3.0
Industrial	103,153	109,063	115,071	120,041	125,594	131,869	138,356	146,473	154,815	163,655	173,184	5.3
Medium-size business	65,266	67,389	69,700	72,051	75,034	78,736	82,678	86,775	91,005	95,717	101,021	4.5
Large industry	37,887	41,674	45,372	47,990	50,561	53,133	55,678	59,698	63,811	67,938	72,162	6.7
Pumping for agriculture	7,960	8,374	8,609	8,763	8,821	8,944	9,070	9,194	9,308	9,432	9,533	1.8
Export	1,299	1,299	1,299	1,299	1,299	1,299	1,299	1,299	1,299	1,299	1,299	0.0

Source: Comisión Federal de Electricidad

As to self-supply, the number of small-capacity permits issued for generation in the commercial and residential sectors in recent years has significantly increased in response to high costs incurred by certain companies when buying electricity from public utilities during the peak periods.

4.2.1 Regional analysis of the electric energy market

The regional analysis of the electric market is performed based on statistical trend studies, projections based on service requests by large consumers and annual surveys applied by CFE. It facilitates the estimation of energy required in each region in order to determine the capacity and location of new generating facilities, as well as the ideal expansion of the transmission grid, coordinated with the needs of each consumption center in the country.

Estimations of the total electricity sales for the next ten years show that the Northeastern region will reach the highest average growth rate with 6.3% (see chart 4). This increase is mainly explained by the growth expected from the states of Nuevo León and Tamaulipas. In the South-Southeastern region growth is expected to reach an annual average of 6.0%, followed by the Central-Western region with 5.2%. The lowest growth rate is expected from the Central region, with 3.5% between 2006 and 2016.

4.2.2 Gross demand by operative area

Gross power demand represents the flow rate (electric power) to which required electric energy must be supplied. It is integrated by the public utility demand and the demand served by self-supply and cogeneration plants requiring transmission and backup services. This energy requirement is satisfied by the public utility generator fleet and the private sector through installed transmission lines.

Chart 4

Public service's total sales by region, 2006-2016

(GWh)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	aagr (%) 2006-2016
Domestic total	**175,371**	**185,219**	**195,718**	**205,557**	**216,443**	**227,330**	**238,087**	**250,358**	**262,844**	**275,905**	**289,728**	**5.1**
Northwest	24,345	26,150	27,744	29,116	30,593	31,596	32,265	33,690	35,146	36,625	38,146	4.6
Northeast	42,843	45,828	49,374	52,801	56,246	59,960	63,818	67,626	71,303	75,034	79,069	6.3
Central-West	40,249	42,784	45,482	47,964	50,438	52,781	55,105	57,936	60,919	63,955	67,121	5.2
Central	42,548	43,582	44,820	45,797	47,350	49,041	50,843	52,857	54,947	57,338	59,890	3.5
South-Southeast	25,289	26,766	28,183	29,758	31,691	33,820	35,919	38,106	40,380	42,797	45,338	6.0
Small systems	97	109	115	120	125	131	137	143	149	156	163	5.3

Source: Comisión Federal de Electricidad

For the planning of NES, regarding the demand satisfied by private entities, only remote self-supply demand is considered and not local self-supply demand. The following section (see chart 5) introduces the figures corresponding to the gross demand by area, represented in three categories: maximum annual demand[1], medium demand[2] and base demand[3].

In Mexico, the Central region is the control area with the highest maximum demand, having registered 8,419 MW in 2006. Between 2006 and 2016, the greatest increases to maximum load are expected in Baja California Sur, with 7.6%, and in the northeastern and peninsular areas with an average 6.0%. It is important to point out that in 2006 the maximum load in the first of aforementioned regions was 284 MW, while in the last regions it was 6,319 MW and 1,268 MW, respectively.

[1] Maximum value of maximum demands in the year (MW). Maximum loads in peak hours during certain times of the year in each operative area constitute the maximum annual demand of NES.

[2] Necessary energy in MWh divided by the total of hours in the year.

[3] Minimum hourly demand in a specific period. Values indicated in the chart refer to the average minimum daily demand.

4.3 Expansion of the National Electric System

The planning of the electric system's expansion is a response to the electric energy demand and consumption estimations for the next ten years. The program features two types of requirements:

1. Capacity in construction or bidding phase

2. Additional capacity: future capacity put out to bid depending on the programmed start-up dates

The planning of additional capacity required to satisfy the demand estimated for the coming years is based on the technical and economic evaluation of different project configurations, selecting generation and transmission projects that present the lowest total cost in the long term. The capacity expansion program also considers due anticipation for planning purposes depending on the projects' maturity times.

Four to six years elapse between the construction of a new generating facility and its commercial start-up. In the case of transmission projects, three to five years are required prior to the start of operations of the new infrastructure.

Chart 5

NES: Gross demand forecast by operative area, 2006-2016

(MW)

Area		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	aagr (%) 2006-2016
	P	3,113	3,308	3,525	3,705	3,892	4,059	4,257	4,488	4,686	4,922	5,154	5.2
North	M	2,140	2,276	2,432	2,557	2,685	2,801	2,938	3,097	3,233	3,396	3,557	5.2
	B	1,831	1,946	2,073	2,179	2,289	2,387	2,504	2,640	2,756	2,895	3,031	5.2
	P	6,319	6,741	7,183	7,672	8,224	8,745	9,308	9,809	10,322	10,828	11,368	6.0
Northeast	M	4,590	4,901	5,218	5,573	5,975	6,354	6,762	7,125	7,499	7,867	8,259	6.1
	B	4,090	4,363	4,649	4,966	5,323	5,660	6,025	6,349	6,681	7,008	7,358	6.0
	P	7,106	7,548	8,050	8,495	9,002	9,479	9,955	10,448	10,972	11,464	11,983	5.4
West	M	5,621	5,963	6,319	6,645	7,039	7,415	7,785	8,172	8,582	8,968	9,370	5.2
	B	4,775	5,072	5,409	5,708	6,049	6,370	6,689	7,021	7,373	7,703	8,052	5.4
	P	8,419	8,654	8,892	9,123	9,492	9,830	10,139	10,454	10,798	11,207	11,627	3.3
Central	M	5,767	5,891	6,039	6,190	6,417	6,630	6,806	7,023	7,247	7,518	7,795	3.1
	B	4,371	4,493	4,617	4,737	4,928	5,104	5,264	5,428	5,606	5,818	6,037	3.3
	P	5,882	6,206	6,507	6,844	7,255	7,655	8,080	8,524	8,984	9,526	10,124	5.6
East	M	4,275	4,515	4,734	4,980	5,277	5,570	5,878	6,200	6,537	6,930	7,364	5.6
	B	3,703	3,907	4,096	4,309	4,567	4,819	5,087	5,366	5,656	5,997	6,374	5.6
	P	1,268	1,345	1,426	1,515	1,613	1,711	1,814	1,923	2,029	2,151	2,281	6.0
Peninsular	M	881	935	993	1,061	1,136	1,210	1,284	1,364	1,443	1,530	1,622	6.3
	B	703	746	791	840	894	949	1,006	1,066	1,125	1,193	1,265	6.0
	P	2,916	3,127	3,296	3,486	3,638	3,848	3,982	4,111	4,315	4,548	4,810	5.1
Northwest	M	1,823	1,943	2,046	2,164	2,258	2,388	2,472	2,551	2,678	2,823	2,984	5.1
	B	1,540	1,651	1,741	1,841	1,921	2,032	2,103	2,171	2,279	2,402	2,540	5.1
	P	2,095	2,228	2,345	2,467	2,594	2,727	2,849	2,972	3,093	3,220	3,344	4.8
Baja California	M	1,266	1,357	1,442	1,522	1,609	1,696	1,778	1,860	1,939	2,022	2,103	5.2
	B	1,039	1,105	1,163	1,223	1,286	1,352	1,413	1,474	1,534	1,597	1,658	4.8
	P	284	315	342	369	401	431	460	489	521	554	592	7.6
Baja California Sur	M	183	203	220	237	258	278	296	314	335	356	380	7.6
	B	149	165	180	194	210	226	241	257	273	291	311	7.6
	P	25	28	29	31	33	34	35	37	39	40	42	5.3
Small systems	M	14	15	16	17	18	18	19	20	21	22	23	5.3
	B	10	11	11	12	13	13	14	14	15	15	16	5.3

P: Peak load M: Medium load B: Base load

Source: Comisión Federal de Electricidad

In addition to the above, the program also considers the following additional elements: the generating system's configuration (unit retirements, self-supply and cogeneration projects, etc.) and the main transmission grid. The analysis is performed for three systems: National Interconnected System, Baja California and Baja California Sur.

Recent studies have revealed the technical and economic convenience of interconnecting the Baja California area with the National Interconnected System (NIS) using an asynchronous link. This interconnection would offer, among others, the following benefits: satisfy the peak demand of the Baja California system with the generating resources of NIS and, during the off-peak periods in Baja California, export surplus capacity and base energy (geothermal and combined-cycle) to the SIN, benefiting from the diversity of the demand in these two systems.

The interconnection would contribute to the reduction of total generation and production infrastructure investment costs. The link between Baja California and NIS would create new opportunities for power and energy transactions with diverse power companies from western USA, using the current links with electric systems in California. This interconnection has been scheduled for 2011.

The possibility of interconnecting the Baja California Sur system with NIS is currently under study. An important benefit of this interconnection would be postponing or even canceling generation projects that imply high investment and operating costs, in addition to the environmental benefit obtained through this alternative.

4.3.1 Reserve capacity

Reserve capacity is defined as the difference between the system's effective generation capacity and the maximum or peak demand in a given period. According to this concept, to properly and reliably satisfy demand, the system's capacity must exceed the maximum annual demand.

The relevance of reserve capacity therefore lies in the reliability of electric power supply for the following reasons:

- As soon as electric energy is produced, it is also demanded and consumed; ergo, it is not possible to store electricity.

- The system's capacity is subjected to reductions as a consequence of scheduled plant outages for maintenance purposes and due to force majeure events such as defects, downgrading, and weather-related phenomena, among others.

In this sense, to satisfy demand in a proper and reliable manner, capacity must exceed the maximum annual demand, that is, it must have a reserve capacity. Factors like effective plant capacity, plant availability and mesh alignment[4] are therefore important in determining the reliability of electric energy supply.

Reserve capacity is measured through the so-called reserve margin (RM), defined as the difference between gross capacity and maximum coincidental demand of the electric system, expressed as a percentage of maximum coincidental demand[5]. 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 2). For the calculation of the reserve margin and the operating reserve margin, in the case of the national electric system, the deterministic[6] model was adopted based on the average availability values of generating plants and on the seasonal behavior of demand.

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

In November 2004, CFE prepared a document called *Reserve margin diagnosis* for the Board of Governors, which determines – based on the variation of availability of the generating facilities – that the criterion on which compliance in generation planning must be based is ORM.

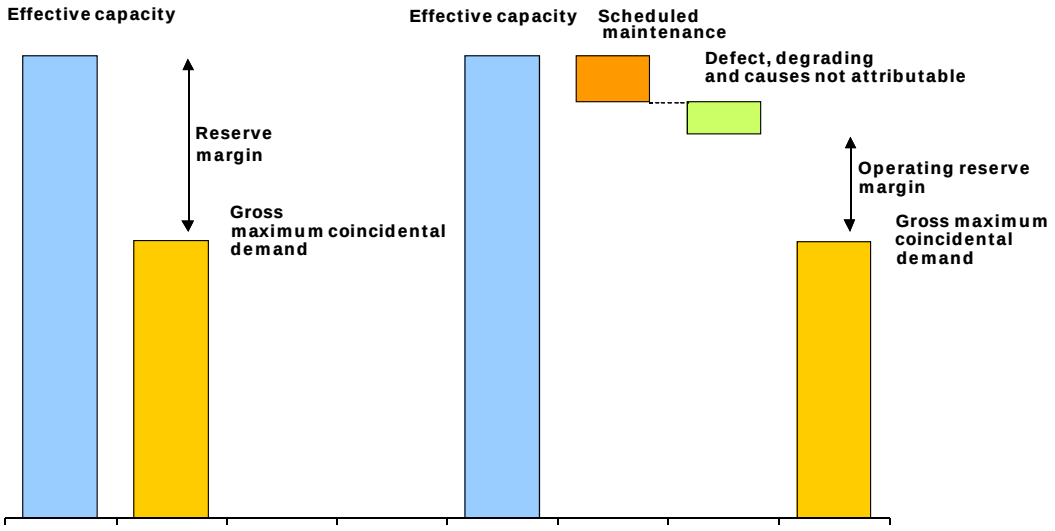
[4] When several regional systems are aligned in a mesh, it is possible to reduce the reserve margin since the resources for generation capacity are shared in an efficient form.

[5] The program for the expansion of the electric system guarantees that maximum demand is covered every day of the year, especially in peak hours.

[6] There are two measuring methods: the probabilistic, which is a function of the cost of failure (probability of loss of load) and the deterministic.

The minimum value adopted for the planning of the NIS is an ORM of 6%; the corresponding RM is obtained from this value.

Graph 2
Reserve margin (RM) and operational reserve margin (ORM)



Source: Comisión Federal de Electricidad

On the other hand, in the case of isolated systems, like the Baja California peninsula, reserve margin is determined separately based on load and maximum 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 maximum demand (see graph 3), whichever is higher. For the Baja California Sur system, the minimum reserve capacity value is the total capacity of the two largest units.

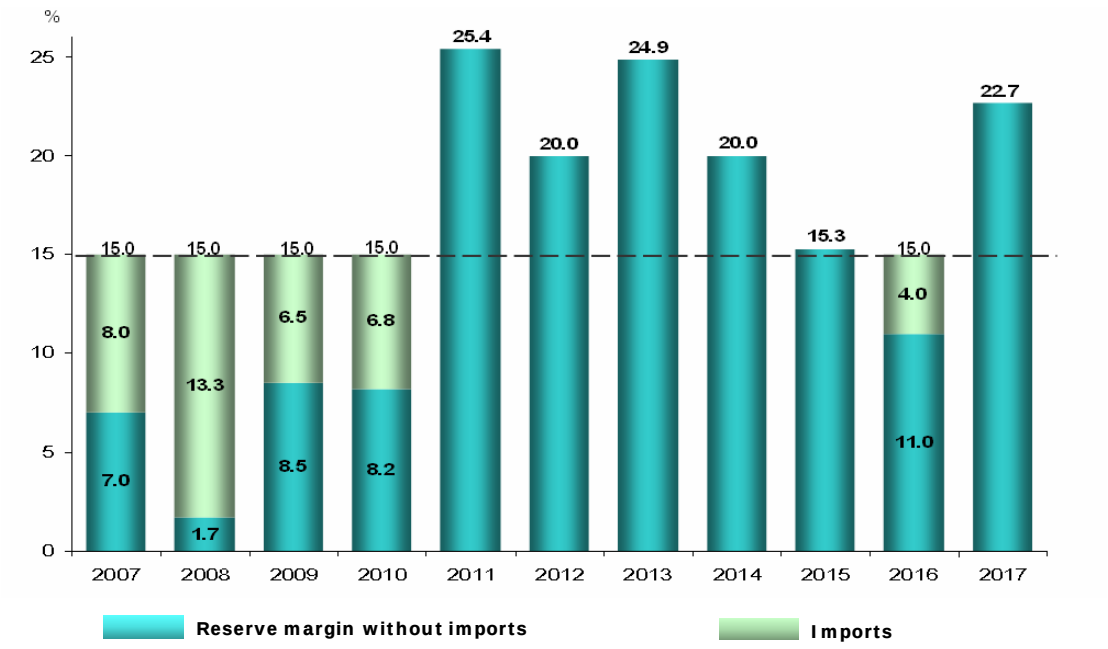
In 2006, NIS´ reserve margin of was 38% and will remain high between 2007 and 2009, due mainly to the decelerating rhythm of electricity demand registered as of 2001. The adjustment of reserve margins is difficult due to the anticipation required for a project to start operations. However, as of 2011 ORM is expected to decrease to 6% and remain at this value during the rest of the planning horizon (see graph 4).

In the short term, it is not possible to adjust RM to a desired value. Nonetheless, having high RM and ORM allows the use of more efficient generating technologies leaving more expensive technologies as reserve. This situation was also used to reduce outages due to maintenance programs and/or speed up the removal of outdated and inefficient plants.

Every year, as part of the planning process, dates scheduled for generating projects are systematically reviewed based on the changes in the country's economic expectations directly affecting the estimated electricity demand. In this sense, adjustments have been made to add capacity to comply with the reserve capacity criteria.

Graph 3

Baja California area's reserve margin

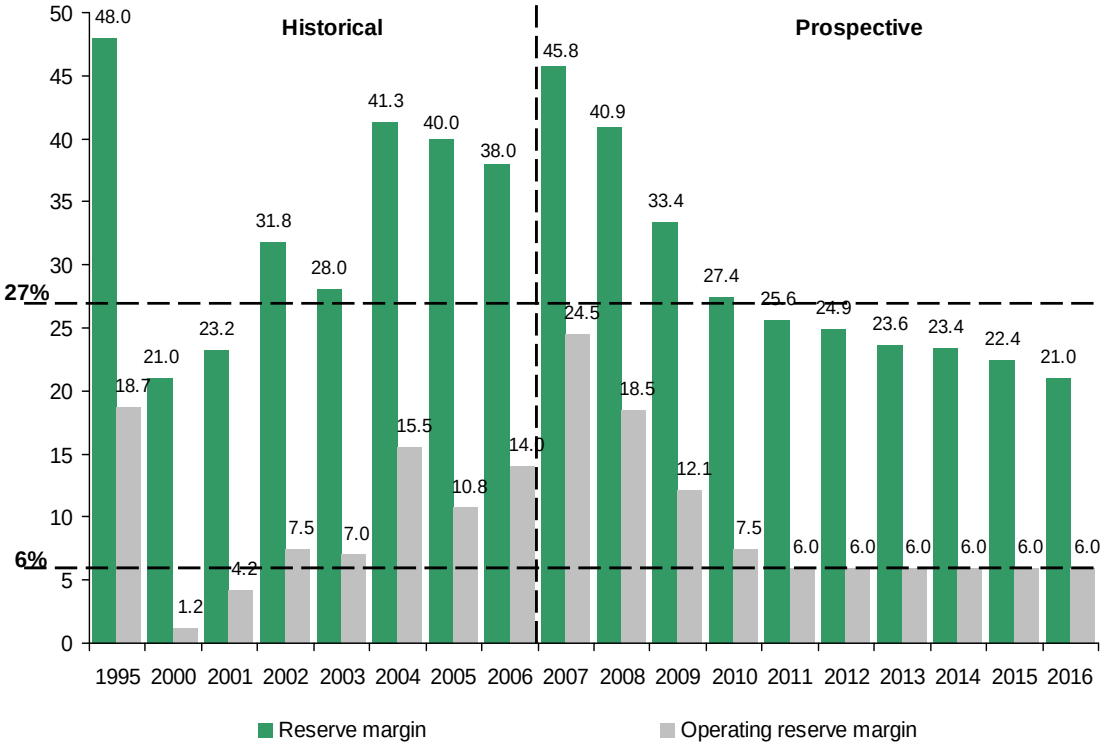


Source: Comisión Federal de Electricidad

Graph 4

Interconnected system: Reserve margin and operating reserve margin

(%)



Source: Comisión Federal de Electricidad

4.3.2 Basic considerations in the planning of the electric system

Based on the fuel price scenarios used for this planning exercise and the investment costs of diverse generating technologies, coal plants and nuclear technology could turn out to be competitive when compared to other sources. This outlook proposes the reactivation of technology based on the use of coal for the expansion of the generating system.

Another basic assumption for the 2007-2016 expansion plan is the diversification of generation sources, focusing on the evaluation and inclusion of coal and renewable energies in the project portfolio for the planning horizon.

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

Power plants running on coal are located to the north of the state of Coahuila, and close to the port of Lázaro Cárdenas, in the state of Michoacán, from where coal is currently being supplied to the Petacalco coal plant . In addition to the port of Lázaro Cárdenas, new coal plants are also planned for the port of Topolobampo, in the state of Sinaloa and, should the mineral coal potential be confirmed in the Sabinas region in Coahuila, another coal plant development pole could be started in that region, considering the use of efficient and clean technologies such as supercritical boilers and gasification integrated with combined cycles.

For the central part of the country, described as an energy-importing area, combined-cycle projects have been foreseen as of 2011. They have a strategic role in the expansion of NES, since they will substantially improve the reliability and quality of electric energy supply in this NIS region.

4.3.3 Expansion program

The expansion program for NES is integrated by the planning of public utilities (CFE and LFC) and the projection of the capacity additions of self-supply and cogeneration concessionaires. These permitees' additional capacity allow synergies between energy supply diversification and energy savings, aimed to achieve a more efficient utilization of the electric energy's generation potential in the industry's sectors and branches.

During the period between 2007 and 2016, the expansion program of CFE will require the addition of 21,737 MW of capacity, of which 5,082 MW are capacity in place, in the construction or bidding phase, and 16,656 MW are additional capacity in projects for which no bidding has taken place yet. In addition, LFC´s program will lead to the start-up of distributed generation projects in the Central region, adding 416 MW of capacity. All in all, 22,153 MW will be added during the period on behalf of the public utility (see chart 6).

On the other hand, a net additional remote self-supply and cogeneration capacity of 2,581 MW is estimated, considering both private and public sector projects, more specifically Pemex and its cogeneration project at Nuevo Pemex with 304 MW of remote self-supply, and the open season wind energy projects (see chart 7).

By 2016, 5,867 MW of obsolete and inefficient capacity will be retired from public service (see graph 5).

4.3.3.1 Capacity in construction or bidding

Capacity in place in 2007, in the construction or bidding phase, considered in this outlook will increase to 5,498 MW; this figure is composed by 5,082 MW corresponding to CFE and 416 MW, to LFC. This capacity is scheduled to start operations during the 2007-2012 period.

Chart 6

NES' additional capacity program , 2007-2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Total	**2,471**	**50**	**562**	**2,181**	**2,852**	**2,994**	**1,569**	**3,299**	**3,778**	**2,982**	**22,737**
Public utility	2,471	50	562	2,029	2,852	2,562	1,569	3,299	3,778	2,982	22,153
Comisión Federal de Electricidad	2,055	50	562	2,029	2,852	2,562	1,569	3,299	3,778	2,982	21,737
Capacity in the construction or bidding phase	2,045	0	501	1,144	641	750	0	0	0	0	5,082
Additional capacity	0	0	11	700	2,036	1,812	1,569	3,299	3,778	2,982	16,187
Rehabilitations and modernizations (RM)	10	50	50	185	175						469
Luz y Fuerza del Centro	416										416
Self-supply and cogeneration	0	0	0	152	0	432					584

Source: Comisión Federal de Electricidad

Chart 7

Self-supply and cogeneration projects, 2007-2016[1]

Additions	Year	MW	Modifications	Year	MW
	2007				
Mexicana de Hidroelectricidad (Mexhidro)		29			
Procter & Gamble Manufactura		44			
	2008				
Eurus		248			
Eoliatec del Istmo		20			
BII NEE STIPA Energía Eólica		22			
Parques Ecológicos de México		79			
	2009				
Eléctrica del Valle de México		49			
Fuerza Eólica del Istmo		27			
	2010			**2010**	
Nuevo Pemex		304	Pemex[2]		-152
Open season:					
Fuerza Eólica del Istmo		49			
Preneal México		393			
Desarrollos Eólicos Mexicanos		226			
Gamesa Energía		285			
Eoliatec del Pacífico		159			
Eoliatec del Istmo		141			
Unión Fenosa		226			
	2012				
GDC Generadora		432			
	Subtotal	**2,733**		**Subtotal**	**-152**
	Total	**2,581**			

[1] Remote self-supply capacity.

[2] Remote portage substituted by the Nuevo Pemex cogeneration project.

Source: Comisión Federal de Electricidad

The expansion program with generation projects in the construction or bidding phase is integrated by 1,507 MW of combined cycle. Operations with other technology will also start in order to diversify electricity generation; an example is Carboeléctrica del Pacífico with 678 MW gross capacity to be launched in 2010, among others (see chart 8).

Regarding the bidding scheme, 567 MW of capacity in the construction or bidding phase will be considered under the scheme known as Independent Power Production (IPP); 2,469 MW will be under the scheme of Financed Public Work (FPP) and 416 MW through budget investment.

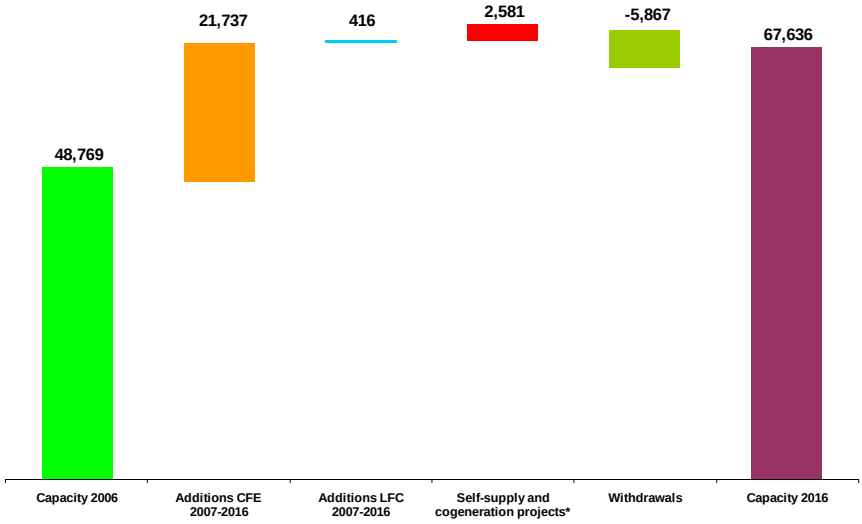
Given the existing reserve margin, since 2007 when the Baja California Sur II, La Venta II, El Cajón and Tamazunchale plants started operating, there are no new plant start-ups scheduled until 2009, when the combined-cycle Baja California (Presidente Juárez) plant will start operations and the San Lorenzo plant in Puebla will be converted from gas turbine to combined cycle.

The geographic distribution of capacity in the construction or bidding phase is shown on Map 7. In the case of the Pacific coast, the new plant is called Carboeléctrica del Pacífico, and has a gross capacity of 678 MW. There will be two plants on the north border: Baja California (277 MW) and Agua Prieta II (641 MW), the latter consisting of a combined-cycle plant integrated with a solar field. On the other hand, the La Venta III wind electric plant will operate in the Tehuantepec Isthmus, contributing to the diversification of the country's generating fleet with 101 MW, as well as the La Yesca hydroelectric plant, recently awarded and expected to add 750 MW of capacity as of 2012.

In the case of the LFC project, distributed 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 generation, in which case electricity production takes place in one or several plants with large installed capacity, and the electric energy generated is transformed, transmitted and distributed among a large number of users. The LFC project consists in 14 gas turbine plants running on natural gas, with an installed capacity of 32 MW each, contributing a total of 448 MW to NES. In November 2007, there were nine plants in operation and the rest are expected to start in 2008.

Graph 5

NES expansion program 2007-2016 (MW)



* Considers only remote self-supply.
Source: Comisión Federal de Electricidad

Chart 8

Finished, under construction and bidding –process generation projects bidding

Project	Location	Technology	Bid date	Bidding or financing mode	Gross capacity (MW)					
					2007	2008	2009	2010	2011	2012
Total annual					**2,461**	**-**	**501**	**1,144**	**641**	**750**
Accrued					**2,461**	**2,461**	**2,963**	**4,107**	**4,748**	**5,498**
		Finished projects								
Baja California Sur II (Coromuel)	Baja California Sur	IC	2003	FPW	42					
La Venta II	Oaxaca	WIND	2005	FPW	83					
Tamazunchale	San Luis Potosí	CC	2003	IPP	1,170					
El Cajón U1 y U2	Nayarit	HYD	2002	FPW	750					
Subtotal					**2,045**	**-**	**-**	**-**	**-**	**-**
		Project in construction phase								
San Lorenzo conversión TG/CC	Puebla	CC	2005	FPW			123			
Baja California (Pdte. Juárez)	Baja California	CC	2006	FPW			277			
Norte (La Trinidad)	Durango	CC	2005	IPP				466		
Carboeléctrica del Pacífico	Guerrero	CAR	2003	FPW				678		
Distributed generation LFC[1]	D.F., Edo. de México	GT	2005		416					
Subtotal					**416**	**-**	**400**	**1,144**	**-**	**-**
		Projects in bidding phase								
La Venta III	Oaxaca	WIND	2007	IPP			101			
La Yesca U1 y U2	Nayarit	HYD	2007	FPW						750
Agua Prieta II[2]	Sonora	CC	2007	FPW					641	
Subtotal					**-**	**-**	**101**	**-**	**641**	**750**

HYD: Hydroelectric CC: Combined cycleI C: Internal diesel combustion WIND: Wind electric
CAR: Carboelectric GT: Gas turbine IPP: Independent Power Producer FPW: Financed Public Work
[1] Budget resources have been disbursed for the execution of this project.
[2] Second bill call, includes 25 MW of solar field.
Source: Comisión Federal de Electricidad

4.3.3.2 Additional capacity

The projects of the Capacity Requirement Program (CRP) for 2007-2016 to be put out to bid according to their scheduled start-up date will start commercial operation as of 2009 with the Guerrero Negro III plant (11 MW) and will continue with various projects, including the Oaxaca I through IV wind energy plants in 2010.

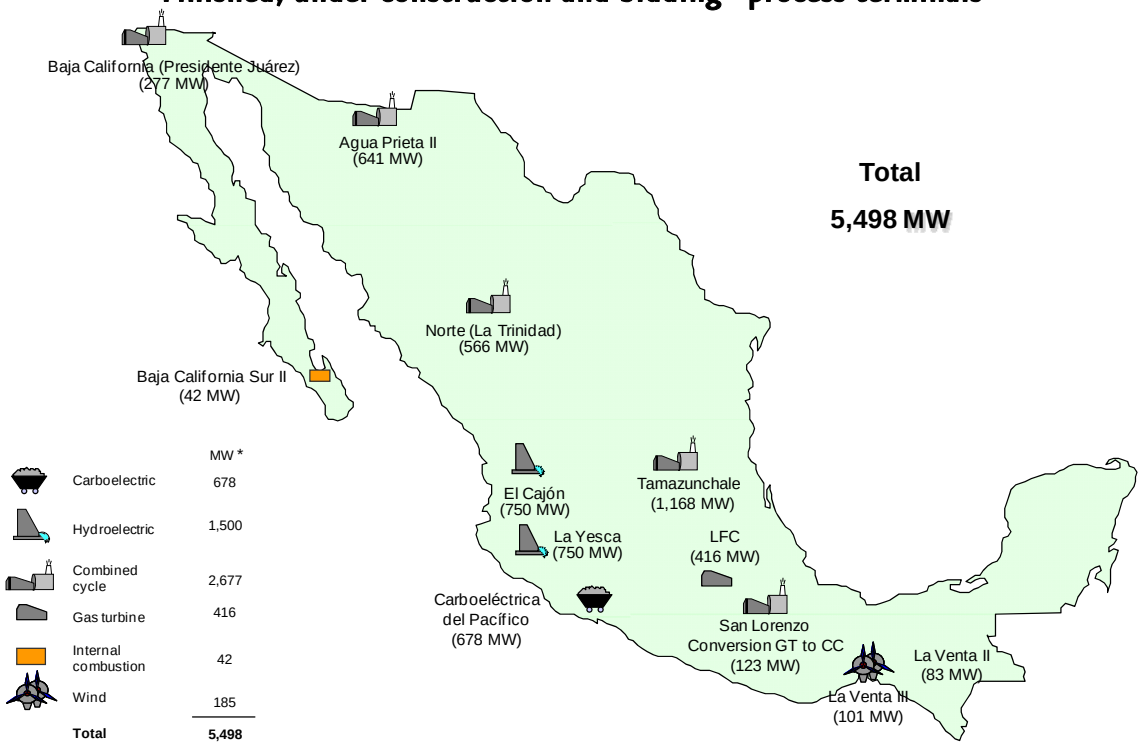
The uncommitted additional capacity for the 2007-2016 planning period considers the installation of 16,187 MW between 2009 and 2016 (see chart 9). This capacity may be installed under different investment schemes, either through private participation in bids for independent energy production or under 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 programmed location and the type of technology used, even if this implies additional transmission to reach the preferred interconnection point, and the alternative interconnection points specified by CFE in the bid bases.

Due to this situation, other options will be available to benefit from the electricity with the lowest total cost in the long term, having the required quality and reliability.

Map 1

Finished, under construction and bidding –process terminals



* Since figures are rounded up to integer numbers totals may not be exact matches.
Source: Comisión Federal de Electricidad

To achieve the goals and objectives of the electricity sector's expansion program, the Mexican government and the other stakeholders will use 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 in this program that by their nature contribute to the reduction of green house gas emissions will require the resources obtained from the sales of these reductions on the international carbon market in order to become economically viable and make progress in their execution and start-up.

Regarding the technologies considered for the requirement of additional capacity, combined-cycles represent 51.8% of the total capacity to be installed during 2009-2016, with 8,385 MW, followed by the assignment of the

so-called free capacity, for which technology has not yet been specified. This capacity totals 3,826 MW, that is, 23.6% 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 sources, such as coal, natural gas and uranium, among others. This would be the way to prevent dependency on a single fuel. The remaining 24.6% of uncommitted capacity corresponds to different technologies, mainly coal, hydro, wind and geothermal. To achieve this diversification, construction of 2,100 MW of new coal capacity is under consideration, even with integrated gasification combined cycle and 406 MW of wind and 158 MW of geothermal energies (see map 2).

Chart 9

Additional capacity requirements

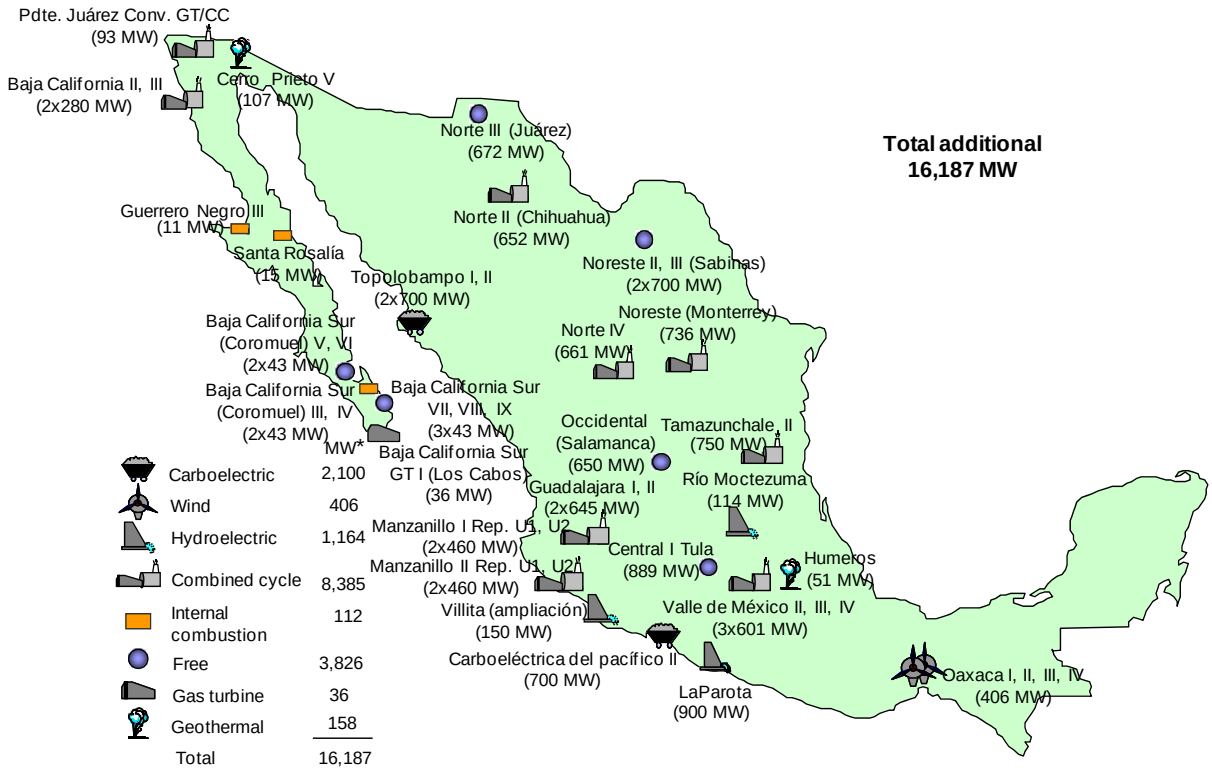
(Financially undefined projects)

Project	Location	Technology	Gross capacity (MW)							
			2009	2010	2011	2012	2013	2014	2015	2016
Total annual			**11**	**700**	**2,036**	**1,812**	**1,569**	**3,299**	**3,778**	**2,982**
Accrued			**11**	**711**	**2,747**	**4,559**	**6,128**	**9,427**	**13,205**	**16,187**
Guerrero Negro III	Baja California Sur	IC	11							
Presidente Juárez conversión TG/CC	Baja California	CC		93						
Baja California Sur III y IV (Coromuel)	Baja California Sur	IC		43	43					
Cerro Prieto V	Baja California	GEO		107						
Humeros	Puebla	GEO		51						
Oaxaca I, II, III y IV	Oaxaca	WIND		406						
Norte II (Chihuahua)	Chihuahua	CC			652					
Baja California III y II (Ensenada)	Baja California	CC			280		280			
Manzanillo I repotenciación U1 y U2	Colima	CC			460	460				
Valle de México II, III y IV	Edo. Méx.	CC			601	601		601		
Noreste (Monterrey)	Nuevo León	CC				736				
Santa Rosalía	Baja California Sur	IC				15				
Norte III (Juárez)	Chihuahua	FREE					672			
Río Moctezuma	Hidalgo, Queréraro	HYD					114			
Manzanillo II repotenciación U1 y U2	Colima	CC					460	460		
Baja California Sur V y VI (Coromuel)	Baja California Sur	FREE					43	43		
Noreste II y III (Sabinas)	Coahuila	FREE						700		700
Villita ampliación	Michoacán	HYD						150		
Guadalajara I y II	Jalisco	CC						645	645	
Topolobampo I y II	Sinaloa	CAR/IGCC						700		700
Baja California Sur TG I (Los Cabos)	Baja California Sur	GT							36	
Norte IV (Torreón)	Coahuila	CC							661	
Tamazunchale II	San Luis Potosí	CC							750	
La Parota U1, U2 y U3	Guerrero	HYD							900	
Baja California Sur VII, VIII y IX	Baja California Sur	FREE							86	43
Carboeléctrica del Pacífico II	Guerrero	CAR/IGCC							700	
Occidental (Salamanca)	Guanajuato	FREE								650
Central I (Tula)	Hidalgo	FREE								889

HYD: Hydroelectric CC: Combined cycle IC: Internal diesel combustión WIND: Wind electric CAR: Carboelectric
GT: Gas turbine GEO: Geothermoelectric IGCC: Integrated gasification combined cycle
FREE: Technology not yet defined
Source: Comisión Federal de Electricidad

Map 2

Non-committed additional capacity requirements



*Since figures are rounded up to integer numbers, totals may not be exact matches.
Source: Comisión Federal de Electricidad.

4.3.3.3 Capacity retirement program

The capacity retirement program is based on the operating costs and the service life of generating units. These criteria allow the evaluation of the convenience of keeping certain plants operating. It is also important to consider the emission level and efficiency of the oldest plants. Bearing this in mind, this planning considers stopping operations of 5,867 MW of public service capacity during the next ten years (see chart 10).

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 the aforementioned criteria and the specific issues in each case - what units and what plants must stop operating, must be rehabilitated or modernized.

Retirements with the greatest magnitude are scheduled to take place in 2011 and 2013 (see chart 11 and graph 6).

Therefore, not counting annual retirements, a total capacity of 65,055 MW of electric energy for public service will be reached by the end of 2016.

4.3.3.4 Evolution of installed capacity by statistical region

During the period between 2007 and 2016, public service electric energy generating capacity is expected to have a net increase of 16,286 MW, from 48,769 MW to 65,055 MW. The region with the highest increase will be the Central-Western region, where total capacity will register net additions of 6,684 MW, due to the formidable increase in the installation of combined-cycle and hydroelectric plants in this region.

In contrast, the Northeastern region will be the one with the lowest amount of additions during the period, with only 2,201 MW (see chart 12).

Chart 10

Public service installed capacity's expected evolution, 2007-2016

(MW)

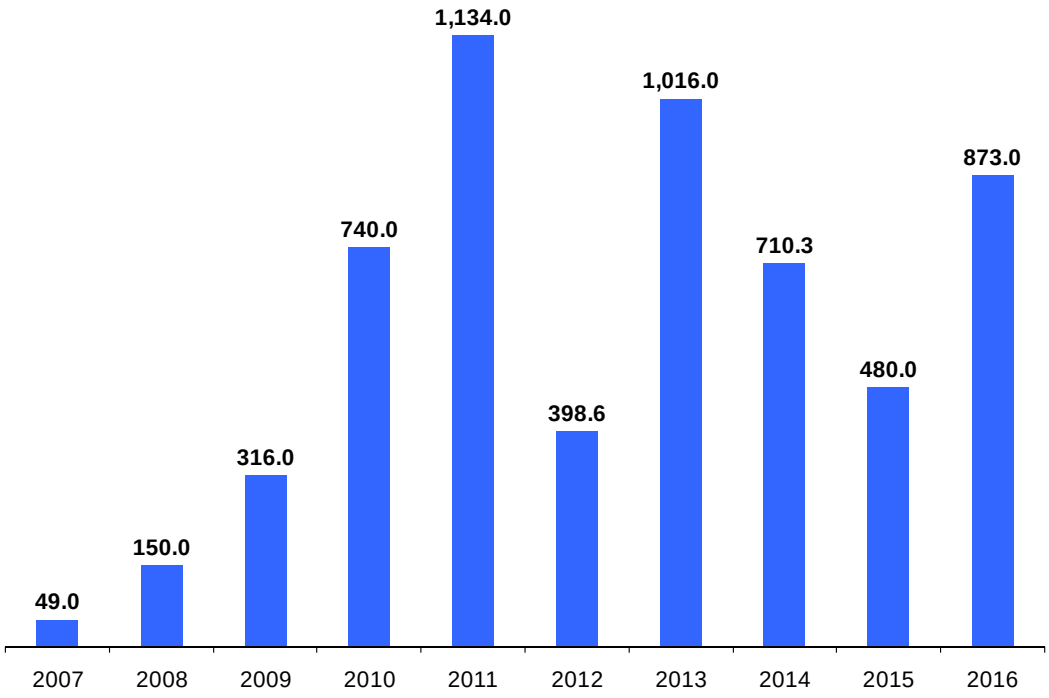
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Capacity by December each year	**51,191**	**51,091**	**51,337**	**52,626**	**54,343**	**56,507**	**57,060**	**59,648**	**62,946**	**65,055**
Capacity by December 2006	48,769	48,769	48,769	48,769	48,769	48,769	48,769	48,769	48,769	48,769
Accrued additions	2,055	2,105	2,668	4,696	7,548	10,110	11,679	14,977	18,755	21,737
Acrrued LFC additions	416	416	416	416	416	416	416	416	416	416
Accrued withdrawals	49	199	515	1,255	2,389	2,788	3,804	4,514	4,994	5,867

Source: Comisión Federal de Electricidad

Graph 6

Capacity retirement program, 2007-2016

(MW)



Source: Comisión Federal de Electricidad

Chart 11

Retirement capacity, 2007-2016 (gross capacity) (MW)

2007						2008					
Central	Unit	Type	MW	Month	Area	Central	Unit	Type	MW	Month	Area
NACHI - COCOM II	2	CT	24.5	Oct.	PEN	LERMA (CAMPECHE)	1	CT	37.5	Feb.	PEN
NACHI - COCOM II	1	CT	24.5	Oct.	PEN	FELIPE CARRILLO PUERTO	1	CT	37.5	Jun.	PEN
						FELIPE CARRILLO PUERTO	2	CT	37.5	Jun.	PEN
						LERMA (CAMPECHE)	2	CT	37.5	Nov.	PEN
Sum of withdrawals			**49.0**			**Sum of withdrawals**			**150.0**		
2009						**2010**					
Central	Unit	Typo	MW	Month	Area	Central	Unit	Type	MW	Month	Area
SALAMANCA	2	CT	158.0	Jun.	OCC	NONOALCO	2	GT	32.0	FEB	CEL
SALAMANCA	1	CT	158.0	Jun.	OCC	NONOALCO	1	GT	32.0	FEB	CEL
						CERRO PRIETO I	1	GEO	37.5	FEB	BC
						CERRO PRIETO I	2	GEO	37.5	FEB	BC
						ALTAMIRA	1	CT	150.0	MAR	NES
						ALTAMIRA	2	CT	150.0	MAR	NES
						LERMA (CAMPECHE)	3	CT	37.5	JUN	PEN
						LERMA (CAMPECHE)	4	CT	37.5	JUN	PEN
						DOS BOCAS	3	CC	63.0	SEP	ORI
						DOS BOCAS	4	CC	63.0	SEP	ORI
						DOS BOCAS	6	CC	100.0	SEP	ORI
Sum of withdrawals			**316.0**			**Sum of withdrawals**			**740.0**		
2011						**2012**					
Central	Unit	Type	MW	Month	Area	Central	Unit	Type	MW	Month	Area
DOS BOCAS	1	CC	63.0	MAR	ORI	E. PORTES GIL (RÍO BRAVO)	3	CT	300	MAR	NES
DOS BOCAS	2	CC	63.0	MAR	ORI	VALLE DE MÉXICO	4	GT	28.0	NOV	CEL
DOS BOCAS	5	CC	100.0	MAR	ORI	VALLE DE MÉXICO	3	GT	32.0	NOV	CEL
C. RODRÍGUEZ RIVERO (GUAYMAS II)	2	CT	84.0	APR	NOR	VALLE DE MÉXICO	2	GT	28.0	NOV	CEL
C. RODRÍGUEZ RIVERO (GUAYMAS II)	4	CT	158.0	APR	NOR	SANTA ROSALÍA	3	IC	0.8	NOV	AIS
FRANCISCO VILLA	4	CT	150.0	APR	NTE	SANTA ROSALÍA	7	IC	2.8	NOV	AIS
FRANCISCO VILLA	5	CT	150.0	APR	NTE	SANTA ROSALÍA	6	IC	1.2	NOV	AIS
JORGE LUQUE	1	CT	32.0	NOV	CEL	SANTA ROSALÍA	5	IC	1.2	NOV	AIS
JORGE LUQUE	2	CT	32.0	NOV	CEL	SANTA ROSALÍA	4	IC	0.6	NOV	AIS
JORGE LUQUE	3	CT	80.0	NOV	CEL	SANTA ROSALÍA	8	IC	1.0	NOV	AIS
LECHERÍA	2	GT	32.0	NOV	CEL	SANTA ROSALÍA	2	IC	2.0	NOV	AIS
LECHERÍA	3	GT	32.0	NOV	CEL	SANTA ROSALÍA	9	IC	1.0	NOV	AIS
LECHERÍA	1	GT	32.0	NOV	CEL						
NONOALCO	3 Y 4	GT	84.0	NOV	CEL						
LECHERÍA	4	GT	42.0	NOV	CEL						
Sum of withdrawals			**1,134.0**			**Sum of withdrawals**			**398.6**		
2013						**2014**					
Central	Unit	Type	MW	Month	Area	Central	Unit	Type	MW	Month	Area
VALLE DE MÉXICO	1	CT	150.0	MAR	CEL	C. RODRÍGUEZ RIVERO (GUAYMAS II)	1	CT	84.0	NOV	NOR
VALLE DE MÉXICO	2	CT	150.0	MAR	CEL	C. RODRÍGUEZ RIVERO (GUAYMAS II)	3	CT	158.0	NOV	NOR
VALLE DE MÉXICO	3	CT	150.0	MAR	CEL	HUINALÁ	1	CC	62.3	NOV	NES
ALTAMIRA	3	CT	250.0	APR	NES	HUINALÁ	2	CC	62.3	NOV	NES
SAMALAYUCA	1	CT	158.0	APR	NTE	HUINALÁ	3	CC	62.3	NOV	NES
SAMALAYUCA	2	CT	158.0	APR	NTE	HUINALÁ	4	CC	62.3	NOV	NES
						HUINALÁ	5	CC	128.3	NOV	NES
						LOS CABOS	2	GT	27.4	NOV	BCS
						LOS CABOS	1	GT	30.0	NOV	BCS
						CD. CONSTITUCIÓN	1	GT	33.2	NOV	BCS
Sum of withdrawals			**1,016.0**			**Sum of withdrawals**			**710.3**		
2015						**2016**					
Central	Unit	Type	MW	Month	Area	Central	Unit	Type	MW	Month	Area
ALTAMIRA	4	CT	250.0	NOV	NES	LAS CRUCES	1 Y 2	GT	28.0	APR	ORI
GÓMEZ PALACIO	1	CC	59.0	NOV	NTE	UNIVERSIDAD	1 Y 2	GT	24.0	APR	NES
GÓMEZ PALACIO	2	CC	59.0	NOV	NTE	ESPERANZAS	1	GT	12.0	APR	NES
GÓMEZ PALACIO	3	CC	82.0	NOV	NTE	CD. OBREGÓN	1 Y 2	GT	28.0	APR	NOR
FUNDIDORA	1	GT	12.0	NOV	NES	LAS CRUCES	3	GT	15.0	APR	ORI
INDUSTRIAL	1	GT	18.0	NOV	NTE	TECNOLÓGICO	1	GT	26.0	APR	NES
						XUL - HA	1	GT	14.0	APR	PEN
						CD. DEL CARMEN	1	GT	14.0	APR	PEN
						SALAMANCA	3	CT	300.0	NOV	OCC
						SALAMANCA	4	CT	250.0	NOV	OCC
						PUNTA PRIETA II	1	CT	37.5	NOV	BCS
						PUNTA PRIETA II	2	CT	37.5	NOV	BCS
						TIJUANA	2	GT	30.0	NOV	BC
						TIJUANA	1	GT	30.0	NOV	BC
						LOS CABOS	3	GT	27.2	NOV	BCS
Sum of withdrawals			**480.0**			**Sum of withdrawals**			**873.2**		
Total						**5,867.1**					

CT: Conventional thermoelectric CC: Combined cycle GT: Gas turbine IC: Internal combustion

GEO:Geothermoelectric
Source: Comisión Federal de Electricidad

Northwestern

In this region, installed capacity is expected to increase by 2,633 MW. The technology registering the highest increase will be combined-cycle, 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 641 MW[7] in different years between 2009 and 2013. 1,400 MW of coal capacity will also be installed during 2014 and 2016, corresponding to the Topolobampo I and II plants.

Northeastern

In 2006, the Northeastern region concentrated the highest regional installed combined-cycle capacity with 7,765 MW, representing 15.9% of the total domestic capacity installed by public utilities. A net increase of 1,937 MW is forecasted for the period between 2007 and 2016, to reach 9,702 MW by the end of aforementioned period. The strong presence of independent power producers in the region makes it a strategic geographic region regarding the generation of electric energy and natural gas consumption.

In this region, more specifically 30 km to the northeast of Durango, Dgo., the Norte (La Trinidad) plant is being constructed under the IPP scheme, with a gross capacity of 466 MW, which will use 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 plants in Coahuila have a joint capacity of 2,600 MW, and no capacity increase is scheduled for them. Their free capacity will increase to 2,072 MW by the end of the period, and may be achieved using diverse technologies.

Central-Western

Just as the *Outlook on the electricity sector, 2006-2015*, the expansion program for this region considers adding the highest capacity, equal to 6,684 MW, for the period between 2007 and 2016. Combined-cycle plants

[7] Includes 25 MW of solar field

will represent 95.0% of this increase, that is, 6,350 MW. Another relevant growth will take place in hydroelectric generating capacity, increasing by 1,850 MW, driven by the El Cajón and La Yesca plants and by the expansion project of Villita.

On the other hand, and as a result of the capacity retirement program, by 2016 a capacity decrease of 2,166 MW will be observed in thermoelectric plants running on fuel oil.

Central

In the Central region, planned capacity additions will take place through the Valle de México II, III and IV plant projects with a capacity of 601 MW each[8]. Slight increase is also expected in geo-thermoelectric capacity with the Humeros project in Puebla, representing 51 MW, scheduled for 2010; on the other hand, LFC, as already mentioned, will contribute 416 MW with 13 units, of which the last five are to start operations during 2008, concluding therewith this project, representing a total of 448 MW.

South-Southeastern

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 capacity additions of 2,341 MW during the 2007-2016 period. In addition to the La Venta III wind energy plant that will start operations in 2009, the region will also benefit from the installation of 1,378 MW of coal capacity that could use both advanced technology, as in the case of supercritical boilers, and gasification integrated with combined cycles[9], known for being clean and efficient combustion technologies.

In connection with the coal capacity to be installed in this region, 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 of this coal plant considers a gross capacity of 678 MW, including a steam turbo-generator, a supercritical steam generator and a surface condenser as its main equipment.

4.3.3.5 Technologies for the expansion of the generating system

As a result of the investment costs of generating technologies and of the fuel price scenarios, the annual revision of the generating system's expansion performed by CFE shows that expansion at minimum costs is achieved through the majority participation of projects based on combined-cycle technology. However, considering the future possibility of highly volatile gas prices or limited supply, other sources are constantly being evaluated.

[8] These projects are scheduled to be installed as combined-cycle.

[9] Although relevant operating experience has been obtained in several countries, a certain degree of maturity is still required to achieve higher competitiveness with respect to other technologies.

Chart 12

Installed electric capacity's expected evolution by technology and region (self-supply not included)

Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total[1]	**48,769**	**51,191**	**51,091**	**51,337**	**52,626**	**54,343**	**56,507**	**57,060**	**59,648**	**62,946**	**65,055**
Northwest Subtotal	6,714	6,756	6,756	7,044	7,212	7,934	7,938	8,261	8,672	8,794	9,346
Hydraulic	941	941	941	941	941	941	941	941	941	941	941
Combined cycle	1,720	1,720	1,720	1,997	2,090	3,011	3,011	3,291	3,291	3,291	3,291
Gas turbine	663	663	663	663	663	663	663	663	573	609	493
Internal combustion	174	216	216	227	270	313	318	318	318	318	318
Wind energy	1	1	1	1	1	1	1	1	1	1	1
Free	0	0	0	0	0	0	0	43	86	172	215
Fuel-oil	2,485	2,485	2,485	2,485	2,485	2,243	2,243	2,243	2,001	2,001	1,926
Carboelectric	0	0	0	0	0	0	0	0	700	700	1,400
Geothermal	730	730	730	730	762	762	762	762	762	762	762
Northeast Subtotal	13,203	13,203	13,203	13,203	13,369	13,721	14,157	14,263	14,585	14,766	15,404
Hydraulic	126	126	126	126	126	126	126	126	126	126	126
Combined cycle	7,765	7,765	7,765	7,765	8,231	8,883	9,619	9,619	9,241	9,702	9,702
Gas turbine	602	602	602	602	602	602	602	602	602	572	510
Free	0	0	0	0	0	0	0	672	1,372	1,372	2,072
Carboelectric	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600
Fuel-oil	2,111	2,111	2,111	2,111	1,811	1,511	1,211	645	645	395	395
Central-West Subtotal	6,704	8,634	8,684	8,418	8,468	8,968	10,178	10,638	11,892	13,287	13,387
Hydraulic	1,857	2,617	2,667	2,717	2,767	2,807	3,557	3,557	3,707	3,707	3,707
Combined cycle	1,161	2,331	2,331	2,331	2,331	3,091	3,851	4,661	6,116	7,511	7,511
Gas turbine	24	24	24	24	24	24	24	24	24	24	24
Free	0	0	0	0	0	0	0	0	0	0	650
Internal combustion	1	1	1	1	1	1	1	1	1	1	1
Carboelectric	0	0	0	0	0	0	0	0	0	0	0
Fuel-oil	3,466	3,466	3,466	3,150	3,150	2,850	2,550	2,200	1,850	1,850	1,300
Geothermal	195	195	195	195	195	195	195	195	195	195	195
Central Subtotal	4,649	5,065	5,065	5,188	5,175	5,410	5,923	5,587	6,188	6,188	7,077
Hydraulic[2]	729	729	729	729	729	729	729	843	843	843	843
Combined cycle	1,038	1,038	1,038	1,161	1,161	1,762	2,363	2,363	2,964	2,964	2,964
Gas turbine[3]	672	1,088	1,088	1,088	1,024	802	714	714	714	714	714
Free	0	0	0	0	0	0	0	0	0	0	889
Fuel-oil	2,174	2,174	2,174	2,174	2,174	2,030	2,030	1,580	1,580	1,580	1,580
Geothermal	35	35	35	35	86	86	86	86	86	86	86
South-Southeast Subtotal	17,496	17,530	17,380	17,482	18,399	18,308	18,308	18,308	18,308	19,908	19,837
Hydraulic	6,913	6,913	6,913	6,913	6,913	6,913	6,913	6,913	6,913	7,813	7,813
Combined cycle	3,906	3,906	3,906	3,906	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	477
Internal combustion	3	3	3	3	3	3	3	3	3	3	3
Dual	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100
Wind energy	2	85	85	186	592	592	592	592	592	592	592
Free	0	0	0	0	0	0	0	0	0	0	0
Fuel-oil	2,659	2,610	2,460	2,460	2,385	2,385	2,385	2,385	2,385	2,385	2,385
Carboelectric	0	0	0	0	678	678	678	678	678	1,378	1,378
Nuclear electric	1,365	1,365	1,365	1,365	1,499	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

[1] Includes CFE and IPP.

[2] The Río Moctezuma project consists of three hydroelectric plants on the same riverbed: Jiliapan and Tecalco in Hidalgo and Piedra Blanca in Querétaro and Hidalgo.

[3] Includes 416 MW of LFC's distributed generation project.

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

Source: Comisión Federal de Electricidad.

Important aspects of energy source security are orienting public politics toward other sources that offer solution alternatives to eliminate dependence on a single fuel. These sources are coal, liquefied natural gas, synthesis gas or syngas (from refining residues) and uranium, among others. Regarding the latter, technological

development in nuclear electric plants has progressed significantly and currently there are third-generation nuclear reactors on the market, such as the ABWR, offering better design and important advance in economic aspects.

As to the participation of each type of technology in the expansion program with respect to capacity in the construction and bidding phase and additional capacity, it is seen that combined-cycle plants prevail in both categories (see chart 13). The combination of electricity generating options is optimized when the projects comprised in the expansion program are those that result in a minimum cost to satisfy expected demand, with the required reliability level and conforming to the energy policy and sustainable development guidelines.

Chart 13

Additional capacity by technology, 2007-2016[1]

(MW)

Technology	Committed (MW)	Uncommitted (MW)	Total (MW)	Percentage share
Total [2]	**5,498**	**16,187**	**21,684**	**100.0**
Combined cycle	2,677	8,385	11,062	51.0
Steam turbine	0	0	0	0.0
Hydroelectric	1,500	1,164	2,664	12.3
Fuel-oil	0	0	0	0.0
Coal	678	2,100	2,778	12.8
Geothermal	0	158	158	0.7
Nuclear	0	0	0	0.0
Gas turbine [3]	416	36	452	2.1
Internal combustion	42	112	154	0.7
Wind energy	185	406	591	2.7
Free [4]	0	3,826	3,826	17.6

[1] Does not include rehabilitation, modernization and remote self-supply.
[2] Since figures are rounded up to integer numbers, totals may not be exact matches.
[3] Includes 416 MW of LFC's distributed generation project.
[4] Pursuant to article 125 of the Public Electric Energy Service Law's Regulation, bid calls will allow participants to confirm or propose the technology and fuel to be used in the generating plant.
Source: Comisión Federal de Electricidad.

4.3.4 Gross public utility generation, 2007-2016

In 2006, electricity generation for public utility increased to 225,079 GWh, representing a growth of 2.8% with respect to 2005. Electricity generation will rise at an annual average rate of 4.8% during the 2007-2016 period, to reach 365,156 GWh by the end of the period.

4.3.5 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 electricity generation. The technologies considered in the CRP are the criteria that define the required fuel. According to an energy source diversification strategy, the 2007-2016 expansion program takes into account the possibility of assigning free capacity to different energy sources, such as coal, synthesis gas or syngas[10], uranium and, in some cases, electric energy imports.

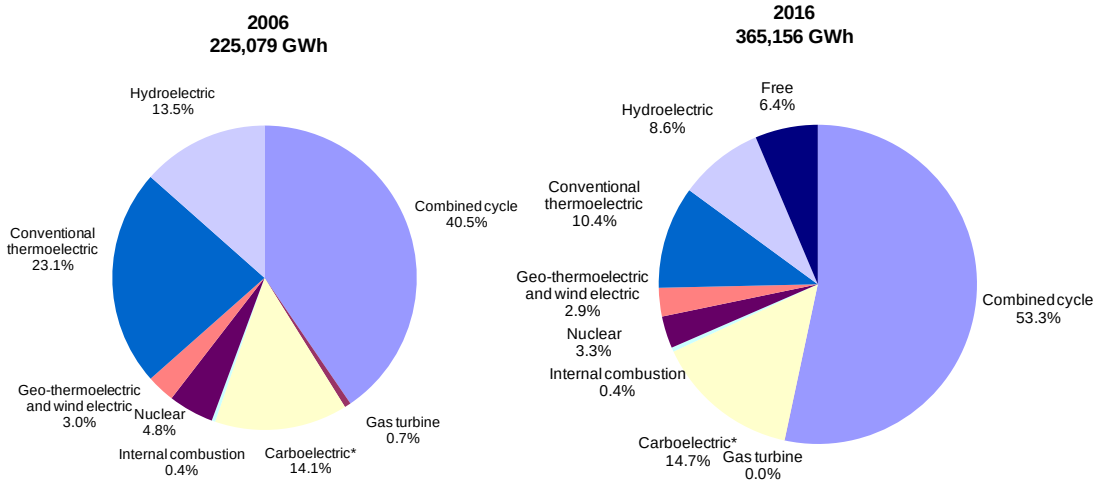
Fuel consumption projections indicate a total of 6,427 terajoules/day for 2016; the share of natural gas will be 64%, followed by coal and fuel oil with 20% and 17%, respectively (see graph 8).

[10] Obtained from the gasification of solid and liquid refining residues.

Graph 7

Public service's gross generation projection by technology, 2006-2016

(GWh)

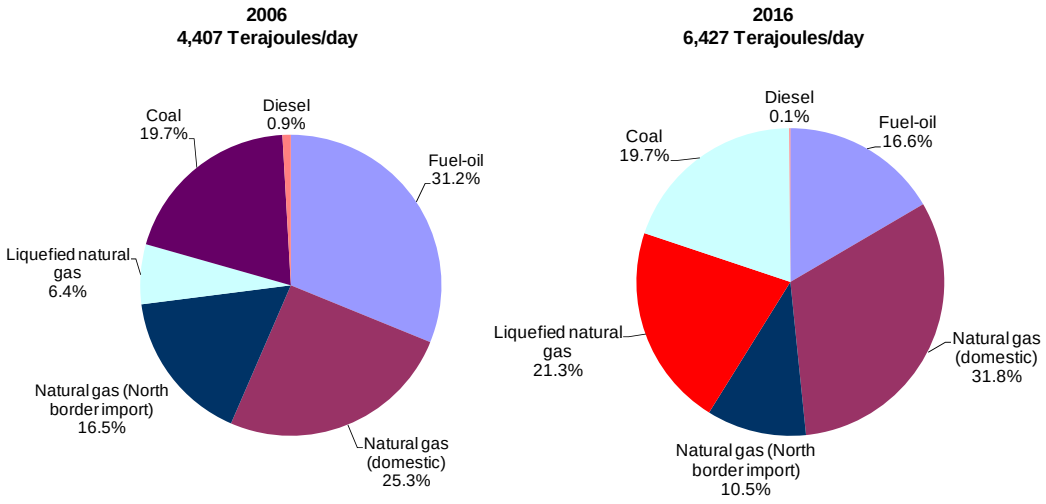


*Includes the dual Petacalco plant.
Source: Comisión Federal de Electricidad.

Specifically, the fuel with the greatest increase in use will be natural gas with an annual average of 6.8%, while diesel will have the greatest annual decrease with –15.8%, followed by fuel oil with –2.5%. Coal usage will increase at an annual rate of 3.9%; this average variation however could increase considering that part of the free capacity could be assigned to projects that use this fuel.

Graph 8

Fossil fuels demand projection for electric generation, 2006-2016



Source: Comisión Federal de Electricidad.

4.4 Self-supply and cogeneration

Self-supply and cogeneration concessionaires have increased their share in recent years, so that they represent a significant capacity within the national electric system. These projects attend to part of the domestic electric energy consumption, and influence the public utility system by requiring transmission and backup services. This makes the installation of additional generating capacity necessary and requires adjustments to the transmission grid's expansion program.

Schematically, (see figure 1), the analysis and planning of NES includes self-supply and cogeneration plants in order to evaluate their impact upon the 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.

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. On the other hand, 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:

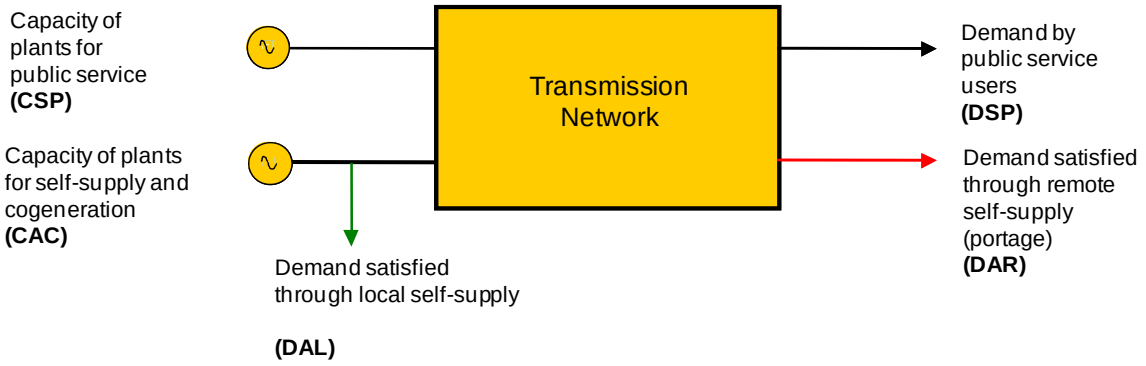
Remote demand (DAR): corresponds to the loads located at sites far away from generating plants, satisfied through the public utility transmission grid.

Local demand (DAL): corresponds to the load located close to generating plants, that does not make use of the public utility transmission grid.

In 2006, the greatest capacity installed by concessionaires 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 electric energy needs.

Figure 1

National Electric System (NES)



Source: Comisión Federal de Electricidad.

On the other hand, since the start of operations of two thermoelectric plants (Peñoles y del Golfo) in 2004, no other large-scale self-supply projects have been undertaken. However, during 2005 and 2006 the number of permits issued for small-scale self-supply has significantly increased. As a cost mitigation strategy, many companies of 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 running on diesel. This type of self-supply is mainly local.

In terms of installed capacity for remote self-supply, Iberdrola Energía Monterrey with 527 MW, Termoeléctrica Peñoles and Golfo with 230 MW each, as well as Tractebel with 229 MW (see chart 14) stand out.

It is worth mentioning that unlike in the *Outlook on the electricity sector for 2006-2015*, this planning scheme does not consider the Pemex Tula cogeneration project, since the assessment performed by Pemex at the closing of this program indicates that the most viable projects are Nuevo Pemex with a capacity of 313 MW and a local self-supply project at the Minatitlán Refinery with 43 MW (see chart 15). Regarding the type of fuel considered for these projects, this Outlook utilizes natural gas for both cases as the primary fuel.

Chart 14

Self-supply and cogeneration projects additional capacity *, 2006-2016

(MW)

	2006**	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total	**1,548**	**1,621**	**1,990**	**2,066**	**3,697**	**3,697**	**4,129**	**4,129**	**4,129**	**4,129**	**4,129**
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	527	527	527	527	527	527	527	527	527	527	527
Energía Azteca VIII	20	20	20	20	20	20	20	20	20	20	20
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	9	9	9	9	9	9	9	9	9	9	9
Impulsora Mexicana de Energía	10	10	10	10	10	10	10	10	10	10	10
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	18	18	18	18	18	18	18	18	18	18	18
Italaise	1	1	1	1	1	1	1	1	1	1	1
Pemex Cosoleacaque	12	12	12	12	0	0	0	0	0	0	0
Pemex Lázaro Cárdenas	6	6	6	6	0	0	0	0	0	0	0
Pemex Independencia	46	46	46	46	0	0	0	0	0	0	0
Pemex Petroquímica Morelos	20	20	20	20	0	0	0	0	0	0	0
Pemex Pajaritos	16	16	16	16	0	0	0	0	0	0	0
Pemex Escolín	14	14	14	14	0	0	0	0	0	0	0
Pemex La Venta	17	17	17	17	0	0	0	0	0	0	0
Pemex Petróleos Mexicanos (Independencia)	6	6	6	6	6	6	6	6	6	6	6
Pemex Cactus	21	21	21	21	0	0	0	0	0	0	0
Mexicana de Hidroelectricidad Mexhidro		29	29	29	29	29	29	29	29	29	29
Procter & Gamble Manufactura		44	44	44	44	44	44	44	44	44	44
Eoliatec del Istmo			20	20	20	20	20	20	20	20	20
BII NEE STIPA Energía Eólica			22	22	22	22	22	22	22	22	22
Parques Ecológicos de México			79	79	79	79	79	79	79	79	79
Eurus			248	248	248	248	248	248	248	248	248
Eléctrica del Valle de México				49	49	49	49	49	49	49	49
Fuerza Eólica del Istmo (1a. Etapa)				27	27	27	27	27	27	27	27
Fuerza Eólica del Istmo (2a. 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					304	304	304	304	304	304	304
GDC Generadora							432	432	432	432	432

* Considers only remote self-supply.

** Existing capacity by December 2006.

Since figures are rounded up to integer numbers, totals may not be exact matches.

Source: Comisión Federal de Electricidad.

Chart 15

Self-supply and cogeneration's capacity evolution*, 2006-2016

(MW)

	2006**	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total	**6,315**	**6,390**	**6,764**	**6,907**	**8,713**	**8,713**	**9,193**	**9,193**	**9,193**	**9,193**	**9,193**
Existing projects (without Pemex)	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992	1,992
Pemex	2,514	2,514	2,514	2,514	2,514	2,514	2,514	2,514	2,514	2,514	2,514
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	8	8	8	8	8	8	8	8	8	8	8
Impulsora Mexicana de Energía	24	24	24	24	24	24	24	24	24	24	24
Bioenergía de Nuevo León	7	7	7	7	7	7	7	7	7	7	7
Tractebel (Enron)	284	284	284	284	284	284	284	284	284	284	284
Agrogen	10	10	10	10	10	10	10	10	10	10	10
Proveedora de Electricidad de Occidente	19	19	19	19	19	19	19	19	19	19	19
Italaise	4	4	4	4	4	4	4	4	4	4	4
Mexicana de Hidroelectricidad Mexhidro		30	30	30	30	30	30	30	30	30	30
Procter & Gamble Manufactura		45	45	45	45	45	45	45	45	45	45
Eoliatec del Istmo			21	21	21	21	21	21	21	21	21
BII NEE STIPA Energía Eólica			23	23	23	23	23	23	23	23	23
Parques Ecológicos de México			80	80	80	80	80	80	80	80	80
Eurus			250	250	250	250	250	250	250	250	250
Pemex Minatitlán				43	43	43	43	43	43	43	43
Eléctrica del Valle de México				50	50	50	50	50	50	50	50
Fuerza Eólica del Istmo (1ra. Etapa)				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
Pemex Nuevo Pemex					313	313	313	313	313	313	313
GDC Generadora							480	480	480	480	480

* Does not include IPP. Considers local and remote self-supply, own use and surplus.

** Existing capacity by December 2006.

Source: Comisión Federal de Electricidad.

Regarding Pemex's remote self-supply, there is the Nuevo Pemex project, starting operations in 2010 with a capacity of 304 MW[11]. The planning also considers the open season self-supply projects based on wind energy 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 2012, using fluidized bed boiler technology for coal, with a remote self-supply capacity of 432 MW, and generating an average of 2,913 GWh by 2016 (see chart 16).

At the beginning of the period for which the estimations have been prepared, capacity will remain stable; as of 2010 and 2012 however, with the start of the Nuevo Pemex and GDC Generadora projects, respectively, capacity will increase.

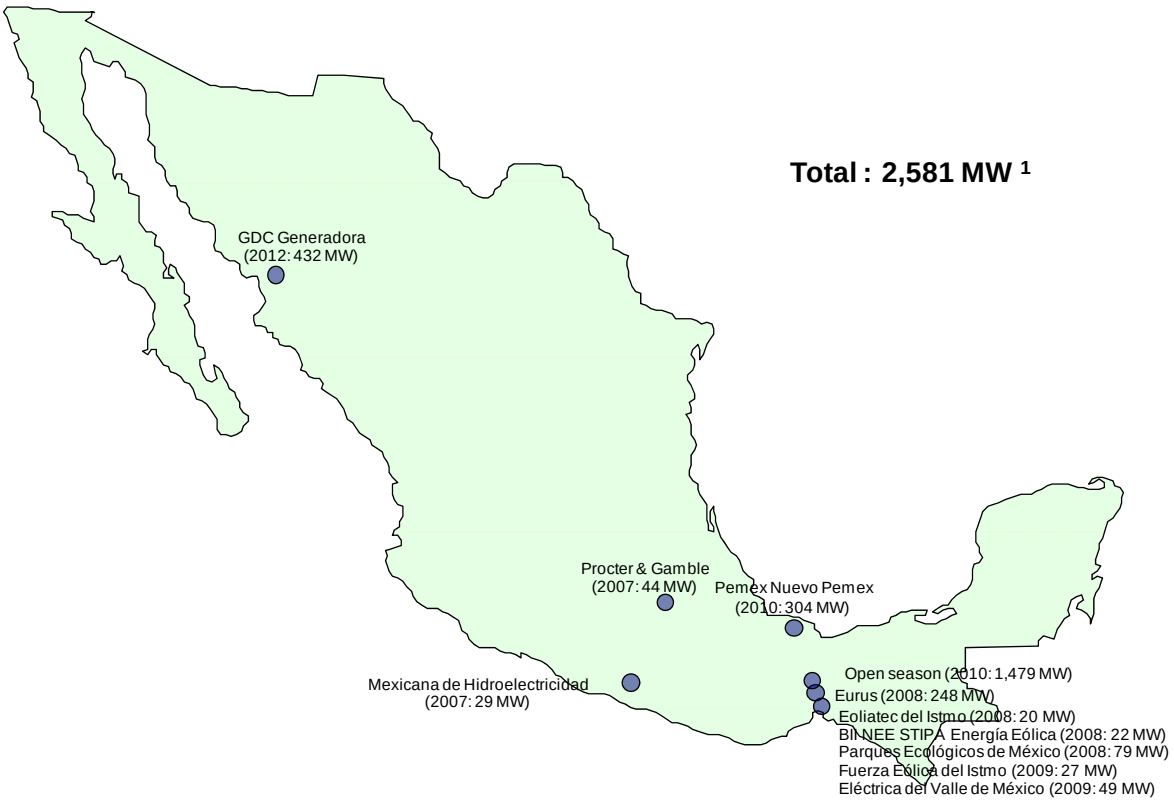
Map 3 shows the geographic location of new self-supply and cogeneration plants that have an important impact upon the system's reserve margin and the expansion of the transmission grid.

[11] See chart 31.

Map 3

Self-supply and cogeneration projects, 2007-2016

(remote self-supply capacity)



[1] Considers 152 MW of remote portage to be replaced by Nuevo Pemex.
Source: Comisión Federal de Electricidad.

Chart 16

Self-supply and cogeneration's energy generation*, 2006-2016

(GWh)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total	**8,937**	**9,791**	**10,140**	**11,117**	**12,962**	**18,516**	**21,154**	**21,060**	**20,437**	**21,024**	**20,912**
Arancia	35	49	54	49	49	49	54	49	49	54	49
Enertek	446	450	431	474	430	430	475	430	430	474	431
Micase	28	38	38	42	38	38	38	42	38	38	42
Iberdrola Energía Monterrey	2,859	3,336	3,303	3,249	3,136	3,236	3,478	3,236	3,211	3,482	3,246
Energía Azteca VIII	113	113	115	124	113	115	123	113	113	125	113
Energía y Agua Pura de Cozumel	14	67	67	73	67	67	67	73	67	67	73
Termoeléctrica del Golfo	1,461	1,443	1,466	1,412	1,357	1,499	1,461	1,412	1,382	1,412	1,461
Termoeléctrica Peñoles	1,580	1,459	1,484	1,426	1,229	1,429	1,413	1,488	1,399	1,429	1,480
Hidroelectricidad del Pacífico	37	50	50	55	50	50	55	50	50	55	50
Impulsora Mexicana de Energía	8	58	58	64	58	58	64	58	58	64	58
Bioenergía de Nuevo León	32	40	40	44	40	40	44	40	40	44	40
Tractebel (Enron)	1,643	1,464	1,499	1,418	1,321	1,484	1,553	1,404	1,344	1,549	1,409
Agrogen	19	34	34	37	34	37	34	34	34	37	34
Proveedora de Electricidad de Occidente	54	100	101	111	100	100	101	111	100	100	111
Italaise	1	6	7	6	6	6	7	6	6	7	6
Pemex Cosoleacaque	61	70	70	77	0	0	0	0	0	0	0
Pemex Lázaro Cárdenas	7	7	7	7	0	0	0	0	0	0	0
Pemex Independencia	172	172	172	172	38	47	52	47	47	52	47
Pemex Petroquímica Morelos	73	73	73	73	0	0	0	0	0	0	0
Pemex Pajaritos	118	118	118	118	0	0	0	0	0	0	0
Pemex Escolín	72	72	72	72	0	0	0	0	0	0	0
Pemex La Venta	32	32	32	32	0	0	0	0	0	0	0
Pemex Cactus	72	115	116	114	0	0	0	0	0	0	0
Mexicana de Hidroelectricidad Mexhidro		168	168	185	128	168	186	168	168	168	186
Procter & Gamble Manufactura		258	259	258	195	258	259	285	258	258	286
BII NEE STIPA Energía Eólica			39	77	57	77	77	77	77	77	77
Parques Ecológicos de México			161	277	207	277	277	277	277	277	277
Eurus			72	869	619	869	869	869	869	869	869
Eoliatec del Istmo			35	70	287	575	577	575	575	627	577
Eléctrica del Valle de México				86	132	172	172	172	172	172	172
Fuerza Eólica del Istmo (1ra. Etapa)				47	75	95	95	95	95	95	95
Fuerza Eólica del Istmo (2da. Etapa)					96	176	176	177	192	176	178
Preneal México					584	1,555	1,414	1,423	1,542	1,410	1,427
Desarrollos Eólicos Mexicanos					351	894	814	887	818	811	821
Gamesa Energía					369	1,129	1,026	1,033	1,119	1,023	1,036
Eoliatec del Pacifico					118	630	573	625	576	571	632
Unión Fenosa					351	894	814	818	887	811	821
Pemex Nuevo Pemex					1,330	2,061	1,875	2,061	1,789	2,039	1,898
GDC Generadora							2,934	2,926	2,654	2,654	2,913

* Does not include IPP. Considers remote self-supply.

Source: Comisión Federal de Electricidad.

4.5 National transmission grid's evolution

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 the expected risk of energy supply impossibility due to possible defects of the system's elements.

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

Projects to become part of the transmission grid are evaluated 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.

According to the medium-term transmission program, between 2007 and 2011, 13,168 km of lines with voltage levels between 69 kV and 400 kV and 29,302 MVA are planned to be incorporated into the electric system in reduction substations (see map 4).

Chart 17 summarizes the transmission capacity of the main internal and external links to the control areas of NES that increase transmission capacity and the reliability of supply to the major consumption centers, for the period between 2007 and 2011.

It shows transmission capacity through links between NES regions during the 2007-2011 period under normal operating conditions. Chart 43 shows the evolution of transmission capacity between links under peak demand conditions.

The maximum use of links is due mainly to maintenance operations performed on generating units, the forced outage of generating and/or transmitting elements, and to peak demand conditions.

Charts 18, 20 and 21 show the main transmission, transformation and compensation projects, respectively, featured in the period between 2007 and 2011.

The Mexico-Guatemala interconnection projects through the Tapachula Potencia-Suchiate transmission line are considered relevant, as is the interconnection between Mexico and the US through the Ciudad Industrial-Laredo and Cumbres-Sharyland links. These projects will facilitate support during emergencies and increase operation reliability. They will allow Mexico to participate in diverse electricity markets through power and energy transactions (see chart 18).

Map 4

NES: Intra-regional transmission capacity, 2011

(MW)

Source: Comisión Federal de Electricidad.

Chart 17

NES: Transmission capacity expansión, 2007-2011

(MW)

Interconnection			Initial capacity 2007	Capacity increase	Total capacity 2011
Region Substation	Region Substation	Voltage kV	MW	MW	MW
Nacozari	Hermosillo	400[a], 230	150	350	500
Obregón	Los Mochis	400[a], 230	400	250	650
Mazatlán	Culiacán	400[c], 230	750	450	1,200
Mazatlán	Durango	400[b], 230	250	50	300
Mazatlán	Tepic	400	750	150	900
Río Escondido	Nvo. Laredo	400, 230	330	195	525
Manzanillo	Guadalajara	400, 230	1,700	950	2,650
Guadalajara	Aguascalientes	400	950	600	1,550
Guadalajara	Salamanca	400, 230	550	650	1,200
Querétaro	San Luis Potosí	230	200	200	400
Lázaro Cárdenas	Central	400	1,700	400	2,100
Lázaro Cárdenas	Acapulco	400[a], 230, 115	250	400	650
Veracruz	Temascal	230	250	120	370
Temascal	Puebla	400	3,110	140	3,250
Coatzacoalcos	Temascal	400	1,064	226	1,290
Grijalva	Tabasco	400[d], 230	561	779	1,340
Nacozari	Moctezuma	400[a]	180	180	360
Moctezuma	Chihuahua	400[a], 230	500	50	550
Laguna	Durango	400[b], 230	250	50	300
Río Escondido	Chihuahua	400	350	50	400
Tabasco	Lerma	400[d], 230	480	620	1,100
Lerma	Mérida	400[d], 230, 115	450	650	1,100
Mérida	Chetumal	230, 115	150	110	260
Tijuana	Ensenada	230, 115	200	150	350
Mexicali	S. Luis R. Colorado	230, 161	215	155	370
La Paz	Los Cabos	230, 115	130	110	240

[a] TL insulated at 400 kV, initial operation 230 kV.

[b] TL insulated at 400 kV, initial operation 230 kV. Voltage shift in 2008.

[c] TL insulated at 400 kV, initial operation 230 kV. Voltage shift in 2009.

[d] TL insulated at 400 kV, initial operation 230 kV. Voltage shift in 2010.

Source: Comisión Federal de Electricidad.

Chart 18
NES: Major programmed transmission lines, 2007-2011

Transmission line	Voltage (kV)	Circuit number	Length (km-c)	Start of operation
Total			**5,760.2**	
Ciudad Industrial - Laredo	230	2	19.0	ene-07
Cruz Azul Maniobras - Cycna	400	1	15.6	abr-07
El Salero - Peñasquito	400	1	45.0	may-07
Santa Lucía - Macuspana II	400	2	131.5	may-07
Nogales Aeropuerto - Nogales Norte	230	2	24.1	jun-07
Parque Industrial San Luis Entq. Cerro Prieto I - Hidalgo	230	2	51.0	jun-07
Jilotepec Potencia - Dañu	230	2	37.3	jul-07
Mesteñas Entq. Francisco Villa - Minera Hércules	230	2	51.6	jul-07
La Parota Entq. Amates - Playa Diamante	230	2	50.0	jul-07
Samalayuca Sur - Valle de Juárez	230	2	116.2	ago-07
Terranova Entq. Samalayuca Sur - Valle de Juárez	230	2	28.2	ago-07
Tula CT - Nochistongo	230	2	44.0	sep-07
Hermosillo 4 - Esperanza I	230	2	63.1	sep-07
El Potosí - Moctezuma	230	1	49.4	nov-07
Tapachula Potencia - Suchiate	400	2	27.0	dic-07
Moctezuma - Nuevo Casas Grandes II	400	2	164.8	abr-08
Las Américas - PI El Fresnal	400	2	16.8	sep-08
El Fresnal - Cananea	230	2	150.8	sep-08
Metrópoli - Tijuana I	230	4	8.2	sep-08
Cerro Prieto II - Parque Industrial San Luis	230	2	54.1	oct-08
La Trinidad - Jerónimo Ortiz	230	2	77.0	oct-08
Nacozari - Hermosillo 5	400	2	200.0	nov-08
Victoria - Valle de México	400	2	50.0	nov-08
Tula CT - Teotihuacan	230	2	132.0	nov-08
Sabancuy II - Concordia (Repotenciación)	230	2	82.0	ene-09
Las Glorias Entq. Villa de García - Aeropuerto	400	2	30.0	may-09
Las Glorias - Huinalá	400	1	8.0	may-09
Regiomontano Entq. Huinalá - Laja	400	2	26.0	may-09
La Ciénega - Oaxaca Potencia	230	1	26.5	may-09
Tapeixtles Potencia - Tecomán	230	2	76.0	may-09
Temascal II - Oaxaca Potencia	230	2	132.9	may-09
Malpaso - Macuspana II	400	2	113.0	jun-09
Mexicali II - Tecnológico	230	2	16.0	jun-09
Encino II Entq. Francisco Villa - Chihuahua Norte	230	2	16.0	oct-09
Encino II Entq. Francisco Villa - Ávalos (L1)	230	2	16.0	oct-09
Ixtapa Potencia - Pie de la Cuesta Potencia	400	2	206.5	nov-09
Lázaro Cárdenas Potencia - Ixtapa Potencia	400	2	75.3	nov-09
Juile - Cerro de Oro	400	2	154.1	dic-09
La Ventosa - Juile C1 y C2	400	2	290.0	dic-09
La Ventosa - Juile C3	400	1	145.0	dic-09
Laguna Verde - Jamapa	400	2	180.0	dic-09
Tabasco - Escárcega	400	2	185.0	dic-09
Jamapa - Dos Bocas	230	2	10.0	dic-09
Jamapa Entq. Jardín - Temascal II	230	2	20.0	dic-09
Jamapa Entq. Veracruz II - Dos Bocas	230	2	7.0	dic-09
Jamapa Entq. Veracruz II - Temascal II	230	2	20.0	dic-09
Las Américas - El Fresnal	230	2	17.4	mar-10
Angostura - Tapachula Aeropuerto	400	2	193.5	may-10
Ixtlahuacan - Zapotlanejo	400	1	21.0	ago-10
Zapotlanejo Entq. Atequiza - Aguascalientes Potencia	400	2	38.0	ago-10
Carapan II - Uruapan Potencia	230	2	69.1	ago-10
Carapan II - Zamora Potencia	230	1	32.7	ago-10
CC Ensenada Entq. Presidente Juárez - Lomas	230	2	22.0	oct-10
CC Ensenada Entq. Presidente Juárez - Ciprés	230	2	22.0	oct-10
San Luis de la Paz II - Las Delicias	230	2	10.0	feb-11
Santa Ana - Loma	230	2	150.0	abr-11
Nuevo Vallarta Entq. Tepic II - Vallarta Potencia	230	2	20.0	jun-11
Arroyo del Coyote - Carbón II	400	2	179.1	jul-11
La Parota - Yautepec Potencia	400	2	550.0	jul-11
Hermosillo 4 - Hermosillo 5	230	2	33.0	jul-11
Piedras Negras Potencia - Acuña II	230	2	172.0	jul-11
Atlacomulco Potencia - Vidrio Potencia	400	2	84.0	oct-11
Manzanillo I - Chapala	400	2	170.0	oct-11
Obregón 4 - Pueblo Nuevo	400	2	70.0	oct-11
Planta Guaymas II - Obregón 4	400	2	128.4	oct-11
Pueblo Nuevo - Guamuchil 2	400	2	260.0	oct-11
Juchitán II - Salina Cruz	230	2	76.0	dic-11

Source: Comisión Federal de Electricidad.

Chart 19
NES: Intra-regional link transmission capacity under peak-demand conditions 2007-2011

Interconnection			2007	2008	2009	2010	2011
Region	Region	Voltage kV			Capacity MW		
Nacozari	Hermosillo	400[a], 230	150	500	500	500	500
Hermosillo	Obregón	230	400	400	400	400	400
Obregón	Los Mochis	400[a], 230	400	400	400	400	650
Los Mochis	Culiacán	400[a], 230	650	650	650	650	650
Mazatlán	Culiacán	400[c], 230	750	750	1,200	1,200	1,200
Mazatlán	Durango	400[b], 230	250	300	300	300	300
Mazatlán	Tepic	400	750	800	900	900	900
Río Escondido	Nuevo Laredo	400, 230	330	330	330	330	525
Reynosa	Nuevo Laredo	138	80	80	80	80	80
Matamoros	Reynosa	400, 230, 138	1,385	1,385	1,385	1,385	1,385
Río Escondido	Monterrey	400, 230	2,100	2,100	2,100	2,100	2,100
Reynosa	Monterrey	400, 230	1,393	1,393	1,393	1,393	1,393
Monterrey	Huasteca	400	765	765	765	765	765
Saltillo	Aguascalientes	400	1,200	1,200	1,200	1,200	1,200
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	1,500	1,500	1,500	1,500	1,500
Huasteca	Valles	400	1,100	1,100	1,100	1,100	1,100
Huasteca	Tamazunchale	400	1,500	1,500	1,500	1,500	1,500
Monterrey	Saltillo	400	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	1,700	2,650
Guadalajara	Aguascalientes	400	950	950	950	1,550	1,550
Guadalajara	Salamanca	400, 230	550	550	550	1,200	1,200
Guadalajara	Carapan	230, 400	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	200	400
Salamanca	Querétaro	400, 230	1,300	1,300	1,300	1,300	1,300
Querétaro	Central	400, 230	1,800	1,800	1,800	1,800	1,800
Lázaro Cárdenas	Central	400	1,700	1,700	2,100	2,100	2,100
Lázaro Cárdenas	Acapulco	400[a], 230, 115	250	250	650	650	650
Tijuana	Mexicali	230	520	520	520	520	520
Tijuana	Ensenada	230, 115	200	220	220	220	350
CFE - ACBC	EUA - WECC	230	800	800	800	800	800
Mexicali	San Luis Río Colorado	230, 161	215	215	370	370	370
Villa Constitución	La Paz	115	90	90	90	90	90
La Paz	Los Cabos	230, 115	130	130	240	240	240
Acapulco	Puebla	230	270	270	270	270	270
Poza Rica	Central	400	3,500	3,500	3,500	3,500	3,500
Puebla	Central	400, 230	2,560	2,560	2,560	2,560	2,560
Veracruz	Puebla	400	1,500	1,500	1,500	1,500	1,500
Veracruz	Temascal	400, 230	250	250	370	370	370
Veracruz	Poza Rica	400	600	600	600	600	600
Grijalva	Temascal	400	2,150	2,150	1,500	1,500	1,500
Grijalva	Coatzacoalcos	400	1,960	1,960	1,750	1,750	1,750
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	1,064	1,064	1,290	1,290	1,290
Grijalva	Tabasco	400[d], 230	561	561	993	1,340	1,340
Nacozari	Moctezuma	400[a]	180	360	360	360	360
Juárez	Moctezuma	230	600	600	600	600	600
Moctezuma	Chihuahua	400[a], 230	500	500	500	550	550
Chihuahua	Laguna	230	250	250	250	250	250
Laguna	Durango	400[b], 230	250	300	300	300	300
Durango	Aguascalientes	230	200	200	200	200	200
Laguna	Saltillo	400, 230	300	300	300	300	300
Río Escondido	Chihuahua	400	350	350	350	400	400
Tabasco	Lerma	400[d], 230	480	480	480	1,100	1,100
Lerma	Mérida	400[d], 230, 115	450	450	450	1,100	1,100
Mérida	Cancún	400[a], 230, 115	560	560	560	560	560
Mérida	Chetumal	230, 115	150	150	150	150	260

[a] TL insulated at 400 kV, initial operation 230 kV.
[b] TL insulated at 400 kV, initial operation 230 kV. Voltage shift in 2008.
[c] TL insulated at 400 kV, initial operation 230 kV. Voltage shift in 2009.
[d] TL insulated at 400 kV, initial operation 230 kV. Voltage shift in 2010.
Source: Comisión Federal de Electricidad.

Chart 20
Major programmed transformation equipment, 2007-2011

Substation	Quantity	Equipment	Capacity (MVA)	Transformation ratio	Start of operation
Total			**19,300**		
Arroyo del Coyote Bco. 3	4	T	500	400 /138	may-07
Puerto Altamira Bco. 1	4	T	500	400 /115	may-07
Llano Grande Bco.1	4	AT	300	230 /138	may-07
Xul-Ha Bco. 3	3	AT	100	230 /115	may-07
Jilotepec Potencia Bco. 1	4	AT	300	230 /115	jul-07
Chilpancingo Potencia Bco.1	4	AT	133	230 /115	jul-07
Guadalajara Industrial Bco. 1	4	T	300	230 /69	oct-07
Niños Héroes Bco. 3 (SF_6)	4	T	133	230 /69	oct-07
El Potosí Bco. 3	4	T	500	400 /115	nov-07
Mazatlán II Bco. 8	4	T	500	400 /115	ago-08
Bacum Bco. 1	4	AT	300	230 /115	ago-08
Guaymas Cereso Bco. 1	4	AT	133	230 /115	ago-08
La Higuera Bco. 2	4	AT	500	400 /230	ene-09
Guerreño Bco.1	4	T	500	400 /138	may-09
Papantla Bco. 1	4	T	500	400 /115	may-09
Las Glorias Bco. 1	4	T	500	400 /115	may-09
Cerro de Oro Bco. 1	4	T	500	400 /115	may-09
Tapeixtles Potencia Bco. 3	4	T	500	400 /115	may-09
Regiomontano Bco. 1	4	T	500	400 /115	may-09
La Malinche Bco. 1	4	AT	300	230 /115	may-09
Tabasco Bcos. 1 y 2	7	AT	875	400 /230	jun-09
Tesistán Bco. 5	4	T	500	400 /69	ago-09
Lázaro Cárdenas Potencia Bco. 4	3	AT	375	400 /230	nov-09
Vicente Guerrero II Bco. 1	4	AT	133	230 /115	nov-09
La Ventosa Bcos. 4, 5 y 6	10	AT	1,250	400 /230	dic-09
Jamapa Bcos. 1 y 2	7	AT	875	400 /230	dic-09
Ticul II Bcos. 2 y 3	7	AT	875	400 /230	dic-09
La Ventosa Bcos. 1, 2 y 3	10	T	1,250	400 /115	dic-09
Dos Bocas Bco. 7 (SF_6)	4	AT	300	230 /115	dic-09
Tepic II Bco. 2 Sust.	4	AT	300	230 /115	feb-10
Loma Bco. 2	3	AT	225	230 /115	mar-10
Cañada Bco. 3	4	T	500	400 /115	abr-10
Carapan II Bco. 3	4	T	500	400 /115	jun-10
San Luis de la Paz II Bco. 2	4	AT	300	230 /115	feb-11
Metrópoli Bco. 2	4	AT	300	230 /115	mar-11
Potrerillos Bco. 4	4	T	500	400 /115	abr-11
Yautepec Potencia Bco. 5	3	T	375	400 /115	abr-11
Ramos Arizpe Potencia Bco. 2	3	T	375	400 /115	may-11
Nuevo Vallarta Bco. 1	4	AT	300	230 /115	jun-11
El Fresnal Bco. 1	4	AT	133	230 /115	ago-11
Salamanca II Bco. 2 Sust.	4	T	500	400 /115	nov-11
Panamericana Potencia Bcos. 1 y 2 Sust.	7	AT	233	230 /69	dic-11
Jardín (Aluminio) SF_6 Bco. 1	4	AT	300	230 /115	dic-11
Tagolaba Potencia Bco. 1	4	AT	300	230 /115	dic-11
Villahermosa Norte Bco. 2	3	AT	225	230 /115	dic-11

Source: Comisión Federal de Electricidad.

Chart 21

Main programmed reactive compensation equipment, 2007-2011

Substation	Equipment	Voltage (kV)	Capacity (MVAr)	Start of operation
Total			**2,384**	
Arroyo del Coyote MVAr	Reactor	400	83	may-07
Cumbres MVAr	Capacitor	138	18	ago-07
Jerónimo Ortiz MVAr	Reactor	400	100	dic-07
Cetys MVAr	Capacitor	161	58	may-08
Centro MVAr	Capacitor	161	46	may-08
González Ortega MVAr	Capacitor	161	12	may-08
Hermosillo 5 MVAr	Reactor	230	28	nov-08
La Higuera MVAr	Reactor	400	175	ene-09
El Palmar CEV	CEV[1]	115	0/150	jun-09
Donato Guerra MVAr Ampliación	Compensación Serie	400	536	nov-09
La Ventosa CEV	CEV[1]	400	300/300	dic-09
Escárcega MVAr	Reactor	400	233	dic-09
Juile MVAr	Reactor	400	75	dic-09
Arroyo del Coyote MVAr	Capacitor	138	30	ene-10
La Parota MVAr	Reactor	400	233	jul-11
Arroyo del Coyote MVAr	Reactor	400	62	jul-11
Guamuchil 2 MVAr	Reactor	230	21	oct-11
Compensación 22.5-45 MVAr	Capacitor	115	285	jul-11
Compensación 15 MVAr	Capacitor	115	300	jul-11
Compensación 7.5 MVAr	Capacitor	115	90	jul-11

[1] Static compensation.

Source: Comisión Federal de Electricidad.

Regarding the National Interconnected System (SIN for its Spanish acronym), studies to evaluate the technical and economic convenience of interconnecting the Baja California area with the SIN through an asynchronous link have been performed. It has been determined that this interconnection would offer, among others, the following benefits: satisfy the peak demand of the Baja California system with the generating resources of SIN and, during off-peak periods in Baja California, export the surplus capacity and energy of this area to the SIN, benefiting from the diversity of demand in these two systems. This interconnection would reduce total generation and production infrastructure investment costs. The interconnection of Baja California to SIN would create new opportunities for power and energy transactions with diverse power companies from western USA, using the current links with electric systems in California. Interconnection would be established with a 300-MW capacity asynchronous link in the first stage, scheduled to start operations in 2011.

4.6 Electricity sector's investment requirements, 2007-2016

For the period between 2007 and 2016, resources required to comply with the national expansion program and satisfy future electric energy needs increase to 63.7 billion dollars as of 2007 (see chart 22). 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.

Investment is composed as follows: 43.4% for generation, 19.5% for transmission, 24.2% for distribution, 11.8% for maintenance and 1.1% for other types of investments.

From the required total, 33.6% corresponds to Financed Public Works; 4.7% to Independent Power Production; 48.7% to budget works and the remaining 13.0% to financial schemes yet to be defined.

The requirements presented herein correspond to instant investments, excluding financial costs and including an amount for contingencies. (budget investment, financed public work and independent production)

Chart 22

National Electric System

Investment requirements 2007-2016 (2007 million pesos)[1]

(Budget Works, Public financed Works and Independent Power Production)

Concept	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Total	**52,927**	**64,200**	**78,611**	**75,756**	**73,201**	**76,698**	**70,451**	**70,519**	**68,161**	**66,014**	**696,539**
Generation	**17,108**	**20,091**	**31,671**	**32,403**	**30,236**	**34,271**	**37,047**	**36,407**	**33,256**	**29,825**	**302,315**
Combined cycles (IPP)	1,169	1,819	3,809	5,306	4,077	1,618	2,095	2,458	615	-	22,966
Wind energy plants (IPP)	1,007	1,043	3,778	4,175	-	-	-	-	-	-	10,003
Private investment (FPW)	12,592	13,060	18,716	17,356	16,340	17,700	17,991	16,962	12,296	6,867	149,880
Hydroelectric	2,521	2,211	3,194	4,482	4,626	5,179	3,190	3,156	2,891	1,851	33,301
Geo-thermoelectric and Wind	395	684	2,348	851	-	-	-	-	-	-	4,278
Combined cycles	5,259	2,321	6,868	7,838	6,235	3,269	1,659	2,364	2,585	803	39,201
Carboelectric	1,388	1,960	784	1,698	4,734	8,572	12,115	10,221	5,665	3,227	50,364
Diesel Units	24	346	781	684	497	680	1,027	1,221	1,155	986	7,401
Rehabilitation and modernization	3,005	5,538	4,741	1,803	248	-	-	-	-	-	15,335
*Budget Investment**	2,340	4,169	5,368	3,988	4,819	4,790	1,698	1,320	204	202	28,898
Works with scheme yet to be defined	0	0	0	1,578	5,000	10,163	15,263	15,667	20,141	22,756	90,568
Transmission	**14,053**	**11,828**	**15,497**	**14,231**	**15,760**	**15,351**	**12,398**	**11,730**	**12,147**	**12,916**	**135,912**
Private Investment (FPW)	8,286	7,080	8,907	6,433	2,620	7,158	5,303	4,751	4,916	5,087	60,541
Budget Investment*	5,767	4,748	6,590	7,798	13,140	8,193	7,095	6,979	7,231	7,829	75,371
Distribution	**13,110**	**22,859**	**22,830**	**20,210**	**18,294**	**18,430**	**12,279**	**13,194**	**13,596**	**14,015**	**168,817**
Private Investment (FPW)	1,850	3,609	4,631	1,456	449	1,998	2,017	2,478	2,566	2,657	23,711
Budget Investment*	11,260	19,250	18,199	18,754	17,845	16,432	10,262	10,716	11,030	11,358	145,106
Maintenance	**7,938**	**8,202**	**7,992**	**8,277**	**8,269**	**7,989**	**8,039**	**8,486**	**8,445**	**8,526**	**82,165**
Generating Units (IPP)	1,368	1,504	1,561	1,561	1,630	1,671	1,725	1,784	1,810	1,810	16,424
Generating Units (CFE and LFC)	6,570	6,698	6,431	6,716	6,639	6,318	6,314	6,681	6,560	6,587	65,516
Works with scheme yet to be defined	-	-	-	-	-	-	-	21	75	129	225
Other Budget Investments*	**718**	**1,220**	**622**	**635**	**642**	**656**	**688**	**702**	**717**	**732**	**7,331**

[1] Instant work cost (excluding financial costs) at constant prices, including 6% for contingencies in transmission and subtransmission projects (CFE), with data available by November 23, 2007.

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

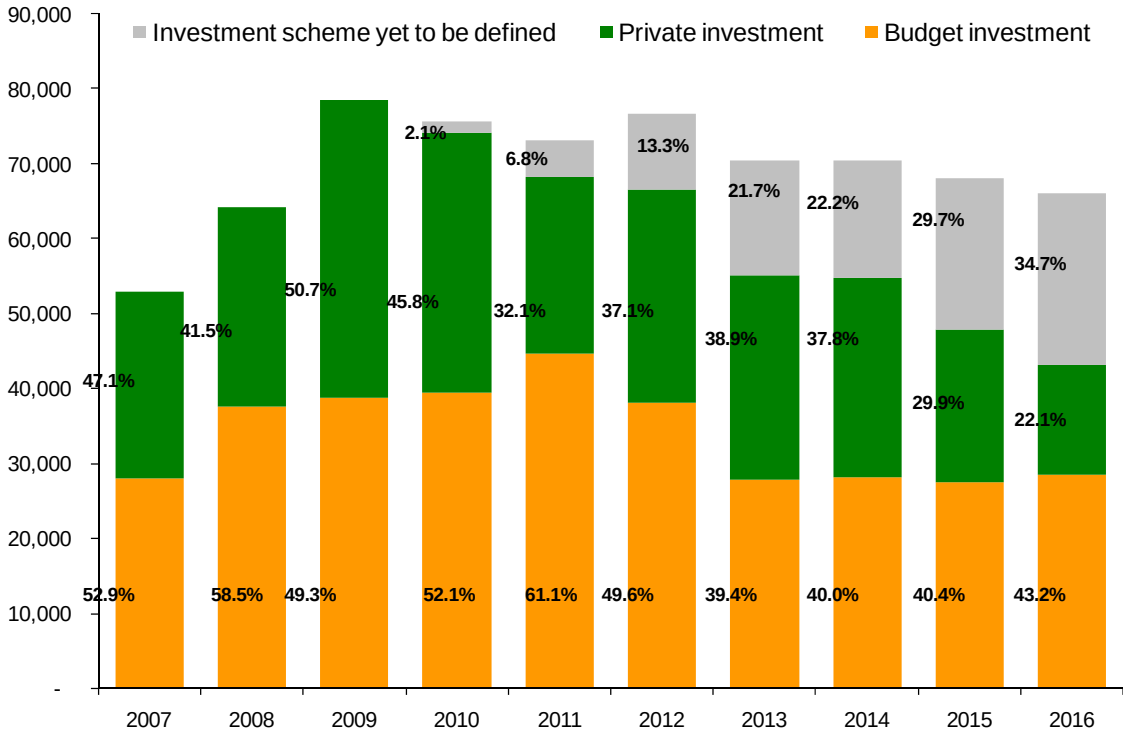
* Includes CFE and LFC.

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

Graph 9

Mexican electric sector's investment requirements 2007-2016

(2007 million pesos)



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

4.7 Technical options for the expansion of the generating grid

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

a) Typical projects for capacities and available generating 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 the expansion of NES are shown in chart 23. Thermoelectric projects currently in the evaluation phase have also been included (see chart 24). These projects represent an additional capacity of 12,055 MW.

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

Chart 23

Typical project's technical data and characteristics

Plant	Power (MW)	Gross efficiency (%)	Service life (years)	Typical plant factor	Own usage (%)
Conventional thermal	2 x 350	37.56	30	0.75	5.8
	2 x 160	36.31	30	0.65	6.2
	2 x 84	32.42	30	0.65	6.4
	2 x 37.5	30.63	30	0.65	8.3
Turbogas[1]					
Air-derived gas	1 x 43.4	37.97	30	0.125	1.1
Industrial gas	1 x 85	30.00	30	0.125	1.0
Industrial gas "F"	1 x 190	33.49	30	0.125	0.8
Industrial gas "G"	1 x 267	35.55	30	0.125	1.2
Air-derived diesel	1 x 41.3	38.40	30	0.125	0.8
Gas combined cycle[1]					
1 x 1 F	1 x 291	51.83	30	0.8	2.9
2 x 1 F	1 x 583	51.99	30	0.8	2.8
1 x 1 G	1 x 400	52.28	30	0.8	2.8
2 x 1 G	1 x 802	52.47	30	0.8	2.7
Diesel[2]	2 x 18.4	45.17	25	0.65	6.6
	4 x 9.7	43.64	25	0.65	7.4
	3 x 3.4	40.40	25	0.65	9.1
Carboelectric	2 x 350	37.84	30	0.8	7.2
C. Dual without/desulfurizer	1 x 700	43.08	30	0.8	6.4
C. Dual 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 determined under the following ISO conditions: environmental temperature of 15 degrees centigrade, relative humidity of 60% and pressure at sea level.
[2] Power and efficiency determined under ISO 3046/1-1986 conditions: environmental temperature of 25 degrees centigrade, relative humidity of 30% and barometric pressure of 1.0 bar.
Source: Comisión Federal de Electricidad.

Chart 24

Thermoelectric projects with finished and underway allocation studies

Area	Project	Unit number	Total feasible capacity (MW)	Current status	Remarks
Total SEN			**12,055**		
Baja California	Presidente Juárez conversión TG/CC	1 X 93	93	Site defined	Sitio CT Presidente Juárez
	CC Baja California III (Ensenada)	1X280	280	Ongoing study	Sitio La Jovita
Baja California Sur	CI Baja California Sur III (Coromuel)	1 X 43	43	Site defined	Sitio San Francisco
	CI Baja California Sur IV (Coromuel)	1 X 43	43	Site defined	Sitio San Francisco
	CI Guerrero Negro III	3X3.6	11	Site defined	Sitio Vizcaíno
Northeast	Noreste (Monterrey)	1 X 736	736	Ongoing study	Áreas Escobedo y Huinalá
	CC Tamazunchale II	1 x 750	750	Site defined	El Tepetate
Northwest	CC Agua Prieta II (híbrido)[1]	1 X 641	641	Site defined	Sitio Las Américas
North	CC Norte II (Chihuahua)	1 X 652	652	Site defined	Sitio El Encino
	CC Norte III (Juárez)	1 X 672	672	Ongoing study	
West	Manzanillo I repotenciación U1		760	Site defined	CT Manuel Álvarez
	Manzanillo I repotenciación U2		760	Site defined	CT Manuel Álvarez
	Manzanillo II repotenciación U1		810	Site defined	CT Manzanillo II
	Manzanillo II repotenciación U2		810	Site defined	CT Manzanillo II
	Guadalajara I	1 X 645	645	Ongoing study	Área Parques Industriales
	Guadalajara II	1 X 645	645	Ongoing study	Área Parques Industriales
Central	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
	Valle de México IV	1 X 601	601	Ongoing study	CT Valle de México
	Central I (Tula)	1 X 889	889	Site defined	CT Tula
	Central II (Tula)	1 X889	889	Site defined	CT Tula
East	San Lorenzo conversion TG/CC	1 X 123	123	Site defined	TG San Lorenzo, Puebla

[1] Includes 25 MW of solar field.
Source: Comisión Federal de Electricidad.

On the other hand, among the hydroelectric projects in the evaluation stage, La Parota (900 MW) is currently in the design stage while the Ixtayutla (900 MW) and Paso de la Reina (825 MW) projects in Oaxaca are in the feasibility evaluation stage (see chart 25).

As for geothermal projects, Cerro Prieto V's bidding process (107 MW) is soon to announced. According to the studies performed by CFE on the most feasible wind energy projects, La Venta III is currently in the bidding process, while the Oaxaca I-IV projects are undergoing feasibility studies (see chart 27).

Chart 25

Hydroelectric projects with finished and underway studies of prefeasibility, feasibility and design

Area	Project	Location	Number of units x power per unit[1]	Total capacity[1] (MW)	Average annual generation (GWh)	Study level[6]
Total				**7,718**	**19,051**	
East	San Juan Tetelcingo	Guerrero	3 x 203	609	1,313	F
East	Xúchiles	Veracruz	2 x 39	78	499	P
East	Tenosique (Kaplan)	Tabasco/Chiapas	3 x 140	420	2,328	F
West	San Cristóbal	Jalisco	2 x 37	74	146	P
West	Arroyo Hondo	Jalisco	2 x 38	76	220	F
North	PAEB Monterrey	Nuevo León	2 x 100	200	292	F
West	Omitlán	Guerrero	2 x 115	230	789	F
Baja California	PAEB El Descanso	Baja California	2 x 300	600	1,252	P
North	Madera	Chihuahua	2 x 138	276	726	F
West	Pozolillo	Nayarit	2 x 250	500	826	F
East	Ixtayutla	Oaxaca	3 x 300	900	1,841	F
East	Paso de la Reina	Oaxaca	3 x 275	825	2,022	F
East	La Parota[2]	Guerrero	3 x 300; 2 x 3	906	1,372	D
East	Copainalá (Kaplan)[3]	Chiapas	3 x 75	225	502	F
West	Mascota Corrinchis	Jalisco	2 x 17	34	51	P
West	PAEB Agua Prieta	Jalisco	2 x 120	240	310	P
Baja California	PAEB Tecate	Baja California	2 x 300	600	1,252	P
East	Acala (Bulbo)	Chiapas	3 x 45	135	310	P
East	Sistema Cosautlán	Veracruz	3 x 12	36	151	GV
East	Sistema Pescados	Veracruz	3 x 66	198	940	GV
West	Amuchiltite	Jalisco	2 x 39	78	173	P
Northwest	Guatenipa	Sinaloa	2 x 87	174	380	P
North	Urique	Chihuahua	2 x 95	190	419	P
East	Rehabilitación Bombaná[4]	Chiapas	-----	-----	66	
West	Sistema Río Moctezuma[5]	Hidalgo y Querétaro	2 x 40; 1 x 20; 1 x 14	114	871	F

[1] Power at generator's outlet.
[2] Power and generation include the Los Llamos regulating dam's miniplant.
[3] Considers current conditions of the Ing. Manuel Moreno Torres (Chicoasén) H.P. with 2,430 MW installed.
[4] Only contributes stream to the Chicoasén dam.
[5] Includes Jiliapan, Piedra Blanca and Tecalco projects.
[6] D: design F: feasibility P: pre-feasibility GV: great vision.
Source: Comisión Federal de Electricidad.

Chart 26

Installed capacity expansion in hydropower projects

Area	Project	Location	Number of units x power per unit[1]	Total capacity[1] (MW)	Annual average generation (GWh)	Study level[4]
Total				**778**	**925**	
Central	Villita Ampliación[2]	Michoacán	2 x 200	150	110	D
West	Ampliación Santa Rosa	Jalisco	1 x 49	49	41	F
Northwest	Ampliación Mocúzari	Sonora	1 x 7	7	42	F
Northeast	Ampliación Oviáchic	Sonora	1 x 6	6	26	F
Central	Ampliación Zimapán[3]	Hidalgo	2 x 283	566	706	D

[1] Power and generation resulting from expansion.
[2] Annual average generation resulting from capacity expansion. Does not consider plant modernization.
[3] Generating in peak hours; the Ing. Fernando Hiriart Balderrama (Zimapán dam) H.P. reduces its plant factor from 0.53 to 0.14.
[4] D: design F: feasibility.
Source: Comisión Federal de Electricidad.

Chart 27

Geothermal and wind power projects catalog

Area	Project	Unit number	Unit number x power per unit (MW)	State	Average annual generation (GWh)	Study level[1]
Total			**798**		**3,871**	
Geo-thermoelectric			**291**		**2,018**	
Baja California	Cerro Prieto V	2	107	Baja California	745	L
West	Cerritos Colorados 1a etapa	1	27	Jalisco	186	F
East	Los Humeros II condensación	1	27	Puebla	186	L
East	Los Humeros II baja presión	7	24	Puebla	156	L
West	Cerritos Colorados 2a etapa	2	53	Jalisco	372	P
East	Los Azufres III	1	54	Michoacán	372	P
Wind electric			**507**		**1,853**	
East	La Venta III	78	101	Oaxaca	361	L
East	Oaxaca I	78	101	Oaxaca	373	F
East	Oaxaca II	78	101	Oaxaca	373	F
East	Oaxaca III	78	101	Oaxaca	373	F
East	Oaxaca IV	78	101	Oaxaca	373	F

[1] L: to be put out to bid F: feasibility P: pre-feasibility.

Source: Comisión Federal de Electricidad.