MEXICO

(Updated 2012)

1. GENERAL INFORMATION

1.1. Country Overview

The United Mexican States, commonly known as Mexico, are located in the southern part of the North American continent. In the north, there is a common boundary with the United Sates; in the south, with Guatemala and Belize. To the east lie the Gulf of Mexico and the Caribbean Sea, and to the west, the Pacific Ocean. Mexico's extreme latitudes are 32°43'N in the north and 14°33'N in the south. Its extreme longitudes are 86°46' West of Greenwich in the east and 117°08' West of Greenwich in the west. The total surface area of Mexico is 1,964,400 km^2.

1.1.1. Governmental System

The United Mexican States are a federation whose government is representative, democratic and republican, based on the presidential system prescribed by the 1917 Constitution. The Constitution establishes three levels of government: the federal union, the state governments and the municipal governments. All officials at each of the three levels are elected by voters through first-past-the-post plurality, proportional representation or are appointed by other elected officials.

The federal government is constituted by the Powers of the Union, with three separate branches of government:

Legislative: the bicameral Congress of the Union composed of a Senate and a Chamber of Deputies. It makes federal law, declares war, imposes taxes, approves the national budget and international treaties, and ratifies diplomatic appointments.

Executive: the President of the United Mexican States, who is the head of state and government as well as commander-in-chief of the Mexican military forces. The President also appoints the Cabinet and other officers. The President is responsible for executing and enforcing the law, and has the authority to veto bills.

Judiciary: The Supreme Court of Justice, comprised of eleven judges appointed by the President with Senate approval, who interpret laws and judge cases of federal competency. Other institutions of the judiciary are the Electoral Tribunal, the collegiate, unitary and district tribunals, and the Council of the Federal Judiciary.

Source: Wikipedia

1.1.2. Geography and Climate

Two main features have to be taken into account regarding the climate of Mexico. These are firstly, the existence of two mountain ranges, one following the Pacific coast and the other the Gulf of Mexico, with a high plateau between the two ranges, and secondly, the fact that the country is divided

in two by the Tropic of Cancer. In a very broad sense, the climate south of the Tropic of Cancer is warm, with an average temperature around 22°C when the altitude above sea level is below 1,000 m, and with a temperate climate of an average 15°C above 1,000 m, with broad daily oscillations. North of the Tropic of Cancer, the climate is warm during the summer and cold during the winter, with occasional snowfalls. The four traditional seasons are only felt in some parts in the north of the country. The rest of the country divides the year into two periods: the rainy season, which lasts from April to September, and the dry season which embraces the rest of the year.

The Laguna Verde Nuclear Power Plant is located on the coast of the Gulf of Mexico, at latitude of 19°43'30" North and longitude of 96°23'15" West. The climate is warm and humid, with rain during the summer and little precipitation during the winter. The annual average humidity is 80%, and throughout the year the temperature oscillates between a minimum of 8°C and a maximum of 39°C. The prevailing winds, especially during summer, blow from the northeast, while during winter the site is affected by winds coming from the north with velocities of between 70 and 90 km per hour. The seawater, which is used as cooling water, has an average annual temperature of 27.5°C, with a maximum of 34°C during summer, and a minimum of 21°C in winter.

1.1.3. Population

In 2010, the Mexican population reached almost 112.3 million inhabitants (see Table 1), and was estimated to grow by 7.3 million in absolute terms. The population growth rate in 2010 was 10.6%, and the population density 57.17 inhabitants per square kilometer.

TABLE 1: POPULATION INFORMATION

							Average Annual Growth Rate (%)
Year	**1980**	**1990**	**2000**	**2005**	**2007***	**2010***	**2000 to 2010**
Population (Millions)	67.6	83.2	97.7	103.9	105.3	112.3	0.97
Population Density (Inhabitants/km^2)	34.5	42.5	49.7	52.9	53.6	57	0.97
Urban Population as % of Total	66.3	72.5	74.7	76	77	77.8	0.99
Area (1000 km^2)	1964.4						

*Latest Available Data
Source: INEGI

1.1.4. Economic Data

In Mexico, the services sector is the greatest component of GDP, followed by the industrial sector, with the agricultural sector comprising the least. Of the work force, it is estimated that 18% is employed in agriculture, 24% in industry and 58% in the services sector.

The manufacturing industry, despite its importance in national production, has faced a critical situation during recent years due to the increase in competitors. Effects of this have been intensified as it must compete against countries with different work and environmental regulations and different levels of government support.

In 2011, Mexico placed 10th among 182 nations, ranked by size of Gross Domestic Product. This was partly achieved through the benefits gained from high oil prices and through being home to the world's richest man.

According to the International Monetary Fund, Mexico was ranked the world's 10th largest economy, with a GDP of $1,154,784 million. This reflects an improvement in position compared to 2006, when it was in 14th place with a GDP of $282.811 million dollars.

This data shows that the Mexican economy has achieved an increase in the value of goods and services produced in a year. These are produced at a lower rate than other nations, which explains the lower place.

TABLE 2: GROSS DOMESTIC PRODUCT

							Average Annual Growth Rate (%)
	1990	**2000**	**2005**	**2007****	**2010****	**2011****	**2010 - 2011**
GDP (Millions of Current US$)	262710	581426	846990	1022820	1035400	1154784	11.53
GDP (Millions of Constant 2000 US$)	413325	581426	635322	846461	713749	674852	-5.45
GDP Per Capita (PPP* US$/Capita)	4711	8857	11113	14495	13932	14610	4.86
GDP Per Capita (Current US$/Capita)	3157	5935	7447	9844	10153	10153	10.14

* PPP: Purchasing Power Parity
** Latest Available Data
Source: IAEA Energy and Economic Database.

1.2. Energy Information

In 2011, Mexico was the ninth-largest oil producer in the world, and the third-largest in the Western Hemisphere. State-owned Petroleos Mexicanos (Pemex) holds a monopoly on oil production in the country and is one of the largest oil companies in the world. However, oil production within the country has begun to decrease, as production at the giant Cantarell field declines. The oil sector is a crucial component of Mexico's economy: while its relative importance to the general Mexican economy has declined, the oil sector still generates over 15% of the country's export earnings. More importantly, the government relies upon earnings from the oil industry (including taxes and direct payments from Pemex) for about 40% of total government revenue. Any decline in production at Pemex will therefore have a direct effect upon the country's overall fiscal balance.

1.2.1. Estimated available energy.

From 1979 to 2007, Mexico produced most of its oil from the large Cantarell Field, which used to be the second-biggest oil field in the world, rated by production levels. Because of falling production, in 1997, Pemex started a massive nitrogen injection project to maintain oil flow, which now consumes half of the nitrogen produced globally. As a result of the nitrogen injection, production at Cantarell rose from 1.1 million barrels per day (170×103 m^3/d) in 1996, to a peak of 2.1 million barrels per day (330×103 m^3/d) in 2004. However, during 2006, Cantarell's output fell by 25%, from 2.0 million barrels per day (320×103 m^3/d) in January to 1.5 million barrels per day (240×103 m^3/d) in

December, with the decline continuing through 2007. In mid-2008, Pemex announced that it would try to end the year with Cantarell producing at least 1.0 million barrels per day (160×103 m^3/d). However, in January 2008, Pemex said that the oil production rate at Cantarell had fallen to 811,000 barrels per day (129,000 m^3/d) by December 2008, a decline of 36% from a year earlier. This resulted in a decline of total Mexican oil production of 9.2%, from 3.1 million barrels per day (490×103 m^3/d) in 2007, to 2.8 million barrels per day (450×103 m^3/d) in 2008, the lowest rate of oil production since 1995.

As for its other fields, 40% of Mexico's remaining reserves are in the Chicontepec Field, which was brought into use in 1926. The field has remained undeveloped because the oil is trapped in impermeable rock, which requires advanced technology and a large number of oil wells for extraction. The remainders of Mexico's fields are smaller, more expensive to develop, and contain heavy oil trades at a significant discount to light and medium oil, which is easier to refine. To date, proven reserves are estimated to be worth 13,810 millions of barrels, while annual production in 2011 was 2873 mbd.

The energy sector in Mexico has certain limitations in terms of private participation, and foreign companies are allowed to operate in the country only through specific service contracts. As required by the Constitution, the electricity sector is federally owned, with the Federal Electricity Commission (Comisión Federal de Electricidad or CFE) essentially controlling the whole sector. Attempts to reform the sector have traditionally faced strong political and social resistance in Mexico, where subsidies for residential consumers absorb substantial fiscal resources.

The electricity sector in Mexico relies heavily on thermal sources (76.3% of total installed capacity), followed by hydropower generation (21.9 %). Although exploitation of solar, wind, and biomass resources has a large potential, geothermal energy is the only renewable source (excluding hydropower) with a significant contribution to the energy mix (1.9% of total generation capacity). Expansion plans for the period 2006-2015 estimate the addition of some 14.8 GW of new generation capacity by the public sector, with a predominance of combined cycles.

TABLE 3: ESTIMATED AVAILABLE ENERGY RESOURCES

	Fossil Fuels			***Nuclear***	***Renewables***
	Solid[(1)]	**Liquid[(2)]**	**Gas[(3)]**	**Uranium[(4)]**	**Hydro[(5)]**
Total Amount in Specific Units*	1211	1611	360	1300	59.8
Total Amount in Exajoules (EJ)	50.7	67.5	13.81	0.38	0.205

*Solid, Liquid: Million tons; Gas: ,million m^3; Uranium: Metric tons; Hydro, Renewable: TW

(*) Source: 20th WEC Survey of Energy Resources, 2008 and Uranium 2009: Resources, Production and Demand ("Red Book")

Source: IAEA Energy and Economic Database.

(1) Coal including Lignite: proved recoverable reserves, the tonnage within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology

(2) Crude oil and natural gas liquid (Oil Shale, Natural Bitumen and Extra-Heavy Oil are not included): proved recoverable reserves, the quantity within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology

(3) Natural gas: proved recoverable reserves, the volume within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology.

(4) Reasonably Assured Resources (RAR) under <UDS 130kgU

(5) Hydropower: technically exploitable capability, the amount of the gross theoretical capability that can be exploited within the limits of current technology.

Source: IAEA Energy and Economic Database.

1.2.2. Energy Statistics

Generation

The generation sector was opened to private participation in 1992. However, the *Comisión Federal de la Electricidad* (CFE), the state-owned utility, is the dominant player in the generation sector, with two-thirds of installed capacity. As of the end of February 2012, private generators held about 23.3% of generation capacity, mostly consisting of combined-cycle gas-fired turbines (CCGFT). Private generators have to sell all their output to CFE, as they are not allowed to sell directly to users. There is indeed a commercialization monopoly controlled by CFE.

Total private generation permits, awarded by CRE as of March 2012, are summarized in the table below:

Modality	**Number of permits**	**Total capacity (MW)**	**Percentage of total national capacity (%)**
Autogeneration	533	7946.8	15.52 %
Cogeneration	71	3535.1	6.9 %
Independent Power Production (IPP)	28	14289.7	27.92 %
Small Generation	7	80.2	.05 %

Consumption of electricity in 2011 was 170.42 TWh, which corresponds to 1,789 kWh per capita. Consumption share by sector was as follows:

· Residential: 25.82%

· Industrial: 57.85%

· Commercial: 6.72%

· Agriculture: 5.69%

· Services: 3.92%

TABLE 4: ENERGY STATISTICS

							Average Annual Growth Rate (%)
ENERGY CONSUMPTION	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2000 - 2007**
TOTAL	1.58	3.76	4.92	8.92	14.27	15.12	9.93
- Solids	0.17	0.23	0.26	0.40	0.22	0.25	-5.36
- Liquids	0.99	2.60	3.46	4.44	7.76	7.03	8.34
- Gases	0.42	0.93	0.97	1.64	1.89	2.12	4.20
- Nuclear	-	-	-	2.16	3.80	4.71	16.87
- Hydro	-	-	0.23	0.28	0.61	1.01	37.11
- Other Renewables	-	-	-	-	-	-	-
ENERGY PRODUCTION	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2000 - 2007**
TOTAL	1.74	5.89	7.77	10.20	16.75	18.37	11.44
- Solids* **	0.16	0.19	0.25	0.34	0.94	0.94	25.21
- Liquids	0.98	4.48	6.26	7.86	8.75	8.95	1.98
- Gases	0.45	1.04	0.96	1.55	2.39	3.45	17.51
- Nuclear	-	-	-	2.28	3.00	2.89	3.82
- Hydro	-	-	4.00	9.06	7.46	7.25	-2.85
- Other Renewables	-	-	-	-	-	-	-
NET IMPORT (IMP - EXP)	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2000 - 2007**
TOTAL	-0.07	-1.93	-2.74	-3.05	-223.89	-167.78	771.57

* Latest available data
** Energy consumption = Primary energy consumption + Net import (Import - Export) of secondary energy
*** Solid fuels include coal and lignite
Source: IAEA Energy and Economic Database

1.2.3. Energy policy

The Ministry of Energy (SENER) determines Mexico's energy policy within the current national framework, with the purpose of ensuring a competitive, high quality, affordable, reliable and environmentally sound energy supply to fuel economic growth.

This responsibility entails ensuring wide-spread access to affordable energy services, as well as fostering the development of industry leaders at the forefront of technology innovation, in both public and private firms.

SENER advocates energy efficiency through a substantial increase in international funds for research, development, diffusion and deployment of green appliances. It promotes the use of alternative sources of energy to deepen security of supply.

Diversification has been promoted especially in the electricity sector, with the inclusion of geothermal energy, nuclear energy, some solar energy, in rural areas isolated from the electrical grid, and recently with the addition of some wind energy.

The concept of integrating the energy markets of Mexico, the United States, and Canada is gaining popularity. Numerous pipelines and transmission lines already connect the United States and Canada, though few span the U.S.-Mexico border. Companies are building power plants in northern Mexico to generate electricity to satisfy rapid demand growth from industrial and residential users. Given Mexico's less burdensome environmental regulations relative to those of California, it is possible that more power plants will be planned for northern Mexico to help satisfy the energy needs of both northern Mexico and southern California. While greater integration of the United States and Mexico is progressing, Mexico should not be seen as a solution to future electricity-supply shortfalls in U.S. markets, such as those in California in 2001, certainly not in the short- to mid-term.

Mexico is a net energy exporter, and the difference between its energy production and consumption is mainly comprised of crude oil exports. Energy consumption in 2010 was estimated to increase to about 9.0 Quads at an average rate of increase of 2.8% per year.

1.3. The electricity system

1.3.1. Electricity policy and decision making process

The Federal Electricity Commission is a Mexican government entity that generates, transmits, distributes and sells electricity to more than 35.3 million customers, representing nearly 109 million people annually and incorporating more than a million new customers. The infrastructure for generating electric power is composed of 210 power stations with an installed capacity of 51,177.2 megawatts (MW).

23.3% of installed capacity corresponds to 22 stations built with private capital by Independent Power Producers (PIE), In the CFE, electricity is produced using different technologies and different primary energy sources. It has power plants, hydroelectric dams, coal plants, geothermal plants, wind power plants and nuclear plants.

To conduct electricity from generating plants to the home of each customer, the CFE has over 809,095 kilometers of transmission and distribution lines.

The power supply comes to 194,399 thousand seats (190,655 rural and 3744 urban). 97.61% of the population uses electricity, and in the last ten years, 42 thousand solar modules have been installed in small communities far from large population centers. This technology will be widely applied in the future for those communities that still lack access to electricity.

While the household sector comprises 88.39% of the customers, their sales represent 25.82% of total retail sales. A reverse situation occurs in the industrial sector, where less than 1% of customers represent 57.85% of sales.

The CFE is also the federal government entity responsible for planning the national electricity system, which is reflected in the Program of Works and Electricity Sector Investment (POISE). This describes the evolution of the electricity market and the expansion of generation and transmission capacity to meet demand over the next ten years, and is updated annually.

The company is committed to providing excellent services, ensuring a high quality in all its processes and operating at the level of the best electric companies in the world.

CFE is a public agency with legal personality and its own patrimony

1.3.2. Structure of electric power sector

Energy policy and, specifically, electricity industry policy, is the responsibility of the Ministry of Energy. Policy for the electricity industry is published in a document called "Electricity sector outlook", a 10 year program revised annually that incorporates analyses of present electricity demand and supply, the projected evolution of national and regional demand, the proposed expansion plan for generation, transmission and distribution capacity and the estimation of required investments. The elaboration of this program is coordinated by the Ministry of Energy, and done with the help of a multidisciplinary group formed by the Federal Electricity Commission (CFE), the Mexican petroleum company (PEMEX), the energy regulatory commission (CRE) and the Electricity Research Institute (IIE).

The external electricity trade is carried out through nine interconnections between the United States and Mexico and one interconnection with Belize. These connections have primarily been used to import and export electricity during emergencies. In 2007, Mexico exported 1.3 TWh of electricity from the United States, while importing 0.6 TWh.

Companies have built power plants near the United States-Mexico border, with the aim of exporting generation to the United States. There are also plans to connect Mexico with Guatemala and Belize as part of the Central American Interconnection System. The 400 kV Mexico-Guatemala interconnection line was commissioned in April 2009, and has an estimated transmission capacity of 200 MW from Mexico to Guatemala, and 70 MW in the opposite direction.

CFE is not a part of the North American Electric Reliability Corporation, although its transmission system in northern Baja California is part of the Western Electricity Coordinating Council and it has a few other interconnections across the border with the United States.

Most of the future generation capacity is expected to be based on gas-fired, combined-cycle type plants due to their cleaner emissions, lower investment costs, shorter construction periods and higher thermal efficiency compared to other conventional fossil fuelled plants.

1.3.3. Main Indicators

Installed electricity capacity in 2011 was 51.177 MW. Of the installed capacity, 73.6% is thermal, 21.9% hydro, 5% nuclear (Mexico has a single nuclear power plant, the 1,620 MW Laguna Verde nuclear reactor in Veracruz, which is operated by CFE (Comisión Federal de Electricidad)) and 1.7% renewable other than hydro. The general trend in thermal generation is a decline in petroleum-based fuels and growth in natural gas and coal. Since Mexico is a net importer of natural gas, higher levels

of natural gas consumption (i.e. for power generation) will likely depend upon higher imports from either the United States of via liquefied natural gas (LNG).

Gross generation was 257.88 TWh that same year (not including cogeneration and autogeneration), with 73.6% coming from conventional thermal sources, 21.9% from hydroelectricity, 5% from nuclear power and 1.7% from geothermal sources.

The expansion program contemplated by SENER for the period 2008-2017 includes the addition of 14,794 MW by the public service.

TABLE 5: ELECTRICITY PRODUCTION, CONSUMPTION & CAPACITY

							Average Annual Growth Rate (%)
Capacity of Electrical Plants [GWe]	**1980**	**1990**	**2000**	**2005**	**2007**	**2011**	**2000 - 2011**
- Thermal	10.77	19.23	29.15	33.67	37.27	38.13	2.8
- Hydro	6.06	7.88	9.62	10.53	11.34	11.45	1.7
- Nuclear	-	0.68	1.36	1.36	1.36	1.36	-
- Wind	-	-	0.00	0.00	0.09	0.087	-
- Geothermal	0.15	0.70	0.85	0.95	1.00	0.887	-
- Other Renewables	-	-	-	-	-	-	-
TOTAL	16.99	28.48	40.98	46.53	51.02	51.77	2.39
Electricity Production (TWh)	**1980**	**1990**	**2000**	**2005**	**2007**	**2011**	**2000- 2011**
- Thermal	49.13	90.84	145.52	171.440	175.812	205.135	3.72
- Hydro	16.91	23.54	33.08	27.61	27.04	35.79	0.74
- Nuclear	-	2.94	8.22	1.80	10.42	10.08	2.05
- Wind	-	-	0.01	0.01	0.25	0.35	309.09
- Geothermal	0.92	5.12	5.90	7.30	7.65	6.5	0.92
- Other Renewables	-	-	-	-	-	-	-
TOTAL**	66.96	122.44	192.73	217.17	231.18	257.88	3.07
Total Electricity Consumption (TWh)	**1980**	**1990**	**2000**	**2005**	**2007**	**20110**	**2000 - 2011**
TOTAL	2.68	4.90	7.71	8.69	9.25	10.31	3.06

*Latest Available Data
**Electricity transmission losses are not deducted

TABLE 6: Energy Related Ratios

	1980	**1990**	**2000**	**2005**	**2007**	**2011**
Energy Consumption Per Capita (GJ/Capita)	58.00	60.00	70.00	75.00	79.00	61.14

Electricity Consumption Per Capita (kWh/Capita)	999.00	1384.00	2753.00	2896.00	2926.00	1789.00
Electricity Production/Energy Production (%)	17.22	23.07	39.33	38.61	37.04	22.62
Nuclear/Total Electricity (%)	-	2.40	4.30	5.01	4.56	4.2
Ratio of External Dependency (%)*	-	-	-	-3.00	-2.00	-1.84

*Latest available data

**Net import/Total energy consumption.
Source: IAEA Energy and Economic Database

2. NUCLEAR POWER SITUATION

Mexico is energy self-sufficient. Not only that, it is also a net exporter of energy. However, it is highly dependent on hydrocarbons, almost all the energy exported is in the form of crude oil and about 90% of the energy used in the country comes from oil and gas, while only about 5% comes from hydro. In order to alleviate this situation, Mexico has recently incorporated other forms of energy like geothermal, coal and, from 1990 onwards, nuclear energy.

2.1. Historical development and current organizational structure

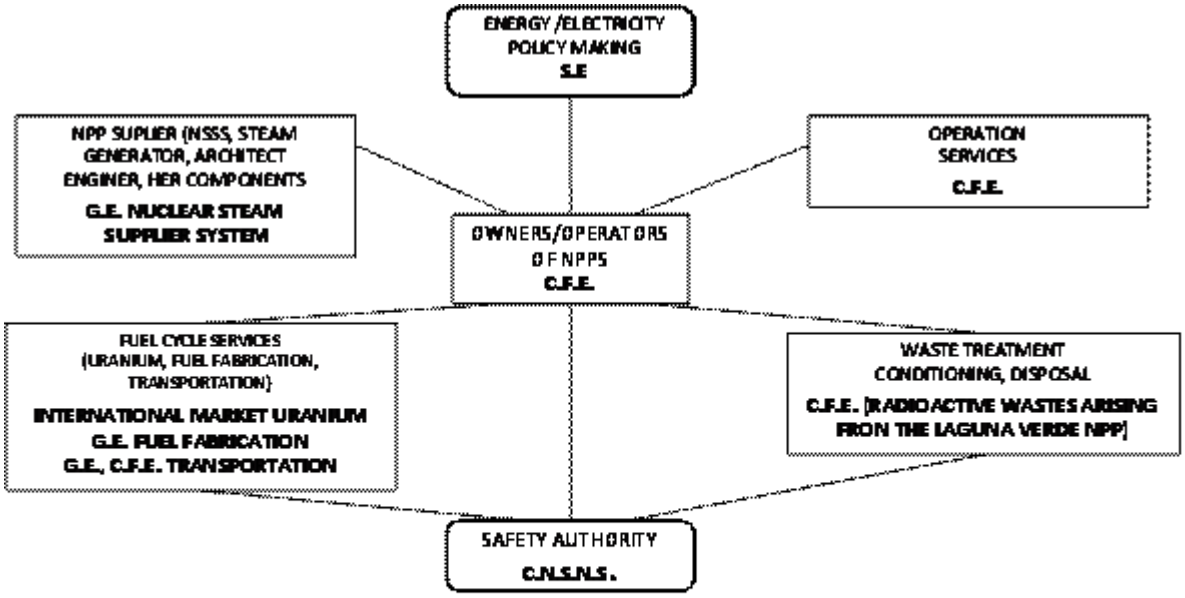
2.1.1. Overview

The National Commission for Nuclear Energy (CNEN) was established in 1956, to pave the way for the introduction of nuclear power and nuclear applications in Mexico. CNEN encompassed all the nuclear activities in the country (exploration for uranium, nuclear research, regulation, etc.) but the generation of electricity by nuclear means, which was the sole responsibility of the Federal Electricity Commission (CFE), and the utilization of radioisotopes. Later, CNEN was transformed into the National Institute on Nuclear Energy (INEN), which redefined the attributes but with very few changes.

In 1979, INEN was replaced by three organizations: The National Institute of Nuclear Research (ININ), in charge of all the aspects related to research, Mexican Uranium (URAMEX), in charge of uranium exploration and eventually uranium production, and the National Commission on Nuclear Safety and Safeguards (CNSNS), in charge of nuclear regulation and safeguards. In 1985, URAMEX was dissolved and all its functions passed to the Ministry of Energy.

Mexico’s interest in nuclear power dates back to the early 60s. The first concrete steps were taken in 1966, when a preliminary investigation of potential sites for nuclear power stations was carried out under the auspices of CFE and the National Commission for Nuclear Energy. At the end of the decade, the government concluded that nuclear power plants might play a major role. In early 1969, CFE decided to invite bids for a 600 MW(e) nuclear power plant of a proven type, and invitations to tender were sent to several manufacturers. Bids were received at the beginning of 1970, but the final decision, with up-to-date bids, was taken in the middle of 1972. In 1976, construction of the Laguna Verde Nuclear Power Plant (LVNPP) was initiated, comprising two reactors of 654 MW(e) net each. The first unit went into commercial operation in 1990, and the second in April 1995.

2.1.2. Current organizational chart(s)



S.E.	Ministry of Energy
C.F.E	Federal Electricity Commission
C.N.S.N.S.	National Commission on Nuclear Safaety and Safeguards
I.N.I.N.	National Institute of Nuclear Research
G.E.	General Electric

2.2. Nuclear power plants: Overview

2.2.1. Status and performance of nuclear power plants

As mentioned above, there is only one nuclear plant in operation in Mexico, with two BWR reactors of 810 MW(e) net each (Table 7). For the time being, there are no plans regarding new units or new plants. The National Energy Plan, issued in 1990, is still currently valid, however it will probably be revised in the near future.

Laguna Verde unit 1 went into commercial operation in 1990. Its performance has been quite good since the very beginning. Unit 2 went into commercial operation in April 1995.

TABLE 7: STATUS AND PERFORMANCE OF NUCLEAR POWER PLANTS

Station	*Type*	*Net Capacity*	*Operator*	*Status*	*Reactor Supplier*	*Construction Date+*	*Criticality Date*	*Grid Date ++*	*Commercial Date*	*Shutdown Date*
LAGUNA VERDE-1	BWR	810	CFE	Operational	GE	28034	32455	32611	33083	-
LAGUNA VERDE-2	BWR	8100	CFE	Operational	GE	28277	34583	34649	34799	-

*UCF (Unit Capability Factor) for the latest available year (only applicable to reactors in operation)
**Latest Available Data
+Date of initial concrete placing for base mat
++Date of first connection to grid
Source: PRIS Database (www.iaea.org)

2.2.2. Plant upgrading, plant life management and license renewals.

Extended Power Up rated (EPU)

In 2006, plans for a power uprate of 20% were announced, that would bring the plant's capacity up to 1620 MWE. General Electric performed the engineering analysis to determine the necessary plant modifications and to support the safety analysis report, necessary for approval of the power uprate by the Mexican nuclear regulator.

Following a competitive tender, which was won by Iberdrola and Alstom, work began in 2008 and was expected to finish in 2010. The main modifications consist of a turbine and condenser retrofit and the replacement of the electric generator, main steam reheater and the feedwater heater. The budget for the project is $605 million. At the time of writing, the power uprate has been finished and units 1 and 2 have passed all the operational tests, allowing them to operate at full power (1620 MW).

License renewals

Efforts are underway to get the new license to operate in the extended power up rated (EPU). The second phase took place in: Laguna Verde Nuclear Power Plant U1 14th Refueling Outage in March 2010, and U2 11th Refueling Outage took place in August 2010. Several major changes include, mainly in the BOP side, new high pressure and low turbines, new generator, new main transformer and auxiliary one new Electro Hydraulic Control System (EHC), change of bypass valves and so on.

The Licensing Amendment Request is under review by the National Commission on Nuclear Safety and Safeguards (CNSNS). Additional information on Preliminary Updated Safety Analysis Report (PUSAR) requirements has been received, along with approval for the use of the Transient Analysis Code (TRACG) in anticipated Operational Occurrence (AOOS).

2.3. Future development of Nuclear Power

2.3.1. Nuclear power development strategy

No nuclear power plants are planned for development.

2.3.2. Project management

Not Applicable

2.3.3. Project funding

Not Applicable

2.3.4. Electric grid development

Not Applicable

2.3.5. Site Selection

Not Applicable

2.4. Organizations involved in construction of NPPs

There are no NPP suppliers in the country. The main components of the Laguna Verde plant were acquired abroad. At the beginning, the main architect engineer for unit 1 was the Electric Bond and Share Company (EBASCO). Later on, and especially for unit 2, CFE acted as architect engineer, with the advice of EBASCO and General Electric (GE).

2.5. Organizations involved in operations of NPPs

The Laguna Verde plant is owned by CFE, and the operation and maintenance is performed by CFE personnel. In the past, operator training occurred at several similar installations in Spain and the United States. Nowadays, training mainly happens locally, using the simulator which has been installed on the plant's premises.

2.6. Organizations involved in decommissioning of NPPs

None

2.7. Fuel cycle including waste management

Mexico does not produce uranium due to the low cost of uranium currently available on the world market. For the next few years, the uranium required for reloads of Laguna Verde will be obtained from the world market, since currently there are no plans for producing uranium in Mexico. Some 1,300 tons of uranium reserves have been identified in Mexico, but these are too expensive to exploit considering current prices.

Uranium is bought either as hexafluoride or as a concentrate that is converted to hexafluoride by TENEX in Russia through a long-term contract. Enrichment is provided by NUKEM in the United States' Department of Energy, also through a long-term contract. Fuel fabrication currently occurs in the United States, through General Electric (GE).

As for spent nuclear fuel, the current plans are to store it at the reactors' pools. These have been re-racked to increase the original capacity in order to accommodate the spent fuel that the reactors will produce during their expected operating life. This plan gives CFE time to make a more definite decision on long-term storage methods, dependent on future developments in uranium availability and price, expansion of the Mexican nuclear power capacity, new technologies, etc.

2.8. Research and development

The main research centers are the National Institute of Nuclear Research (ININ) and the Electric Research Institute (IIE). Within the field of peaceful uses for nuclear energy , ININ has defined 11 research and development topics to which its scientific and technological activities are directed in order to improve population living conditions.

2.8.1. R&D organizations

ININ is focused on the creation and development of technology, carrying out research projects in response to energy sector needs, as well as in order to develop disciplines from which our country could benefit.

This institute has qualified personnel, recognized both nationally and internationally. These are expert in several sciences and engineering areas, which provides the institute with the ability to support multidisciplinary projects.

2.8.2. Development of advanced nuclear technologies

None

2.8.3. International co-operation and initiatives

1. Agreement of co-operation between the Mexican Electric Research Institute and the Electrical Power Research Institute of the United States of America (USEPRI) for the development and application of the RETRAN-3 Code for NPP's operational transient analysis.

2. Agreement of co-operation between the Mexican Electric Research Institute and the USEPRI in the development and application of the R & R Workstation for NPP's probabilistic risk analysis applications.

3. Agreement of co-operation between the Mexican Electric Research Institute and the USEPRI in the development and application of the MAAP-3 Code for NPP's severe accidents analysis.

4. Agreement of co-operation between the Mexican Electric Research Institute and the USEPRI in the development and application of the CPM-3 Code for the nuclear data library generation for advanced fuels.

5. Agreement of co-operation between the Mexican Electric Research Institute and the Rensselear Polytechnic Institute of the United States for the development and application of the April Code I for NPP's severe accidents analysis.

6. Agreement of co-operation between the Mexican Electric Research Institute and the Cuban Institute for Hydrography for the development of the Northwest Caribbean Sea Oceanographic Chart. I

2.9. Human resources development

Currently, careers related to nuclear engineering are offered at the following Mexican universities:

- Universidad Autónoma del Estado de México, "Masters of Science Nuclear".

- Universidad Nacional Autónoma de México, "Masters and PhD. in nuclear power systems"

- Universidad Nacional Autónoma de México, "Masters of nuclear physics"

- Instituto Politécnico Nacional, "Master in Nuclear Engineering"

- Instituto Nacional de Investigaciones Nucleares, "Nuclear Engineering"

Laguna Verde is showing a growing trend in the incorporation of large numbers of qualified collaborators as instructors. An increase in 48% has been obtained from 2005 to 2011, going from 11.93 to 17.75% (including retired workers) from 2005 to 2008. One out of seven collaborators is qualified as a specialized instructor, which has allowed us to capitalize on their experience by preparing instructors not only to teach courses but also to develop training materials.

From 2004 to 2011, the number of developed teaching packages increased by 377, going from 235 to 612 due to the support of these qualified instructors. This reinforces knowledge management at an organizational level. The number of teaching packages prepared by the GCN is a lot higher than those produced by the training centers from Comisión Federal de Electricidad (CFE). .

Training includes the training packages (or lectures) required by the substantive processes. In 2005, we reached the American nuclear industry average, and we are currently positioned as benchmark. Starting this year, we started analysis of other supporting processes to develop the training plans, using the Systematic Approach to Training (SAT). .

We maintain a replacement index higher than 40% to guarantee the replacement of qualified personnel due to vacations, sick leaves and commissions, as well as attending to the generational change because of retirements (The GCN staff started 35 years ago). In our GCN, the institutional goal has been widely exceeded.

Leaving of the company and voluntary retirement levels are practically nil. These last four years, only three people have asked for a voluntary retirement from a staff of 1,200 workers.

2.10. Stakeholder Communication

The Comisión Federal de Electricidad (CFE), trough of Laguna Verde Nuclear Power Plant has been approached by business groups such as:

Business Coordinating Council http://www.cce.org.mx/

Industrial Club http://www.club.org.mx/

Mario Molina Center http://www.centromariomolina.org/

Forum Chamber of Deputies http://www3.diputados.gob.mx/

Camara Academy of Engineering http://www.ai.org.mx/

The approaches mentioned do not correspond to government agencies. During these dialogues and presentation of studies and books whose content displays data and facts regarding the feasibility of the development of new plants, positive expressions of interest in the growth of installed capacity by nuclear power plants have been enabled.

3. NATIONAL LAWS AND REGULATIONS

3.1. Regulatory framework

The licensing process for a NPP consists of two steps. The first step concludes with the granting of the "Construction Permit", while the second step concludes with the "License for Commercial Operation". The process starts with an application by the utility to build a NPP (in Mexico there is a nationally-owned company, called Federal Electricity Commission), who must present this application to the National Regulatory Body (National Commission on Nuclear Safety and Safeguards), along with the preliminary studies of:

· Siting· Environmental impact

· Quality assurance program during construction phase

If these documents satisfy the scope required by CNSNS, the utility is required to present the technical information on the planned NPP. This information includes the construction procedures and fundamental safety systems designed to cope with the operational transients and postulated accidents. This is evaluated by the CNSNS's technical personnel, and a set of questions is then transmitted to the utility before the pouring of any concrete at the site. In the case of Laguna Verde, three "Provisional Construction Permits" were granted to CFE before the so-called "Definitive Construction Permit" was issued. This limited-work authorization has been eliminated from the present procedure for future NPPs.

During the actual construction phase, the regulatory body inspects the construction of the NPP and has the legal authority to stop the work if the agreed standards are not met. After the evaluation of the documentation, the regulatory body can issue the "Technical Basis" to grant the construction permit, addressed to the Ministry of Energy as this is the authority legally allowed to grant the permit.

At a certain stage of construction, before the start of the pre-operational test period, the utility is required to present the regulatory body with technical information related to:

· Final design of the station

· Final site studies

· Final environmental impact studies

· Quality assurance program for NPP operation

· Final studies on plant performance during transients and postulated accidents

· Set of operating procedures

· Operations personnel training program

· Pre-operational and start-up test program

· Proposed technical specifications

If these process documents are not clear enough in any technical subject, the regulatory body generates questions to clarify the topic.

As a result of this process, the regulatory body issues the following documents:

· Permit to load the fuel

· Set of technical specifications

The technical basis to grant the operation license is addressed to the Ministry of Energy as, according the nuclear law, this is the only authority who can grant such documents.

After the fuel load, the regulator remains in order to monitor the performance of the low power test period and any change of power (0 to 5%, 5 to 10%, 10 to 25%, 25 to 50%, 50 to 75% and 75 to 100%). Engineers of the national body review the test results, and evaluate possible discrepancies between the results and the acceptance criteria.

3.2. Main national laws and regulations in nuclear power

Essential legal texts regulating nuclear power in the country:

· Constitution of Mexico, Article 27 in force

· Regulatory Law of Article 27 of the Constitution on Nuclear Matters, published in the official gazette on February 4, 1985

· Law on Third Party Liability for Nuclear Damage, published in the official gazette on December

· Radiological Safety Regulations, published in the official gazette on November 8, 1988

· General Act on Ecological Balance and Environmental Protection, published in the official gazette on January 28, 1987

· Mexican Official Guidelines NOM-OI2-STPS-1993, on health and safety at work in premises where ionizing sources are handled, stored or carried, published in the official gazette on June 15, 1994

Mechanisms in place for financing decommissioning and waste disposal:

· For wastes proceeding form radioisotope applications, storage costs are recuperated from the generators of this kind of waste

· For low- and intermediate-level radioactive wastes proceeding from the Laguna Verde Nuclear Power Plant (LVNPP), they will be stored in a repository using the French approach. This repository will be located on site

· For high level radioactive wastes, technology progresses and the future nuclear program are being expected in order to make a decision for these kinds of wastes

The final disposal of radioactive waste is the responsibility of the State. In the case of wastes from LVNPP, the Federal Electricity Commission will be in charge of financing its storage. For decommissioning, the State, through CFE, will be in charge of financing this process.

Nuclear power stations are a proven alternative in Mexico, as demonstrated by the high availability, reliability and safety indicators at Laguna Verde. It is also a realistic option, in order to better comply with environmental requirements that are anticipated to become stricter in the future. However, there are no immediate plans for development of new nuclear facilities due to the high initial investments required. At the moment, these are not competitive when compared with those of plants based on natural gas.

The Ministry of Energy is responsible for nuclear fuel cycle policy and operations, and can by law authorize some of these responsibilities to public entities, such as the Federal Electricity Commission (CFE) and the National Institute of Nuclear Research (ININ).

CFE has been authorized by the Ministry of Energy to negotiate uranium stock purchases, uranium enrichment and fuel fabrication contracts.

An interim waste repository managed by ININ collects all low- and intermediate-level radioactive wastes produced in medical, industrial and other radioisotopic applications. This repository will be replaced by a permanent one in the future. Another interim low- and intermediate-level radioactive waste repository is operated by the Laguna Verde Plant, to handle wastes coming from the station.

Spent nuclear fuel from the Laguna Verde Plant is being stored in the reactor's pools, which have been re-racked to increase the original capacity in order to accommodate all the spent fuel that the reactors will produce during their expected lifetime. This solution gives CFE the time needed to study all possibilities before adopting a definitive solution, depending on future development regarding the final disposal of high-level radioactive wastes.

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APPENDIX 1: INTERNATIONAL, MULTILATERAL AND BILATERAL AGREEMENTS

AGREEMENTS WITH THE IAEA

· NPT and Tlatelolco related safeguards agreement - INFCIRC No: 197

Entry into force: 14 September, 1973

· Additional Protocol

Not signed

· Improved procedures for designation of safeguards inspectors

Accepted: 27 February, 1989

· Supplementary agreement on provision of technical assistance by the IAEA

Entry into force: 4 June, 1981

· ARCAL

Entry into force: April, 1988

· New ARCAL Agreement

Ratification: 7 August, 2000

· Agreement on the privileges and immunities of the IAEA

Entry into force: 19 October, 1983

OTHER RELEVANT INTERNATIONAL TREATIES

· NPT

Entry into force: 21 January, 1969

· Tlatelolco

Entry into force: 20 September, 1967

· Convention on the physical protection of nuclear material

Entry into force: 4 May, 1988

· Convention on early notification of nuclear accidents

Entry into force: 10 June, 1988

· Convention on assistance in the case of a nuclear accident or radiological emergency

Entry into force: 10 June, 1988

· Vienna convention on civil liability for nuclear damage

Entry into force: 25 July, 1989

· Joint Protocol Non-Party

· Protocol to amend the Vienna convention on civil liability for nuclear damage

Not signed

· Convention on nuclear safety

Entry into force: 24 October, 1996

· Convention on supplementary compensation for nuclear damage

Not signed

· Joint convention on the safety of spent fuel management and on the safety of radioactive waste management

Not Signed

· ZANGGER Committee

Non-member

· Nuclear export guidelines

Not Adopted

· Acceptance of NUSS codes as guidelines in preparation and application of national requirements (Mexican nuclear safety legislation is in conformity with codes)

Summary: Codes should be used by 11 July, 1963

MULTILATERAL AGREEMENTS

· Standard agreement concerning technical assistance to Mexico

Parties:

- United Nations Organization (ONU)

- International Labour Organization (ILO)

- Food and Agriculture Organization of the UN (FAO)

- United Nations Educational Scientific and Cultural Organization (UNESCO)

- International Civil Aviation Organization (ICAO)

- World Health Organization (WHO)

- International Telecommunicatios Union (ITU)

- World Meteorological Organization (WMO)

- International Atomic Energy Agency (IAEA)

- Universal Postal Union

· Transfer of enriched uranium for a research reactor

Entry into force: 18 December, 1963

Parties: Mexico, USA, IAEA

· Lease of source material for a subcritical assembly

Entry into force: 20 June, 1966

Parties: Mexico, USA, IAEA

· Lease of source material for a subcritical facility

Entry into force: 23 August, 1967

Parties: Mexico, USA, IAEA

· Transfer of a training reactor and enriched uranium

Entry into force: 21 December, 1971

Parties: Mexico, Germany, IAEA

· Second supply agreement for transfer of enriched uranium for a research reactor

Entry into force: 4 October, 1972

Parties: Mexico, USA, IAEA

· Supply of uranium enrichment services

Entry into force: 12 February, 1974

Parties: Mexico, USA, IAEA

· Second supply agreement for supply of uranium enrichment services for a second reactor unit

Entry into force: 4 June, 1974

Parties: Mexico, USA, IAEA

· Transfer of title to natural uranium

Entry into force: 23 May, 1989

Parties: Mexico, USA, IAEA

· Plan of operation for a UN Special Fund project in Latin America (Eradication of Mediterranean Fruit Fly)

Entry into force: 29 July, 1965

Parties: Mexico, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, UN Special Fund, IAEA

· Plan of operation for a UNDP project in Latin America,

Entry into force: 31 July, 1968

Parties: Mexico, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, UN Special Fund, IAEA

· Preliminary study of a nuclear electric power and desalinization plant

Entry into force: 7 October, 1965

Parties: Mexico, USA, IAEA

· Agreement concerning provision of a dose assurance service by IAEA to irradiation facilities in its Members States (Exchange of letters)

Entry into force: 18 September, 1985

Parties: Mexico, India, Syria, Argentina, Philippines, Malaysia, Belgium, Chile, Switzerland, Egypt, Hungary, Thailand, South Africa, Korea, Republic of, Algeria, Netherlands, Lebanon, Singapore, Denmark, Yugoslavia, Brazil, China.

BILATERAL AGREEMENTS

· Agreement between the Government of the United Mexican States and the Government of Australia concerning co-operation in peaceful uses of nuclear energy and the transfer of nuclear material.

Signed on 28 February, 1992; entered into force 1 October, 1992

· Agreement between the Government of the United Mexican States and the Government of Canada for Co-operation in the peaceful uses of nuclear energy.

Signed in 16 November, 1994; entered into force 9 May, 1995.

APPENDIX 2:MAIN ORGANIZATIONS, INSTITUTIONS, AND COMPANIES INVOLVED IN NUCLEAR POWER RELATED ACTIVITIES

NATIONAL ENERGY AUTHORITIES

Ministry of Energy (SE) Tel.: +525-55000-6000

Av. Insurgentes Sur 890

Col. del valle http://www.sener.gob.mx

México D.F.

Federal Electricity Commission (CFE) Tel.: +525-5 52 294400

Paseo de la Reforma 164: http://www.cfe.gob.mx

Col. Juarez

México D.F.

National Commission of the Nuclear Safety Tel.: +525-590-41-81

And Safeguards (CNSNS) Fax: +525-590-61-03

Dr. Barragan No 1779 Email: cnsns1@servidor.unam.mx

Col. Narvarte

México D.F.

NUCLEAR RESEARCH INSTITUTES

National Institute of Nuclear Research (ININ) Tel.: +525-521-94-02

Carretera Federal México-Toluca Km. 36.5 Fax: +525-590-61-03

Salazar, Edo. de México. http://www.inin.mx

Electrical Research Institute (IIE) Tel.: +525-521-94-02

Av. Reforma N1 113 Fax: +525-521-37-98

Col. Palmira http://www.iie.org.mx

Temixco, Morelos.

Instituto de Ciencias Nucleares (UNAM)

OTHER ORGANIZATIONS

Comisión Federal de Electricidad http://www.cfe.gob.mx/

Agency for the Prohibition of the Nuclear Weapons

In Latin America and the Caribbean (OPANAL) http://www.opanal.org/

Instituto Mexicano del Petróleo (IMP) http://www.imp.mx

Name of report coordinator:

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