ENERGY DOSSIER

07

MEXICO

IDB

Prologue

This publication forms part of a series of monographs produced by the Energy Division of the Infrastructure and Environment Department of the Vice President of the Research Department at the Inter-American Development Bank (IDB) for regional public good. It is designed to increase the base of knowledge about the characteristics and functions of the Energy Sector in Latin American and Caribbean countries (LAC).

This is the first step in a project that will culminate in books that organize the countries according to the subregions in which the IDB groups the countries of LAC. The purpose of publishing each country separately is to obtain feedback from the descriptive analysis provided by local authorities, academics and the general reading public.

Comments and observations can be sent to the authors via email at: ramones@iadb.org

The sources of information are made explicit and the responsibility for their use and interpretation is exclusive to the authors of this monograph.

The authors would like to thank their supervisors at the Inter-American Development Bank for their unconditional support: the head of the Energy Division, Leandro Alves; the Manager of the Infrastructure and Environment Department, Alexandre Rosa; and the Vice President of the Research Department, Santiago Levy.

We hope that this contribution to regional knowledge will be useful,

Ramón Espinasa

Lenin Balza

Carlos Hinestrosa

Carlos Sucre

Banco Interamericano de Desarrollo
1300 New York Avenue, N.W.
Washington, DC 20577 USA

Introduction

This Energy Report is part of a series that includes all Latin American and Caribbean countries (LAC) that are members of the Inter-American Development Bank (IDB). The publications will be made in sequential order and grouped according to the geographic regions organized by the IDB in the following order: countries of the Central American Isthmus and the Dominican Republic (CID); countries of the Andes (CAN), countries of the Southern Cone (CSC); countries of the Caribbean (CCB).

The Report on each country has two components: the Energy Flows and the Description of Industrial Organization and Institutional Framework of the energy sector. For both components, the most recent description will be presented first and then the historic development will be discussed.

In the case of Energy flows, the information is gathered from the energy balances that the International Energy Agency (IEA) produces for almost all of the countries in the world. The use of a single source allows comparisons between countries and also a long-term analysis without methodological distortions. Schematic flows derived from this information and are used to describe the energy sector in each country during a specific period.

The most recent "photo" with information from the IEA is from 2009. Even though it is from a few years ago, we used this matrix in order to ensure consistency among countries. It reflects the current situation because energy matrixes change slowly. What follows is an analysis of the historic evolution of the matrix from 1971 to 2008. It is divided into four periods: 1971-74; 1984-87; 1999-02; and 2005-08.

The reason for using an average of four years as the break between periods is to neutralize the distorting impact that sudden natural, economic and political events could have in a given year. The unit of measurement for the energy flows is thousands of barrels of oil per day (kboe/day), a simple transformation of the unit of measurement used by the IEA, equivalent to tons of oil per year.

For the description of the Industrial Organization and the Regulatory Framework, the work is more complex because they don't have a single source of common information. Even when all the countries are presented under a single descriptive framework, the work of gathering basic information was ad-hoc by country.

In addition to the public information from various agencies and organizations, legal texts, academic publications and press reports are referenced. Beyond a strict description of the sector, this report seeks to link information with the political evolution of a country, which makes the reading more enjoyable and provides a clear picture of institutional changes.

INDEX

GUIDE TO ACRONYMS

Amegas	Mexican Association of Gasoline Entrepeneurs
CENACE	National Center for Energy Control
CEPAL	Economic Commission for Latin America and the Caribbean
CFE	Federal Electricity Commission
CNH	National Hydrocarbon Commission
CRE	Energy Regulatory Commission
TEC	Total Energy Consumption
DAC	Domestic High Consumption
LPG	Liquefied Petroleum Gas
GWh	Gigawatt Hour
IEA	International Energy Agency
kV	Kilovolt
KWh	Kilowatt hour
LAERF	Law for Renewable Energy Use and Financing Energy Transition
LASE	Law for Sustainable Energy Use
LFC	Central Light and Power
LOPM	Organic Law of Mexican Petroleum
LRRP	Regulatory Law
LSPEE	Public Service Electricity Law
mbd	Thousands of barrels per day
Mbd	Million barrels per day
Kboe/day	Thousand barrels of oil equivalent per day
Mbpe	Million barrels of petroleum equivalent
BBOE	Billion barrels of petroleum equivalent
MW	Megawatt
PES	Primary Energy Supply
OLADE	Latin American Energy Organization
Onexpo	National Organization of Petroleum Retailers
PAN	National Action Party
PEMEX	Mexican Petroleum
PEP	Primary Energy Production
GDP	Gross Domestic Product
PIDIREGAS	Productive Infrastructure Products with Deferred Impact on Program Spending
IEP	Independent Energy Producers
UNDP	United Nations Development Programme
PRI	Institutional Revolutionary Party
SE	Ministry of Economy
SEN	National Electricity System
SENER	Ministry of Energy
SHCP	Ministry of Finance and Public Credit
UPC	Continuous Self Use
WB	World Bank

Mexico

With an area of 1,943,945 Km,2 Mexico is the third largest country in Latin America behind Brazil and Argentina. In 2011 its Gross Domestic Product (GDP) reached 1,155 billion dollars, and its population during the same year was 114.8 million inhabitants according to the World Bank. Gross National Income per capita was 9,240 current dollars in 2011, 8% above the average in Latin American countries. According to the income level per inhabitant, Mexico is classified as a country with upper middle income according to the categorization of the multilateral organization.

En 2011, 51.2% of Mexican households were below the poverty line. The rural population was estimated to be 21.9% of the total population, which is above the level of Latin America and the Caribbean, which averages 20.9%. The country is ranked 57 of the 169 nations that participate in the Human Development Index, and is seventh in Latin America and the Caribbean. According to the UNDP classification, Mexico is included among the countries with high human development.

In relation to the energy sector and, in particular, the electricity subsector, in 2010 Mexico had an installed generation capacity of 52,945 MW and a total generation of 257,884.00 GWh, the second highest in Latin America and the Caribbean after Brazil. According to OLADE statistics, 98.2% of homes had access to electricity in 2011.

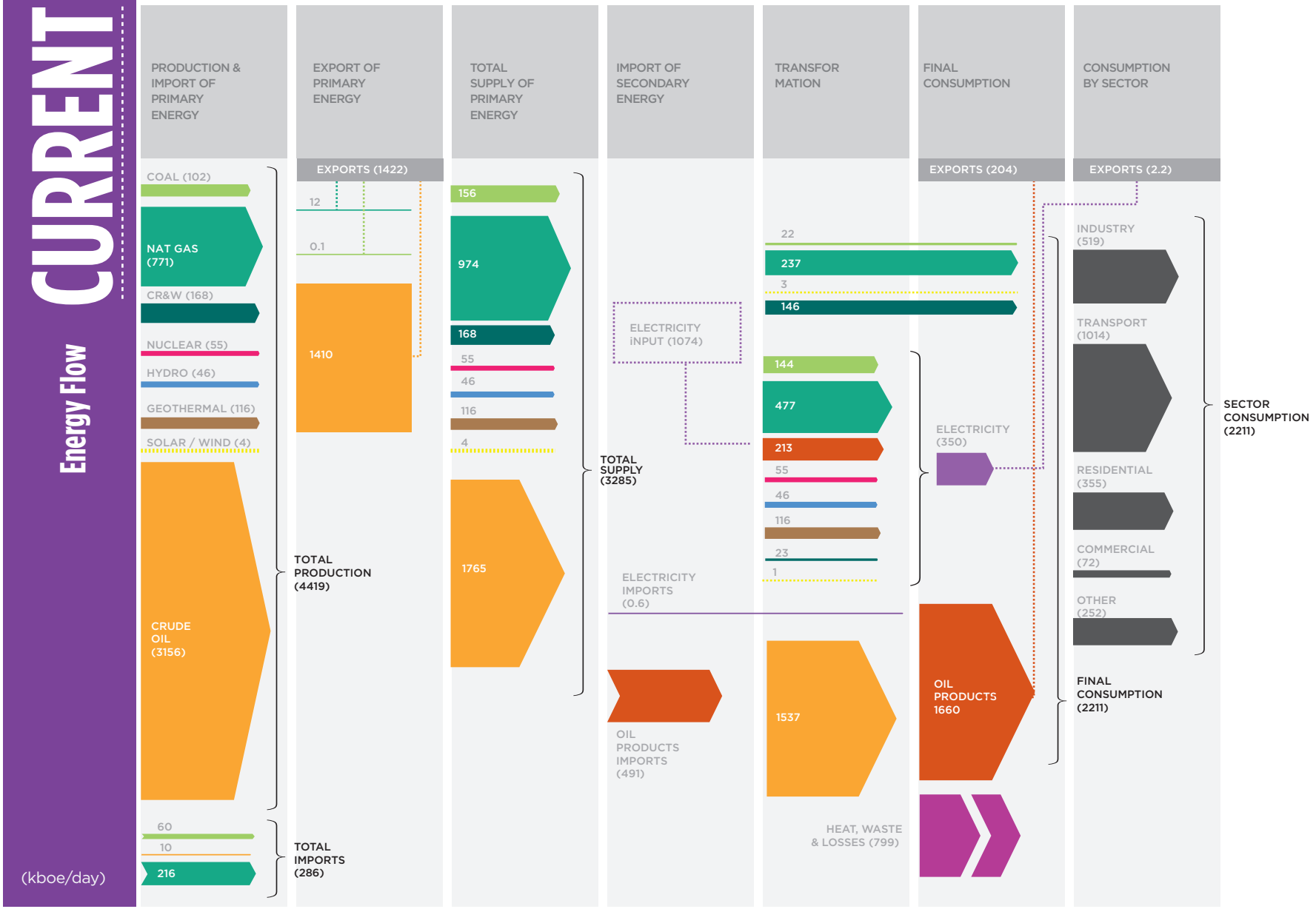
Mexico is the eighth largest oil producer in the world and the main producer in Latin America and the Caribbean, followed by Venezuela. In 2011 it had an average production of 2.55 million barrels per day (Mbd), of which it exported 1.3 Mbd, which represented around 50% of its production. Exports to the United States accounted for 82% of the total, to average around 1.095 Mbd in 2011. Mexico, despite being a net exporter of crude, is currently a net importer of petroleum products with an average volume in 2011 of 0.678 million barrels a day.

Current Energy Sector

Total Energy Consumption (TEC) during 2009 reached 3.5 millions of barrels of equivalent per day (Kboe/day), thus representing a growth of 18.7% over the simple average during the 1999-2002 period. The share of fossil fuels in the TEC in Mexico stood at 89% in 2009, given that petroleum and liquid fuels contributed more to represent 56% of the demand composition, followed by natural gas with 28% and coal with 4%.

CURRENT

Energy Flow



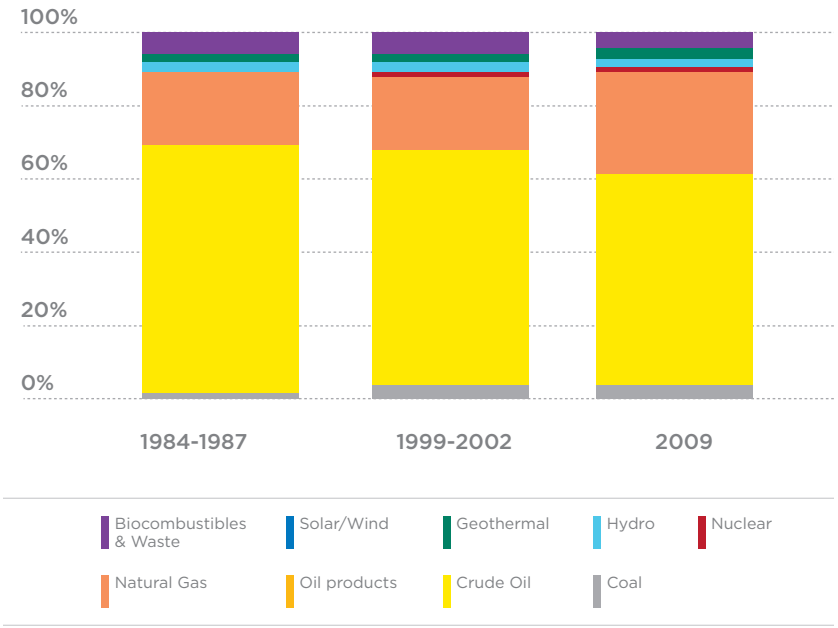
(kboe/day)

Source: Own Calculations based on IEA Energy World Balances

Fossil fuel consumption in Mexico has remained constant over the past decades at nearly 90% of the TEC. Oil and its derivatives continue to lead the share of demand, but their relative contribution has been hampered in favor of natural gas, which grew from 20% of the total TEC during the 1984-1987 period to 28% in 2009.

Renewable energy sources had low participation in the Mexican energy matrix, representing nearly 390,000 barrels of petroleum equivalent per day (kboe/day) in 2009, which made up 10% of the TEC in 2009, only 4.4% above what was reported during the 1999-2002 period.

TOTAL ENERGY CONSUMPTION



Source: Own Calculations based on IEA Energy World Balances

Production, commercial balance and primary energy

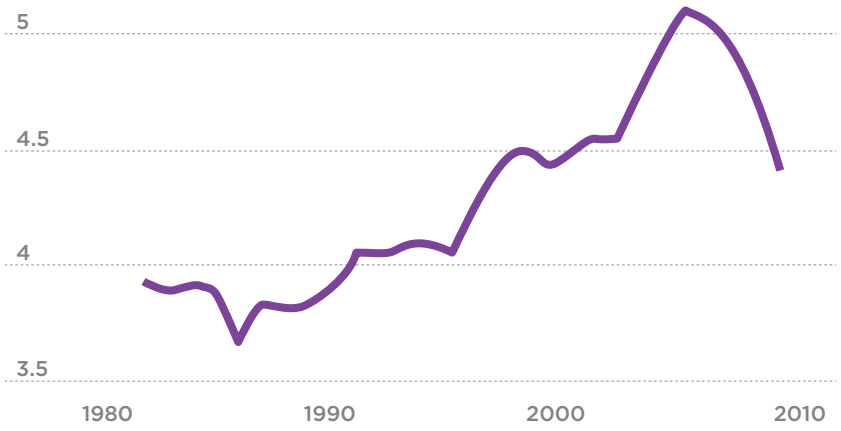
Production

The production of Primary Energy (PEP) declined by 13.4% in comparison to the historic high it reached in 2005, to settle at 4.4 Kboe/day at the end of 2009. The huge drop in PEP is mainly due to difficulties faced in recent years by the Mexican oil industry to maintain crude production. Crude production fell 20.3% between 2005 and 2009 to register 3.1 Kboe/day at the end of 2009. This result determined the performance of the PEP, which barely increased at 1.6% compared with the 1999-2002 average, thus showing a plateau in total output over the last decade.

Mexico's PEP is mainly concentrated in Hydrocarbon production (petroleum, gas, and coal) which contributes 91% of the total. For their part, renewable fuels represent 9% of the remaining production, where renewable fuels and wastes (essentially firewood for rural consumption) participate with (3.9%), geothermal (2.2%), hydropower (1.1%) and nuclear energy (1.1%).

MEXICO: PRIMARY ENERGY CONSUMPTION

Thousand barrels of oil equivalent per day (kboe/day)



Source: Own Calculations based on IEA Energy World Balances

Commercial balance of primary energy

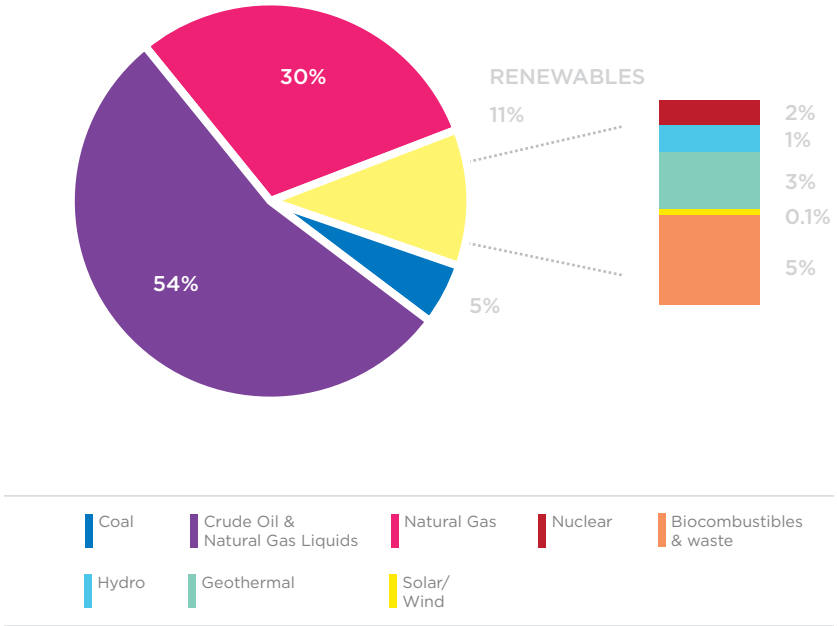
The amount and availability of natural resources in Mexico determines the primary energy export bias. In late 2009, Mexico exported about 1.4 Kboe/day, which represented a reduction of 6% compared to exports registered in 2005 and 22% compared to the average during the 1999-2002 period. 100% of the total export corresponds to Hydrocarbons (99% unprocessed crude).

Meanwhile, primary energy imports reached 0.28 Kboe/day, which represents a growth of 8.3% over recorded imports registered in 2008, of which 76% are natural gas imports, 20% coal and 4% unrefined crude. Thus, primary energy imports continued to show a robust growth over the last decade, which demonstrates an annual average growth of 12.3%, led by sustainable growth in natural gas imports.

Internal offering of primary energy

Primary Energy Supply (PES) destined for processing centers to obtain secondary energy, final consumption of the economic sector and the self-consumption of the energy sector reached 3.3 Kboe/day at the end of 2009.

PRIMARY ENERGY SUPPLY



Source: Own Calculations based on IEA Energy World Balances

Fossil fuels contributed to 88% of the PES (54% crude, 30% natural gas and almost 5% coal). For its part, renewable energy participation was at around 12% of the PES, of which the supply of renewables and wastes (mainly firewood) contributed (5.1%), geothermal (3.5%), nuclear (1.7%), hydropower (1.4%) and solar/wind energy (0.1%).

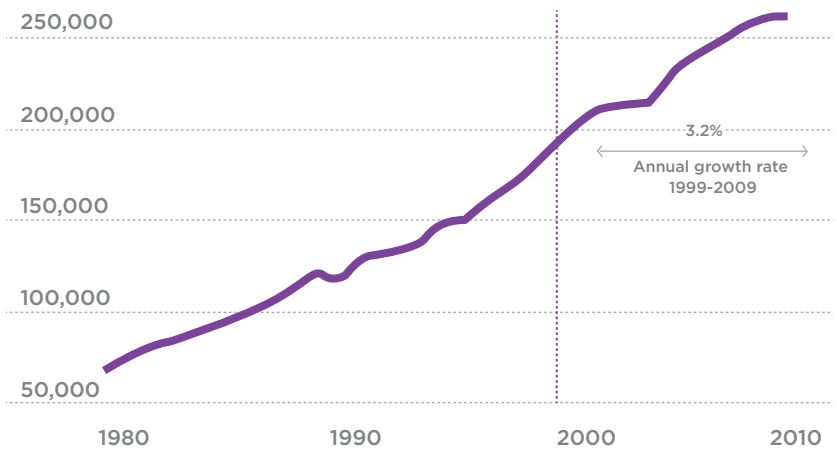
The low participation of renewable energies within the PES responds largely to the amount and availability of fossil energies that Mexico has as well as the scarce success of programs for the promotion and development of clean energy generation.

Electricity

Constant pressures from the demand side, a product of greater economic development, have marked the dynamism of the electricity sector during the last decade. In this sense, Mexico's electricity production in 2009 reached 261,018 GWh. As a result, the annual growth rate stood at 3.2% during the last decade, a moderate result in comparison to the 5.8% and 5.6% registered in the preceding decades.

Mexico today stands as the second greatest producer of electricity in Latin America and the Caribbean, participating with almost 20% of the total of electricity generated in the region.

MEXICO: ELECTRICITY GENERATION (GWh)



Source: Own Calculations based on IEA Energy World Balances

Installed capacity

By the end of 2009, Mexico had an installed electricity generation capacity of 59,326 MW, of which 75% was from thermoelectric plants operated with fossil fuel (liquid fuels, gas and coal), the installed capacity for renewable sources reached 22.7% (hydroelectric 19.4% and geothermal and other renewables 3.3%) while nuclear energy represented the remaining 2.3% of capacity.

Installed Capacity (%)	2000	2005	2009
Thermoelectric	70.6	74.4	75
Nuclear	3.2	2.6	2.3
Total Renewables	26.2	23	22.7
Hydroelectric	23.3	20.2	19.4
Non-hydroelectric	2.9	2.8	3.3
Total	100	100	100

Source: U.S. EIA

Additional installed capacity incorporated in the last decade came mainly from thermal generation, which moved from 71% in 2000 to 75% in 2009, although it had a strong tendency to increase the use of natural gas to the detriment of derivative petroleum fuels.

Inputs to electricity generation

Around 33% (1.07 Kboe/day) of the primary energy supply is directed to processing centers for electricity generation. The share of fossil fuels used as inputs for electricity generation reached 77.5%. Although fossil fuels continue to participate with 3/4 of the inputs necessary for generation, they have changed their composition remarkably, mainly due to the use and introduction of natural gas as a substitute for liquid fuels.

Mexico	1992-2002		2009	
Total inputs for generation (kboe/day)	**951**	**100%**	**1074**	**100%**
Coal	110	11.5%	143	13.4%
Oil Products	427	44.9%	213	19.8%
Natural Gas	199	21.0%	476	44.4%
Nuclear	48	5.0%	55	5.1%
Renewables	167	18.0%	186	0.2%

Renewables include hydro and combustibles renewables & waste.
Source: Own Calculations based on IEA Energy World Balances

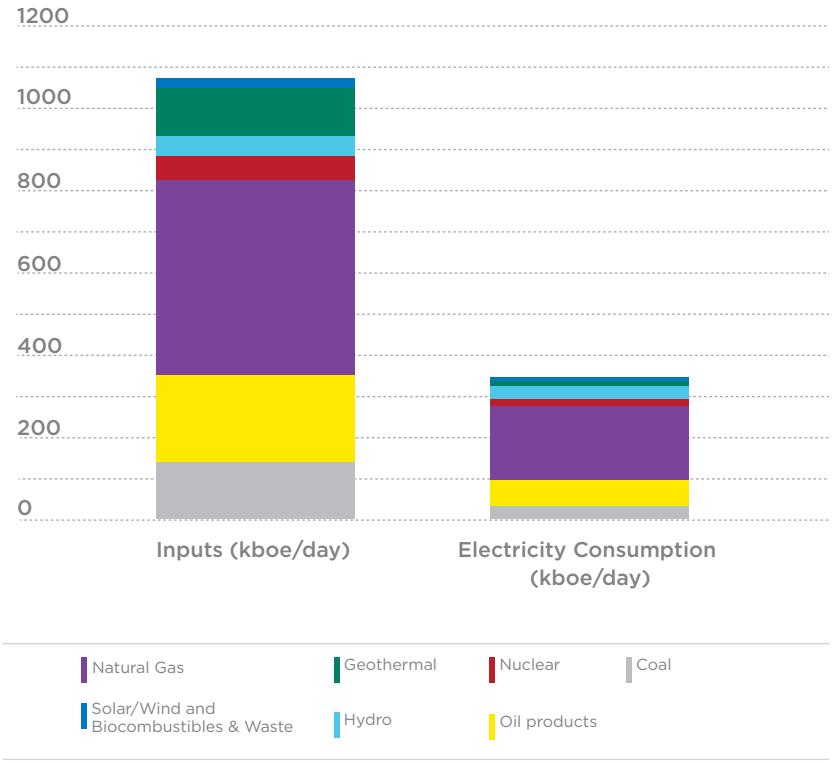
Thus, natural gas has increased its share from 21% during 1999-2002 to 44.4% in 2009, while liquid fuels decreased from 45% to 20%, and coal continues to maintain participation at around 13% of the input for electricity generation. Meanwhile, renewable resources registered a participation of nearly 17.3% in 2009, where geothermal represented 10.8%, hydraulic energy 4.3%, renewable fuels and wastes 2.1% and solar and wind 0.2%. Finally, inputs for nuclear generation reached 5.1%

Electricity matrix

Electricity consumption in 2009 reached 261,018 GWh, based mainly on thermoelectric generation, which was responsible for 82% of generation, followed by hydrogeneration with 10.2%, nuclear with 4%, geothermal with 2.6%, renewable fuels and wastes with 1% and solar/wind 0.2%.

The supply of fossil fuels in the case of Mexico determines the bias in its generation matrix. However, it is important to note the change in the relative composition of the use of hydrocarbons for electricity generation. Product of its lower price, greater efficiency and less pollution, natural gas has replaced hydrocarbons as the main source of electricity generation.

ELECTRICITY GENERATION MATRIX – MEXICO



Source: Own Calculations based on IEA Energy World Balances

Electricity consumption (GWh)	261,018	100%
Coal	29,522	11.3%
Oil products	45,745	17.5%
Natural gas	138,471	53.1%
Nuclear	10,501	4.0%
Hydro	26,713	10.2%
Other renewables	10,066	3.9%

Other renewables include geotermal, solar, wind, and biocombustibles & waste
Source: Own Calculations based on IEA Energy World Balances

Final consumption by sector

Final energy consumption in the economic sectors reached 2.2 kboe/day during 2009, thus representing a 14% increase in relation to the simple average during the 1999-2002 period. A little more than 2/3 of final energy consumption is concentrated in the Transportation (46%) and Industry (23%) sectors.

The transportation sector was the most dynamic among final consumers, registering an annual average growth rate of 3.5% during the 1999-2009 period. This result ensured that its participation increased, moving from 37% to 46% during the period discussed.

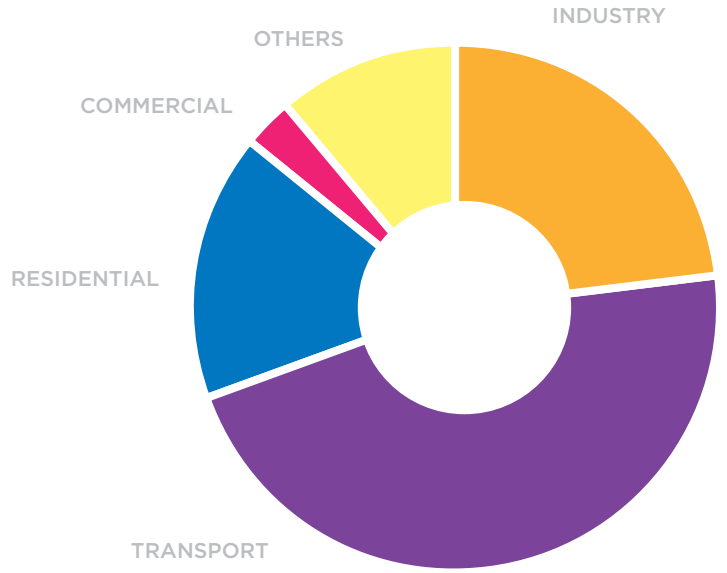
The particular characteristics of each sector determine the supply requirements for different fuels. Fossil fuels and electricity supplied the entire energy demand for the transportation sector. In the industrial sector, electricity was the main energy source (36%), followed by natural gas (32%) and liquid fuels (24%).

For the residential sector, the main energy source used was liquid fuels (36%), followed by firewood consumption (35%) and electricity (24%). Mexico, like the rest of countries in the region, implemented programs and strategies that sought to increase access to modern energy sources that displace the use of firewood and kerosene in homes. In the case of firewood, Mexican homes reduced their consumption of the latter by more than 5% during the last decade. In this sense, firewood consumption in final consumption in the residential sector was reduced from 37% during 1999-2002 to 35% in 2009.

Finally, consumption in the commercial sector has maintained its participation in final energy consumption around 3% over the last decade. The commercial sector mainly used electricity (51.2%), liquid fuels (40.8%) and natural gas (6%).

FINAL ENERGY CONSUMPTION BY SECTOR

Thousand barrels of oil equivalent per day (kboe/day)



FINAL CONSUMPTION (KBOE/DAY)	2.21	100%
Industry	0.52	23%
Transport	1.01	46%
Residential	0.36	16%
Commercial	0.07	3%
Others	0.25	11%

Source: Own Calculations based on IEA Energy World Balances

Institutional Organization of the Energy Sector

Institutional Structure

The energy sector in Mexico is currently controlled by two state companies subordinate to the Ministry of Energy (SENER). In the hydrocarbon subsector the public company is Mexican Petroleum (PEMEX), which maintains a monopoly on the majority of activities. In the electricity subsector the Federal Electricity Commission (CFE) has a monopoly on distribution and transmission and controls 77.5% of installed generation capacity.

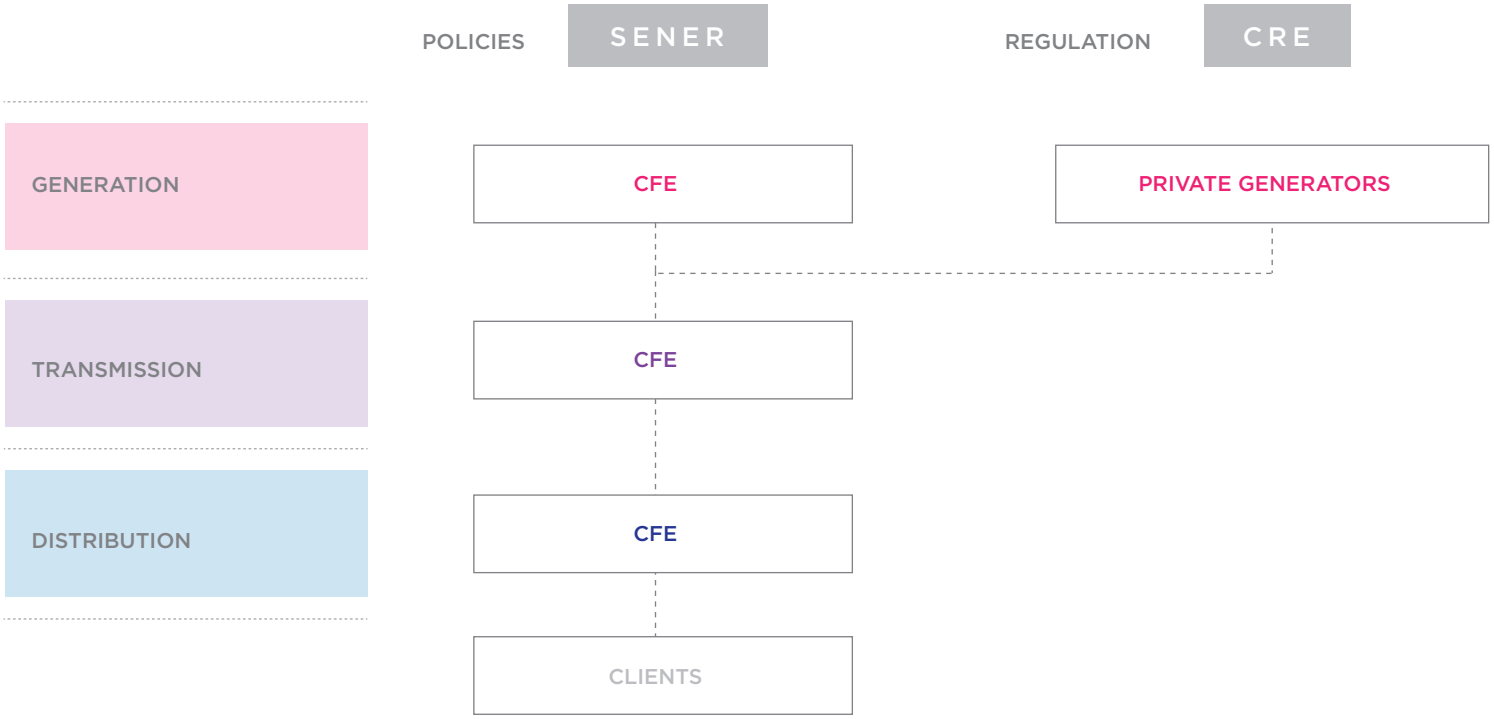
As a result of the reforms carried out in the 90s and 2000s, the private sector has some participation in the country's energy sector. The participation of private capital is more evident in the electricity subsector given that since 1992 the installation of generation plants under some special conditions has been permitted.

In the hydrocarbon subsector private participation is reduced to some service contracts, which were incorporated into the 2008 reforms for the exploration and exploitation of crude, called "comprehensive contracts." In addition, the reforms of the 90s liberalized the marketing chain of natural gas and created a franchise outline for PEMEX for the sale of gasoline at service stations.

La SENER maintains its control over energy sector politics, but two new institutions were created to perform its regulatory functions: the Energy Regulatory Commission (CRE) for all activities that allow the participation of the private sector (marketing of gas and electricity generation) and the National Hydrocarbons Commission (CNH) for the activities of oil exploration and exploitation carried out by PEMEX.

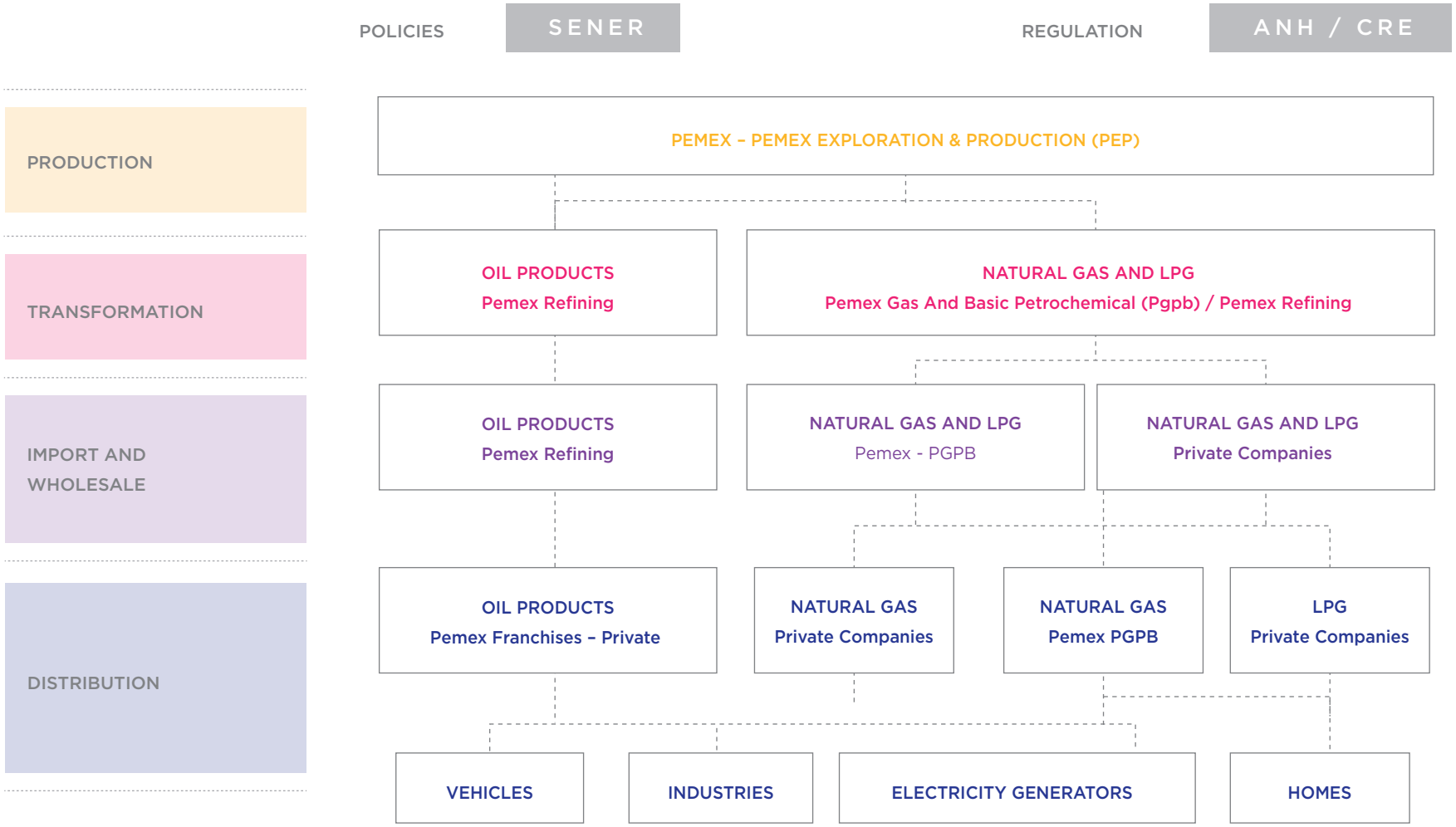
The rates of the main products of massive consumption of the energy sector (electricity, gasoline, diesel, and liquefied gas) are regulated by the State, where responsibility lies mainly with the Ministry of Finance and Public Credit (SHCP) and the Ministry of Economy (SE).

Institutional Structure of the Electricity Sub-Sector



Source: Author's work based on SENER, CRE, CFE and regulatory framework

Institutional Structure of the Hydrocarbon Sub-Sector



Source: Author's work based on SENER, CRE, CFE and regulatory framework

Policy making in the energy sector

The Energy Secretary designs energy sector policies. Each year the Federal Executive presents the National Energy Strategy for the approval of Congress. The National Energy Council, presided over by the secretary of Energy, creates this document, which must have a 15-year outlook.

Article 33 of the Organic Law of Federal Public Administration establishes that the Ministry of Energy has the following responsibilities related to energy policy:

- To establish and lead the country's energy policy, as well as monitor compliance with priority given to security and energy diversification, energy saving and environmental protection.
- To conduct and monitor the activity of public sector organizations in the Ministry, as well as the programming of exploration, exploitation and processing of hydrocarbons and the generation of electric and nuclear energy, subject to applicable provisions.
- To promote the participation of the private sector in sector activities, whether in terms of legislation or in terms of applicable provisions.
- To conduct energy planning for the mid and long-term, and to set economic and social guidelines for public sector energy.
- To integrate the National Energy Board and issue its rules of operation in order to plan energy tasks.[1]
- To approve the main hydrocarbon exploration and exploitation projects created by Mexican Petroleum (PEMEX) based on energy policy guidelines and with technical support in opinions issued by the National Hydrocarbon Commission.
- To register oil lands.
- To propose the annual oil and gas production platform of PEMEX to the President.
- To establish policy on hydrocarbon reserves replacement.

Regulator

The Energy Regulatory Commission (CRE) is the main organization responsible for energy sector regulation in Mexico. The CRE is a decentralized body subordinated to the Ministry of Energy, which has neither legal powers nor financial autonomy. However, the law does provide technical, operative, management and decision-making autonomy. This organization, established in 1995, is composed of five commissioners who are appointed by the President of the Republic at the proposal of the Ministry of Energy.

1 The Council will have the following tasks: a) to propose criteria and elements of energy policy to the Ministry of Energy and b) to support the Ministry of Energy in the design of mid and long-term energy planning. The National Energy Council is constituted by the head of the Ministry of Energy, who shall preside, as well as sub-secretaries and the senior office of that unit and the heads of decentralized organizations in the sector and the National Water Commission.

According to the Law of the Energy Regulatory Commission, which was signed in 1995 and later reformed in 2008, the CRE has the goal of promoting the development of the following activities that are called "regulated activities":

- The supply and sale of electricity to public service users. co.
- The generation, export and import of electricity, realized by particular agencies.
- The acquisition of electricity intended for public service.
- Services of transmission, transformation and electricity delivery among entities responsible for the provision of public service electricity and between them and the holders of generation, export and import permits for electricity.
- The first hand sales of gas, fuel oil and basic petrochemicals.
- The transport and distribution of gas, of petroleum derivatives, of basic petrochemicals and of bioenergy is performed through pipelines and storage systems that are directly linked to the product transport and distribution systems and form an integral part of the import or distribution terminals of such products;

So that the CRE can meet its goals, the law grants it a number of powers to:

- Participate in setting rates for the supply and sale of electricity.[2]
- Approve methodologies to calculate the compensation for electricity acquisition that is intended for public service.
- Approve the fees related to electricity transmission.
- Approve and issue the terms and conditions that first hand sales of fuel oil, gas and basic petrochemicals will be subject to, as well as the methodologies for determining their price.
- Approve the criteria and the basis for determining the amount of contribution of state government entities and beneficiaries of public electricity service.
- Verify that the CFE purchases electricity at the lowest cost and that it offers, furthermore, the highest stability, quality and security for the national electricity system..
- Grant and revoke permits and authorizations in accordance with applicable legal provisions required in order to carry out regulated activities.
- Approve and issue standard agreements and adhesion contracts for conducting regulated activities.
- Issue and monitor compliance with general administrative provisions applicable to people engaged in regulated activities.
- Act as a mediator or arbitrator to resolve regulated activity disputes.
- Impose administrative sanctionss:
  - Whoever sells or resells or, by any legal act transfers capacity or electricity, except in cases expressly permitted by this Act.
  - Whoever establishes self-supply, co-generation, independent production or small production plants or exports or imports electricity without permission.

2 According to article 31 of the Law of Public Service Electricity, setting rates for electricity is an exclusive power of the Ministry of Finance and Public Credit at the proposal of the CFE. The CRE does not participate in setting these rates.

In addition to the CRE, in 2008 the National Hydrocarbons Commission (CNH) was created as a decentralized body subordinate to the Ministry of Energy. Its main responsibility is to regulate hydrocarbon exploration and extraction, including processing, transport and storage activities that are directly related to exploration and extraction. This organization is composed of five commissioners directly appointed by the Federal Executive.

The CNH is mainly a technical organization that aims to support the work of the Ministry of Energy through the monitoring and technical certification of oil exploration and exploitation projects carried out by PEMEX. The main objectives of the commission are: (i) to increase, over the long-term and in economically viable conditions the recovery rate, as well as to obtain the maximum volume of crude oil and natural gas from wells, fields and abandoned deposits or deposits in the process of being abandoned or currently being exploited (ii) to gradually replenish the hydrocarbon reserves, (iii) to use the most appropriate technology for hydrocarbon exploration and extraction, (iv) to protect the environment and achieve the sustainability of natural resources in oil exploration and extraction, (v) to carry out hydrocarbon exploration and extraction, taking into account the necessary conditions for industrial security; and (vi) to minimize gas and hydrocarbon flaring and venting during removal.

The CNH is responsible for helping determine the Petroleum Reserve Areas that, as indicated in the rules of the law, are established by the Ministry of Energy. These areas are land areas where exploration activities are restricted and hydrocarbon exploitation activities by any public or private organization are prohibited. Once these areas are established, the Ministry can grant PEMEX Exploration and Production (PEP) Surface Exploration Permits authorizing it to undertake reconnaissance and surface exploration activities in these areas.

While the subsidiary of PEMEX operates in these areas, it should present a report annually to the Ministry about certified petroleum reserves as certified by a third party and approved by the CNH. The CNH also participates in registering comprehensive contracts awarded by the PEP to private companies. However, it does not regulate them.

The Ministry of Finance and Public Credit participates in the regulation of the energy sector given that it is responsible for setting public sale prices for gasoline, diesel and electricity. This power is granted to the SHCP in article 31, section X of the Organic Law of Federal Public Administration, which state that it is the responsibility of the ministry “to establish and review the prices and tariffs for goods and services under federal public administration or to review the information in order to set them.” The determination of administrated price adjustments is subordinate to the Undersecretary of Revenue, which sets prices through the General Office of Petroleum Revenue Policies (Gas LP, gas and diesel) and the General Office of Prices and Tariffs (electricity).

The Ministry of Economy is responsible for setting prices for liquefied petroleum gas for the final user.

ELECTRICITY SECTOR INSTITUTIONAL MATRIX

Generation

	Installed capacity
Hydroelectric	20.2%
Solar & wind	2.7%
Thermoelectric	77.1%
Nuclear	2.6%
Main state-owned company	CFE 77.5%
Private participation	Partially allowed
Requirements	Diverse
Registrations	28 private companies [a]
Vertical integration	Not Allowed
Incentives	
Machine and Equipment	Only for renewable energies
Income & Other taxes waived for biofuels projects	Except of permits if smaller than 0.5 MW
Pricing politics	
Contracts market	Price determined in generation contracts with private generators and CFE
Spot market	n/a

Transmission

Company	CFE
Ownership	State
Market	Monopoly
Functions	The dispatch operations are controlled by the CFE through the National Control Center for Energy (Centro Nacional de Control de Energía, CENACE)
Pricing policy	Partially regulated. Established in the transmission rights contracts
Private participation?	No
Retailers	No
Large consumers	No

Distribution

Distributor	CFE
National coverage	96.80%
Market	National monopoly
State company	CFE
Private participation?	No
Concessions	n/a
Subsidized users	Residential users with consumption smaller than 250 kWh/month
Pricing policy	Regulated

Regulator	Energy Regulatory Commission (Comisión Reguladora de Energía, CRE)
Members of the board	5
Named by the President of the Republic?	Si
Financing	Funds from the National Budget (Ministry of Energy)

Source: CEPAL, SIE, CDEEE, IDB, and own calculations.

a. There are 28 companies authorized as independent producers

Electricity subsector

The electricity subsector in Mexico operates under a legal and institutional structure designed mainly in the Law of Public Electricity Service (LSPEE) and its regulations. This law states that the Federal Electricity Commission (CFE) is the agency responsible for all public electricity service activities. The CFE is a decentralized organization with its own character and patrimony, which includes the following among its objectives:

- Ensure the provision of the public electricity service, which involves:
  - Planning of the national electricity system.
  - Generation, transmission, processing, distribution and sale of electricity.
  - Completion of all works, facilities and jobs that require the planning, implementation, operation and maintenance of the national electricity system.
- Propose investment programs to the SENER for approval.
- Export and import electricity for public service use.
- Enter into agreements or contracts with the Governments of Federal States and Municipalities or with public and private entities or individuals to carry out actions related to the provision of public electricity service.
- Carry out operations and to make acts and contracts necessary for the fulfillment of its purpose.

The Federal Electricity Commission is run by a governing board that sets its policies and priorities and by a CEO named by the Federal Executive who has administrative responsibilities. The governing board consists of eight members of which five[3] are appointed by the Federal Executive and three representatives of the CFE union. The governing board's most important functions include:

- The CEO's proposals for the adjustment or restructuring of rates, which must subsequently be submitted for approval to the Ministry of Finance and Public Credit.
- The financial statements and annual budgets of the organization.
- The programs should be subject to authorization by the SENER.
- The organization's internal regulations and internal organizational changes.

The CEO manages the administrative units of the CFE, which have five offices. Of these, it is important to highlight the Directorate of Operations, which is responsible for the Branch of the National Center for Energy Control (Cenace), which is the unit responsible for directing and coordinating the operation of the National Electricity System. The Cenace has additional functions such as:

- Establish the policies, standards and guidelines for the operation of the National Electricity System.
- Form guidelines and policies in areas of control, in the administration of regulated contracts with licensees and regulated external energy producers.

3 The five (5) members named by the Federal Executive are: the secretary of Energy, who presides; the secretary of Finance and Public Credit; the secretary of Social Development; the secretary of Environment and Natural Resources; the secretary of Economy; the CEO of Mexican Petroleum.

- Establish programs in coordination with the National Water Commission for the management of water storage and water use in hydroelectric plants.
- Participate in contract negotiations for international energy exchange for the cooperation and development of technology in the area of electricity power systems.
- Lead the development and implementation of methodologies and projects for the operation and establishment of price transfers.

Private businesses can participate in the electricity industry by permits issued by the Energy Regulatory Commission (CRE)[4]. The LSPEE allows the granting of these permits as long as they are confined to one of the four categories defined by law or are for export or electricity import. The conditions are defined as:

- **Independent production:** the generation of electricity from a plant with a capacity greater than 30 MW, destined exclusively for sale to the Commission or for export
  - Must be individuals or entities incorporated in Mexico.
  - Project should be included in the Commission's programming or have an equivalent capacity to one of the increased capacity or substitution proposals to the Commission.
  - Can apply for permits to export.
  - Permits will not exceed 30 years

- **Self-supply:** The use of electricity for self-consumption as long as such energy comes from plants that will meet the needs of all owners or partners.
  - Permits may be for an undefined time.
  - Contracts for the sale of capacity and energy with the CFE can be for up to 20 MW, as long as the installed capacity of the plant is not greater than 40 MW.
  - For plants of more than 40 MW, the contracts with the CFE for capacity and energy cannot exceed 50% of the installed capacity[5].
  - Permission is not necessary for plants with a capacity of less than a 0.5 MW.

- **Co-generation:** (i) The production of electricity together with vapor or another type of secondary thermal energy, or both; (ii) The direct or indirect production of electricity from thermal energy not utilized in the processes in question, or (iii) the direct or indirect production of energy using fuels produced in the processes in question.
  - The licensee will have to put the energy produced at the disposal of the CFE.
  - The electricity produced can only be used by the facility where electricity is generated or in facilities of their shareholders
  - They can apply for export permits.
  - Contracts with the CFE for capacity and energy can be up to 100% of the surplus production.[6]
  - The contracts can be for an undefined time.

4 The CRE awards Independent Energy Producer permits (IEP) to the winners of bids carried out by the CFE. As consulted experts indicated, the awarding of these permissions is mainly a formality given that the CRE has little participation in the bidding process.

5 In practice self-supply contracts only reach a maximum of 20 MW of installed capacity, so it does not apply to the 50% percentage of plants with over 40 MW.

6 In practice co-generation contracts have the same characteristics as self-supply contracts, including the restriction of offering a maximum of 20 MW of installed capacity.

- **Small production:** (i) electricity generation in establishments with a capacity greater than 30 MW and that sell all of their generated electricity to the Commission; (ii) self-supply of small rural communities or isolated areas that lack electricity service in which case projects cannot exceed 1 MW, and (iii) export within the maximum limit of 30 MW.
    - The owner will not be able to own plants totaling more than 30 MW of generation capacity in the same area.
    - In remote areas or small rural communities cooperatives should be formed for these generation projects.
    - They can request permits for export.
    - The permits can be for an undefined time.

In Mexico, the National Electricity System is divided into nine areas[7] of generation and transmission. All the areas are interconnected. Only the two areas on the Baja California peninsula are still isolated systems.

Generation

In 2010 the National Electricity System (SEN) had 178 electricity generation centers of which 156 were run by the CFE and 22 were Independent Energy Producers (IEP). The age of generation plants considered for their installed capacity was 31.6 years in the case of hydropower plants and 18.8 years for thermal plants.

The nine areas into which the National Interconnected System was divided in December 2010 had an installed generation capacity of 52,945.4 MW. The CFE controlled 77.5%, while independent producers accumulated 22.5% of the total installed capacity. As shown in table 1, the greatest portion, 73.7% of installed capacity, is made up of thermal generation plants, followed by hydraulic generation plants that represented 21.7%.

Table 1. Distribution of public service electricity generation installed capacity in Mexico, 2010

Sources	Public	Private*	Total
Primary			
Nuclear	2.6%	n.a.	2.6%
Hydro	21.7%	n.a.	21.7%
Geothermal	1.8%	n.a.	1.8%
Wind	0.2%	n.a.	0.2%
Secondary			
Thermal	51.2%	22.5%	73.7%
Total	**77.5%**	**22.5%**	**100.0%**

Source: SENER and own calculations
* This total only includes the installed capacity of plants with independent producer permits that sell 100% of their generated electricity to CFE

Until 2010, the CRE had awarded 623 permits to private generators totaling an approved capacity of 26,003 MW. In the case of the IEP, 29 permits were awarded, of which 23 were for combined cycle plants and the other five were for wind generation projects. The use of natural gas was also predominant in the permissions awarded to

7 The National Electricity System includes nine electrical areas: Northwest, North, Northeast, West, Central, East, Peninsular, Baja California and South Baja California.

exporters, where 83% were awarded to plants that used natural gas and the remaining 17% were awarded to wind generation plants. Exporters were predominantly located in the north in the states of Baja California and Sonora. Only one was located in the south in the state of Yucatán. In addition, the regulatory organization awarded 469 of these permits to self-generators, averaging 13 MW of approved capacity for each permit issued.

Table 2: Granted permits to private operators by the CRE till 2010

Type of permit	Number of permits granted	Approved capacity (MW)	Average approved capacity (MW)
Independent Energy Producer	28	14,290	510
Auto-generator	469	6,320	13
Exporter	6	2,780	463
Co-generator	43	1,959	46
Continuous own-use	44	463	11
Import	28	144	5
Small producer	5	47	9
Total	**623**	**26,003**	**1,058**

Source: CRE and own calculations

Transmission

Electricity transmission in Mexico is a monopoly run by the CFE through the National Energy Control Center (Cenace), an office under the Operations Directorate. The CFE transmission system has a central unit; six control centers located in Baja California, Sonora, Durango, Nuevo León, Jalisco, Puebla and Yucatán; and 35 sub-areas of control with a processing capacity of 154,485.70 MW. The transmission network under the control of the CFE in 2010 had a total length of 50,136.84 Km, and 54.5% of the lines had 230 KV of tension, 44.4% of 400 KV and the remaining 1.1% were less than 230 KV.

The permit agency should suspend tariffs to the CFE called "charges for transmission services" to use the transmission infrastructure. These amounts are calculated based on the amount of electricity that is transmitted and are differentiated from other types of energy sources because they are fixed for renewables and variable for generators with non-renewable sources.

Table 3: CFE Transmission lines managed by CENACE, 2010

Transmission line characteristics	Length (Km)	
400 KV Transmission lines	22,271.36	44.4%
230 KV Transmission lines	27,316.68	54.5%
230 KV or lower Transmission lines	548.8	1.1%
Total transmission lines	**50,136.84**	**100.0%**

Source: CFE and own calculations

Auto-generators can ask for authorization to use CFE transmission lines. In this sector, the amount of energy transported in the National Energy System by auto-generators reached 10,487.0 GWh in 2010, representing an increase of 7.16% since 2009.

The rules of the Cenace office state that they "will be held strictly in increasing order of their respective total short-term cost or proposed price until it is needed to meet the demand at all times." The same rules establish that Cenace "will provide each of the energy producers, by appropriate means, at no later than 3pm each day, the office program, hour by hour for the following day, detailed by the producer."

Distribution

As with transmission, the distribution network in Mexico is controlled entirely by the CFE. In 2010, the commission calculated that the system had 698,626 Km of sub-transmission and distribution lines and 1,674 distribution substations. The system had 23.95 million users in 2010, divided into seven categories. The majority of domestic users paid an average of 9.91 cents on the dollar for each Kwh consumed. However, despite the fact that a growing number of users are residential, the CFE sold the majority of electricity to industrial users and to medium sized companies, which accumulated 61% of the total.

Table 4: Users, percentage of sold electricity, and tariffs by sector, 2010

	Users	Percentage of Sold Electricity	Average Tariff (December 2010) US$ Cents
Residential	20,457,564	16%	9.91
Commercial	2,751,324	4%	20.08
Services	174,997	3%	15.40
Industrial	228,339	37%	10.22
Mid-size company	227,579	24%	11.21
Large industry	760	13%	8.53
Agricultural	118,100	3%	5.19
Total	**23,958,663**	**100%**	**10.90**

Source: CFE and own calculations. Exchange rate on December 31, 2010 was 12.345 pesos/US$

In Mexico there are 32 different tariffs that are determined by the tariff sector (type of user), zones and the level of demand among other variables. For the residential sector there are eight different types of tariffs[8], seven of them for consumers that use less than 250 Kwh/month on average during the previous 12 months, and the remaining for consumers that used more than this level, which is called Domestic High Consumption (DAC). The only residential tariffs

8 8 1, 1A, 1B, 1C, 1D, 1E, 1F and DAC. The tariffs 1A to 1F are specific tariffs that depend on the average temperature of the region in which the domestic user lives.

that aren't subsidized are the DAC tariffs that accumulated during 5.62% of the electricity sales made by the CFE in 2010 to residential consumers. Thus, 94.38% of residential users enjoyed some subsidy in their electricity tariff.

Price Formation

In Mexico, the most important variable for determining the cost of electricity generation is the price of fuels. In 2010, 71.3% of the 241,493 GWh of electricity generated was produced from fossil fuels.[9] In its role as large fuel consumer, the CFE maintained contracts with PEMEX that allowed it to buy fuels at the maximum first hand price determined by the CRE (natural gas and fuel oil) by the Ministry of Finance (diesel). Also, as an intermediary, the CFE has contracts with private plants (IEP) to provide natural gas, which ensures long-term guaranteed thermal consumption with a defined fuel. The IEP also has the option of participating in the internal natural gas market or importing it, if they deem it necessary.

The CFE buys part of the generation from private operators or licensees. The pricing mechanism of these purchases is supported by individual contracts between the commission and each of the licensees and in the rules of the Cenace office, which must buy energy at the total short-term cost. LSPEE regulations establish the guidelines to calculate the compensation that should be included in purchase contracts. The guidelines establish that contracts will include compensation that will contain a payment for *capacity* and a *payment for energy* delivered to the point of interconnection.

9 CFE. 2010 Annual Report.

The payment for *capacity* must include the fixed costs incurred by the licensee and the yield on investment (including investments made for transmission). This payment will be adjusted monthly by a coefficient calculated based on an availability[10], factor of 10, which will penalize or repay the licensee for the amount of energy generated by the unit according to its capacity[11]. The *payment for energy* should include cost variables (fuels, employees, maintenance, transmission fees, etc.), which licensees will incur to generate this energy.

In addition to contracts with private operators like IEP, who are forced to sell their entire generated energy to the CFE, there are other types of contracts with other concessionaires (co-generators, auto-generators and small producers) in which the plants can sell their surplus to the commission. These contracts have three forms for the sale of surplus:

- **With notification**: a month before release. In this case the generator suggests a price (proposed price) for the sale of their surplus energy with which it will compete on the scale of total short-term Cenace costs. If the energy is requested, the generator should supply the agreed energy.

10 Availability factor: It is an indicator of availability relative to a generation unit during a determined period, calculated as the difference between the maximum energy that the unit can produce and the energy that is cannot produced due to maintenance activities, failures, decreases in capacity or other causes, dividing the difference by the maximum energy that the unit can produce.

11 In the contract the licensee agrees to maintain a monthly availability factor within a specific range, with a upper and lower limit and a minimum. If the availability factor is below the minimum allowable, the coefficient will be zero; if it is below the lower limit the coefficient will be less than one; if it is located within the range the coefficient will be equal to the unit; if it is greater than the upper limit it will be greater than the unit.

- **With notification:** short-term, less than a month before release. In this case, the generator informs the commission of the availability of excess energy that it would be interested in selling. If the CEF is interested, it proposes a price that the generator will accept. This price will be between 85 and 90% of the total short-term cost at that time. In that case the licensee is a *price taker*.
- **Without notification:** In this case, the licensee who is interested in selling an unplanned energy surplus should take a price determined by the CFE, which should be between 85 and 90% of the total short-term cost at that time. In this case the licensee is a *price taker*.

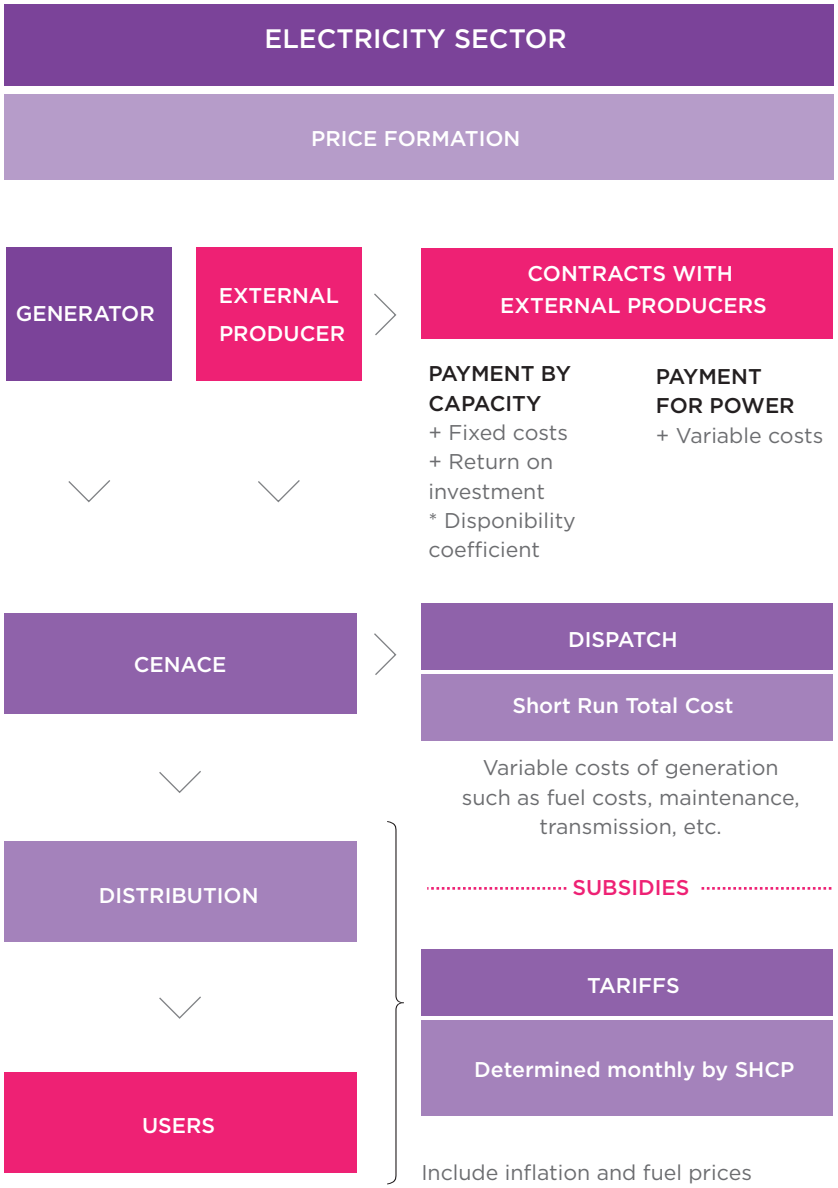
After acquiring all the energy needed to supply domestic demand, the CFFE sells it to final users using its distribution network. However, it doesn't set the rates at which it sells.

According to article 31 of the LSPEE, the Ministry of Finance and Public Credit (SHCP) determines the rates for electricity sales with the participation of the SENER, the Ministry of Economy and the CFE. The "additional provisions" contain rules to calculate the rates published by the SHCP. According to this regulation, the rates are calculated from formulas that include variables such as the price of fuels, the area of consumption, inflation, consumption levels and types of users, among others. The rates are adjusted monthly as a result of changes in the variables that form part of the calculation of the Inflation Adjustment Factor and the Fuel Adjustment Factor.

Electricity rates for final users do not include direct transfer (*pass-through*) of the generation costs. This situation is present in the electricity market even though article 26 of the Regulations of the Federal Law of Public Entities states that, "prices and rates of entities are set according to economic efficiency and financial health criteria" and that the LSPEE in article 31 establishes that the electricity rates should "cover the financial needs and the expansion of public service and rational energy consumption."

The gap between generation costs and rates is partially cushioned by the "coefficient alpha"(**α**), which is calculated by the CFE and whose value is determined each year based on the composition of the basket of fuels used by all the public service generation plants during the year in question. According to consulted experts, it is common that rates and generation costs have a gap and that, in some cases, they produce losses and, in others, surplus income. When this occurs, the losses are assumed by the CFE and the surplus income is transferred to the Ministry of Finance.

Figure 1. Price formation in the electricity sector



Renewables

The Law for the Use of Renewable Energy and Financing Energy Transition (Renewable Energy Law) states that by 2024 no more than 65% of electricity generation in Mexico will come from fossil fuel sources. It also states that these sources will not exceed more than 60% by 2035 and more than 50% by 2050. Since the mandate only provides a limit on fossil energy, the planning of the Ministry of Energy includes the expansion of nuclear energy and large hydroelectric plants.

The definition of renewable energy in the law establishes that they are considered as "those sources that lie in natural phenomena, processes or materials that can be converted into energy for use by mankind, that are naturally regenerating, so they are available continuously or periodically, such as:

- Wind
- Solar radiation in all its forms.
- Movement of water in natural or artificial channels; excluding hydropower with the capacity to generate more than 30 MW, except when:
  - Use of storage less than 50,000 meters squared for water or if it has a reservoir with less than one hectare of surface and does not base said storage capacity on water storage. These reservoirs should be located within the property on which the generator has real rights.

- If it relates to existing reservoirs, even greater capacity ones, they should be suitable for electricity generation.
- Ocean energy in its various forms, namely: tidal, thermal ocean energy, waves, marine currents and the salt concentration gradient.
- Heat from geothermal reservoirs.
- Bioenergy[12] as determined by the Law on Promotion and Development of Bioenergy.
- Any others that, in their case, the Ministry decides that the source meets the requirements of the first paragraph of this fraction."

In 2008, according to the "Special Program to Use Renewable Energy 2009-2012,"[13], the installed capacity of generation plants that use renewable energy (according to the definition of the law) represented 3.3% of the total system installed capacity. Generation with these sources corresponded to 3.9% of the generation total.

Due to the strategic importance that was given to the objective of achieving the targets set, the regulatory framework provides a number of incentives for the development of renewable sources that are listed below:

- **Tax incentives[14]:** Companies that invest in machinery and equipment to be used for generation with renewable energy sources are allowed to deduct the income tax of up to 100% of the amount of investment. The teams should be in business for at least five years.
- **Transmission service fee[15]:** Establishes a fixed fee charged by the CFE for transmission services to licensees that produce energy from renewable sources. According to Mexican government sources, this charge is under the amount charged by other generators with non-renewable sources
- **Energy bank[16]:** In the case of intermittent sources, the CRE contracts establish the inclusion of an "energy bank." This mechanism allows the private generator to transmit all the energy produced regardless of demand. The transmitted energy accumulates virtually and is sold, as there is demand. The total short-term costs meet the generation costs of the licensee.
- **Energy surcharge[17]:** Contracts with small producers or with auto-generators (contracts to sell its excess) that use renewable energy sources for their operation stipulate that the CFE is going to buy all the energy produced at 98% of the total short-term cost in the corresponding region, which increases the range from 85-90% for non-renewable generators.

12 Bioenergy: biomass fuels obtained from organic matter in the following activities: agriculture, livestock, forestry, aquaculture, algae culture, fisheries waste, domestic, commercial, industrial, microorganisms and enzymes, as well as their derivatives produced by sustainable technological processes.
13 Published in the DOF on August 6, 2009.

14 Law on Income Tax. Article 40.
15 CRE document: Methodology to Determine the Fee for Electricity Transmission Service for Renewable Energy Sources.
16 CRE contract models, for example, "Interconnection contract to self-supply government entities."
17 CRE contract models, for example, "Contract for the buying and selling of electricity for small producers" and "Contract for the buying and selling of excess electricity."

Hydrocarbon Sub-Sector Institutional Matrix, 2011

Production

Main company	Petróleos Mexicanos. PEMEX
Ownership	100% owned by the Mexican state
Operative subsidiary	PEMEX Exploración y Producción (PEP)
Infrastructure	
Productive fields	416 (250 crude oil and associated gas / 166 associated gas)
Crude oil production	2,550.1 Mbd
Natural gas production	6,594 Mcf/day
Private participation	Very restricted. Only for services under integral contracts

Exporting

Main company	Petróleos Mexicanos. PEMEX
Operative subsidiary	PEMEX Exploración y Producción (PEP)
Crude oil exporting	1,338 Mbd
Export destinations	
Volume Mbd / total export percentage	1,095 (81.8%)
United States	110 (8.2%)
Spain	371 (2.8%)
India	366 (2.7%)
China	205 (1.9%)
Canada	178 (1.3%)
San José Agreement	171 (1.3%)
Rest of the World	

Importing

Main company	Petróleos Mexicanos. PEMEX
Ownership	100% owned by the Mexican state
Natural gas (includes liquefied natural gas)	
Total imports	1,750 Mcf/day
Main company	PEMEX Gas y Petroquímica Básica (PGPB)
Ownership	100% owned by the Mexican state
Private participation	Allowed
PGPB Imports (Volume Mcf/day / Percentage of total imports)	829 (47.4%)
Private Imports (Volume Mcf/day / Percentage of total imports)	920 (52.6%)
Oil products (gasolines, diesel, and others)	
Total imports	547 Mbdpce
Main company	PEMEX. Organismos subsidiarios
Ownership	100% owned by the Mexican state
Private participation	Not allowed
Gasolines (Volume Mbd / share)	335 (61.2%)
Diesel (Volume Mbd / share)	135.6 (24.7%)
Others	76.9 (14%)
Liquefied Petroleum Gas	
Total Imports	82.4 Mbd
Main company	PEMEX Gas y Petroquímica Básica (PGPB)
Ownership	100% owned by the Mexican state
Private participation	Allowed

Source: Author's work with information from SENER, CRE, PEMEX, and current legislation

Transformation/refining

Main company	PEMEX
Ownership	100% owned by the Mexican state
Private participation	Not Allowed
Crude oil	
Main company	PEMEX Refinación
Total refining capacity	1,690 Mbd
Total refineries	6
Total refined products	1,005.2 Mbdpce
Gasolines	32%
Diesel	27%
Fuel oil	33%
Others	8%
Liquefied Petroleum Gas (LPG)	
Total national production	210.5 Mbd
Main company	PEMEX Gas y Petroquímica Básica (PGPB)
Total PGPB Production	185.4
Market share	88.1%
Gas Processing Centers	9
Natural Gas	
Total Processing	4,527 Mcf/day
Main processing company	PEMEX Gas y Petroquímica Básica (PGPB)
Gas Processing Centers	9

Transport / Distribution

Gasoline and diesel	
Private participation	Allowed. PEMEX franchises
Total service stations	9,637
Prices	Regulated
LPG	
Transport and wholesale storage	
Main company	PEMEX Gas y Petroquímica Básica (PGPB)
Private participation	Allowed
Total supply terminals	20 belonging to PGPB
Prices	Regulated
Distribution	
Total distribution plants	983
Private participation	Permitted
Transport companies	171
Prices	Regulated
Natural Gas	
Transport and wholesale storage	
Main company	PEMEX Gas y Petroquímica Básica (PGPB)
Private participation	Allowed
Total supply terminals	11 belonging to PEMEX
Distribution	Regulated. CRE establishes a maximum price of first sale
Private participation	Allowed
Total active permits	20
Main company	Gas Natural de Mexico S.A. de CV - Union Fenosa
Consumption	
Oil sector	45%
Electricity sector	39%
Industrial sector	14%
Others	2%
Prices	Unregulated

Hydrocarbon subsector

The Mexican constitution, in articles 27 and 28, grants the State a monopoly over all hydrocarbon sector activities. The exploitation of this constitutional requirement is made through the Regulatory Law of article 27 of the Constitution of the Petroleum Sector and its regulations, which are the main legal instruments that govern the hydrocarbon subsector. Article 4 of the law establishes that Mexican Petroleum (PEMEX) will be the institution responsible for carrying out all petroleum industry activities defined in article 3. The activities to which this article makes reference are:

- Exploration, exploitation, refining, transportation, storage, distribution and first hand sales of oil and the products obtained from refining it.
- Exploration, exploitation, processing and first hand sales of gas, as well as the transport and storage necessary and indispensable to interconnect its exploitation and processing (excluding gas associated with coal deposits).
- Production, transportation, storage, distribution and first-hand sales of petroleum and gas derivatives are likely to serve as basic raw industrial materials and to be used to make basic petrochemicals[18].

Private companies may carry the transport, storage and distribution of gas, methane gas and secondary petrochemicals without prior permission.

18 These petroleum products are: ethane, propane, butanes, pentanes, hexane, heptane, raw material for coal fillers, oil and methane, when it comes from hydrogen carbides obtained from deposits located in the country and used as raw material in industrial petrochemical processes.

The regulatory framework that established the operation of PEMEX was instituted in 2008 with the approval of the Mexican Petroleum law and its regulations. The law states that a CEO named by the Federal Executive and a Board of fifteen members will run the state oil company. On the board, there will be six State representatives designated by the Federal Executive, five representatives of the Union Oil Workers of the Republic of Mexico and four professionals assigned by the Federal Executive who should be ratified by the Senate. The president of the Board will be the head of the Ministry of Energy, and will be able to vote in the case of a tie. The Board of Directors is supported by management committees in seven functional areas divided by business.[19]

Among the most important powers granted to the Board of the Directors are:

- Central leadership and strategic direction of Mexican Petroleum and its subsidiaries.
    - Establish, consistent with the Energy Sector Program, general policies relating to production, marketing, technology development, general management and finance.
    - Issue guidelines that regulate the working relationships between Mexican Petroleum and its subsidiaries.

19 The seven committees that support the Board of Directors are: I. Audit and Performance Evaluation; II. Strategy and Investments; III. Compensation; IV. Acquisitions, Leases, Works and Services; V. Environment and Sustainable Development; VI. Transparency and Accountability, and VII. Technology Research and Development.

    - Adopt rules for the consolidation of annual accounting and finance for the subsidiaries of Mexican Petroleum.
- Monitor and evaluate the performance of Mexican Petroleum and its subsidiaries.
- Annually approve the business plan for Mexican Petroleum and its subsidiaries.
- Approve:
    - Remuneration of the CEO and staff of the three hierarchical levels below the CEO.
    - Provisions applicable to Mexican Petroleum and its subsidiaries for the procurement of works and services related to acquisitions, leases and services.
    - Projects and investment programs, such as contracts exceeding the amounts established in the provisions issued to that effect.
- Approve budgets for projects for Mexican Petroleum and its subsidiaries.
- Approve the annual financial statements of the entity.
- Approve the terms and conditions for the contracting of public debt obligations of Mexican Petroleum according to the funding program approved by the Ministry of Finance and Public Credit and the guidelines approved by this authority.
- Approve, at the request of the CEO, the proposal to set up subsidiaries and other organizations with ties to Mexican Petroleum.

For his/her part, the CEO has the following duties:

- Manage and legally represent PEMEX.
- Conduct strategic planning and to prepare drafts of income and consolidated budgets for PEMEX and its subsidiaries.
- Develop and submit for the approval of the Board the business plan and annual operational and financial work program.
- Agree with the Union of Oil Workers of the Mexican Republic to the collective contract.

To conduct their operations, PEMEX consists of six subsidiaries: PEMEX Exploration and Production; PEMEX Refining; PEMEX Petrochemical; PEMEX Gas and Basic Petrochemical; the Mexican Petroleum Institute and PMI International Trade. The following paragraphs will describe the most important activities of the hydrocarbon subsector in Mexico

Exploration and Production

PEMEX Exploration and Production (PEP) is the subsidiary of PEMEX responsible for the activities related to the exploration and production of petroleum and natural gas. They are also responsible for the transport, storage in terminals and first hand marketing of both products. PEP exploration and exploitation activities are carried out in four geographic regions of Mexico that are located in the east of the country bordering the Gulf of Mexico. These zones are called North and South in the continental territory and Marine Northeast and Marine Southeast in marine territory.

In the report[20] presented on January 1, 2011, "the estimates of total possible and tested reserves (3P) were 43,055.4 million barrels of oil equivalent. By type, 31.9% corresponded to tested reserves, 34.5% to probable and 33.6% to possible reserves. Of the total 3P reserves, the Northern Region has 44% (18,917.7 million barrels of crude oil equivalent). In particular, the project Tertiary Gulf Oil, Chicontepec, has the greatest accumulation of reserves with 17,211 million barrels and also the greatest challenge for its exploitation. It is followed in order of importance by the Marine Northeast Region with a participation of 28% (12,054.3 millions of barrels), the Marine Southwest Region with 14.8% (6,383.7 millions of barrels) and the South Region with 13.2% (5,699.6 million barrels)."

In terms of the oil industry, the above report indicates that "in 2010, the extraction of crude oil was 2,575.9 thousand barrels a day, 1% less than the previous year, mainly due to the decline and closing of Active Integral Cantarell wells, coupled with lower production in the comprehensive assets Bellota-Jujo, Abkatún-Pol-Chuc and Poza Rica-Altamira."

On the production of natural gas: in 2010 "it fell 0.2% from the previous year, registering 7,020 million cubic IEPs per day, a statistic that includes 683 million cubic IEPs per day of nitrogen, which is obtained from natural gas and is an undesired compound."

This PEMEX subsidiary has the additional responsibility of making further bids and managing the comprehensive contracts for exploration and production where private companies participate.

20 Mexican Petroleum. Annual report 2010. March 2011.

Refining

PEMEX Refining, a subsidiary of PEMEX, is responsible for the refining, processing of petroleum products and derivatives, storage and first hand sale. It is also responsible for the planning, management and control of the commercial network, as well as the subscription of contracts with private investors who participate in the PEMEX Franchise program.

In 2010, PEMEX Refining had a refining capacity of 1.54 million barrels and had six refineries, 77 storage and distribution terminals, 14 maritime terminals, 1,360 tankers, 5,199 Km of oil pipelines and 8,983 Km of polyduct pipelines.[21] That same year the subsidiary company processed an average of 1,184 thousand barrels per day, developing 1,229 thousand barrels per day of oil products, of which 34.5% were gasoline, 26.2% fuel, 23.6% diesel and the remaining 14.2% is divided among other products.

Marketing

In 2010 Mexico had 9,232 service stations for internal fuel marketing. It is estimated that these facilities sold an average of 792,600 barrels of gasoline per day. All of these stations are managed by the private sector under the franchise model. The PEMEX Franchise system, like the tradition franchise model, involves the sale by PEMEX of the right to operate service stations where the contracted entity promises to maintain the image of PEMEX in its establishments and to buy fuels

21 Annual statistic 2011. PEMEX.

exclusively from the Mexican petroleum company. The state petroleum company assures that the owner of the service station will earn a margin on the fuel. At the end of 2010, this margin held at around 6.7% of the sale price of the product.

The PEMEX franchise market is very decentralized (the majority of owners have two service stations) given that large groups control only 500 of the 10,000 service stations. Supply of fuel to the service station is controlled 60-65% by PEMEX, and six large transport companies carry out the remaining supply.

The fuel retailers are organized under civil associations such as the National Organization of Petroleum Retailers S.A. (Onexpo) and the Mexican Association of Gasoline Entrepreneurs C.A. (Amegas).

Private retail entrepreneurs carry out the distribution of liquefied petroleum gas. The installed infrastructure for this includes 991 distribution plants, a little more than 12,000 semi-trailers, 20,000 vehicles for the distribution to transportable containers, 2,774 carburation stations (85% specialize in the sale of LP gas for carburetion and 15% in the form of auto-consumption), 171 LP gas transport companies.[22]

Price formation

The Ministry of Finance and Public Credit, the Energy Regulatory Commission, the Ministry of Economy and the Ministry of Energy regulate domestic prices of hydrocarbon subsector products. The Ministry of Finance and the Ministry of Economy regulate the "administered" prices, which are the prices of products considered to be of the greatest importance to the public, like gasoline, diesel and liquefied petroleum gas. Meanwhile, the Energy Regulatory Commission participates in "regulated" price markets like natural gas and fuel.

Liquefied Petroleum Gas

Liquefied petroleum gas (LPG) is used in 80% of homes, which is why it is considered an important necessity and is included in the basic energy basket. Due to this circumstance, the Federal Executive participates actively in the regulation of prices through the Ministry of Finance and Public Credit, the Ministry of Economy and the Ministry of Energy.

The Federal Executive, with the participation of the ministries discussed above, and based on the Income Law of the Federation for the Fiscal Exercise for 2012, determines monthly "the average national price discussed for the public." Using this price as the basis for calculation, a few days after the agreement where different prices are established for final LPG users, the Ministry of Economy publishes them for each of the 145 regions[23] in which fossil fuel supply is divided. In this way, the averaged discussed for all the prices in the 145 regions will be similar to the average price discussed by the national public.

22 SENER. Prospective Liquefied Petroleum Gas. From 2012 to 2026.

23 The 145 price regions into which the LPG market is divided were published in the Diario Oficial de la Federación by the Ministry of Economy on December 31, 2007. This agreement specified the municipalities and states that formed part of each region.

The legislation, however, establishes the more active participation of the Energy Regulatory Commission in the LPG market than the agency really has. In fact, the agreement published monthly by the Ministry of Economy[24] that establishes the formula[25] to calculate the price for the final user includes variables that are established by the CRE, such as the first hand sale price of LPG according to a methodology established by the same agency.

However, the mandate of the Federal Executive states that the methodology determined by the CRE must meet the national price discussed by the public as established by other agencies. This provision, which sets the final price and adapts those prices to the price formation structure, substantially reduces the ability of the regulator to influence prices. Of the other three variables that form part of the formula, only the marketing margin is determined by the CRE, but they are pre-set values and don't vary greatly over time.

Figure 2: Price formation in the Liquefied Petroleum Gas market

24 See as an example of the agreement about LPG prices what was published in the Diario Oficial de la Federación on April 30, 2012, where May 2012 prices are established. .

25 The formula used by the CRE to calculate the maximum first hand sale price is: Maximum sale price of liquefied petroleum gas to the final user in the corresponding zone = price of first hand sale + freight shipping to the center.

Gasoline and diesel

Gasoline and diesel in all their forms, like LPG, are important products in Mexican homes, which is why the Ministry of Finance sets the prices. The main legal instrument that has interference on gasoline and diesel prices is the Special Tax Law on Production and Services (IEPS) which establishes several key definitions in calculating the public price for gasoline and diesel.

The first component of the formula[26], which according to the Center for Studies on Public Finances[27], uses the SHCP, is the Reference Spot Price. The calculation of this price is established in the IEPS Law, which indicates that for gasoline the reference will be "the average spot price of regular unleaded gasoline in use in the Gulf Coast of the United States of America." In the case of diesel, the Gulf Coast is also used as a reference, and it varies according to API degrees and the sulfur content. Logistical costs, handling, freight, commission to distributors (PEMEX franchises) and VAT are all set values established or calculated by PEMEX

The main component for managing the State's policy on the price of liquid fuels is the Special Tax on Production and Services IEPS. This tribute plays a countercyclical role in the price of liquid fuels on the international market. When the international price of fuels rises, this tax tends to fall, including taking on negative values. When prices fall, this tax tends to rise. This tax creates a partial stabilization mechanism for domestic gasoline and diesel prices. When the tax is negative, resembling a subsidy, the amount of this transfer is made by PEMEX.

26 The following formula is recommended by the CEFP: Administrated Price of Gasoline to the Public – Reference Spot Price + Logistical Costs + Handling Costs + IEPS + Freight + Commission to Distributors + IVA.

27 Center for Studies on Public Finances. Energy sector prices administered by the public sector. CEFP/011/2005.

Natural gas

The Energy Regulatory Commission regulates the natural gas market. It allows private participation, which is why price formation for final consumers mainly depends on market rules. The CRE participates in price formation given that it is the agency that establishes the Maximum First Hand Sale Price, which is the price at which PEMEX sells to the first buyer. The reason for CRE intervention is to avoid the abuse of market power accumulated by PEMEX. Prices of imported natural gas aren't regulated.

Historic Development of the Energy Sector

Evolution of the Energy Matrix 1971 - 2008

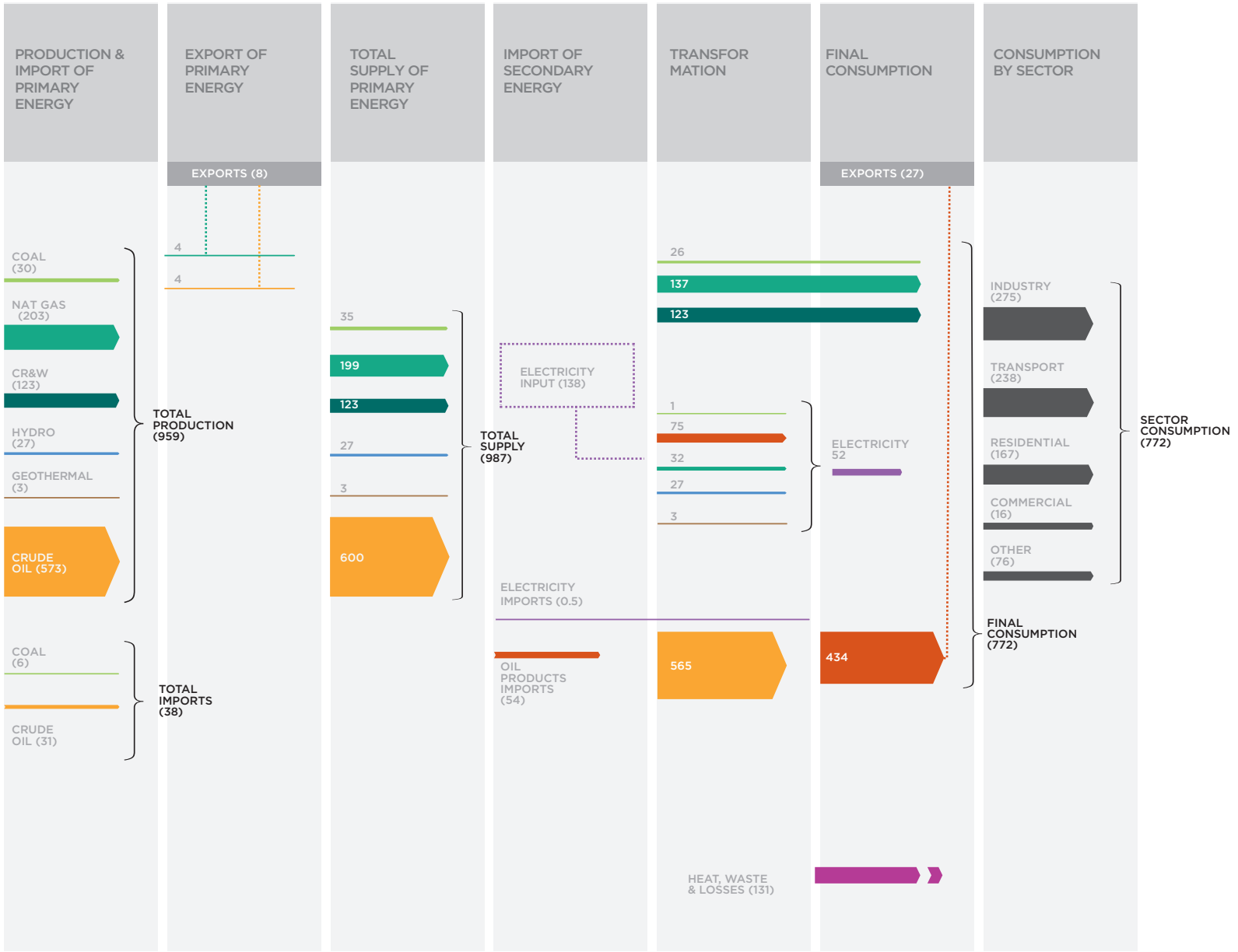
1971–1974

The initial situation in our analysis clearly demonstrates the dominance of the hydrocarbon market in the Mexican energy matrix. Crude production, before the discovery of Cantarell, provided half of the country's energy, while natural gas was the second source.

1971–1974

Energy Flow

(kboe/day)



Source: Own Calculations based on IEA Energy World Balances

Total Energy Consumption

Dominated by hydrocarbons, total energy consumption in Mexico during this period reached 1,041 kboe/day. Crude represented 58% of total consumption with 600 mbd – of which 573 were produced in the country. The second source was natural gas, which with 199 kboe/day, totaled 19%. Thus hydrocarbons made up 80% of energy consumption. Lagging far behind were biofuels with only 123 kboe/day. Other energy sources included coal, with 30 kboe/day and hydropower, with 27 kboe/day. At that time, Mexico had 6 hydroelectric plants with an installed capacity above 100 MW: El Novillo (135 MW, 1964), Mazatepec (220 MW, 1962), Villita (300 MW, 1973), Temascal (354 MW, 1959), Malpaso (1,080, 1969) and Infiernillo (1,120 MW, 1965).

Electricity

At that time, electricity generation consumed 138 kboe/day, of which 78% came from hydrocarbons – 55% from petroleum derivatives and 23% from natural gas. The third most important source of generation input during 1971 and 1974 was hydropower with almost 20% – 27 kboe/day. From these inputs 52.38 kboe/day were generated – 35,871 GWh, of which the largest portion is the product of hydropower, with 15,658 and almost 44% of the total, thanks to its high efficiency. Liquid fuels generated 14,624 GWh – 41% and natural gas reached 15%.

Source	Inputs (kboe/day)	%	Electricity consumption (GWh)	Electricity consumption (kboe/day)	%
Coal	1.0	0.7%	203.25	0.31	0.6%
Oil products	75.1	54.5%	14,624.00	21.37	40.8%
Natural gas	31.9	23.2%	5,229.75	7.65	14.6%
Hydro	27.0	19.6%	15,657.75	22.89	43.7%
Geothermal	2.7	2.0%	156.00	0.16	0.3%
Total	137.7	100%	35,870.75	52.38	100%

Source: Own Calculations based on IEA Energy World Balances

Final Consumption by Sector

The bulk of energy consumption during these years was consumed by industry, which with 275 kboe/day represented 36%. The sector used 44% natural gas, 27% derivatives, 10% electricity, 10% biofuels and 10% coal. The transport sector followed it with 238 kboe/day and 31% - entirely composed by petroleum derivatives. Residential consumption, 58% biofuels and 30% liquid fuels, reached 22% of final consumption while commercial use and other sectors closed final consumption with 2 and 10% respectively.

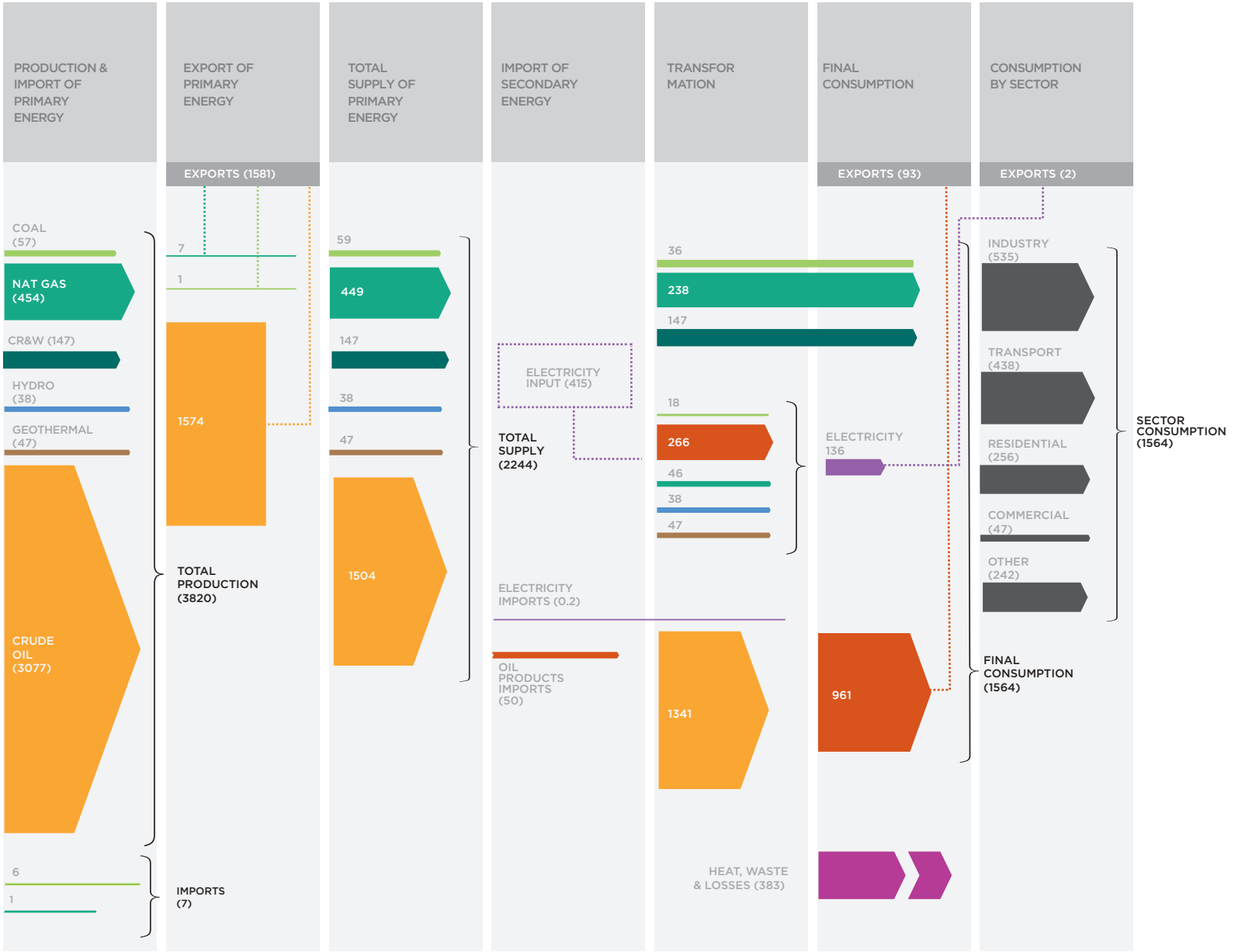
Consumption by sectors	Industry	Transport	Residential	Commercial	Others
Coal	9.3	0	0	0	0
Oil products	27.1	100	29.9	85.6	77.2
Natural gas	44	0	4	0	13
Biocombustibles	9.3	0	58.4	0	0
Electricity	10.8	0	7.4	14.4	10.0
Total	100%	100%	100%	100%	100%

Source: Own Calculations based on IEA Energy World Balances

1984–1987

Between 1974 and 1984 the Mexican energy matrix changed radically thanks to the discovery and exploitation of the huge Campeche oil deposits. With the immense growth in petroleum production, the matrix moves further towards the use of hydrocarbons. The incorporation of geothermal energy in greater measure in the past 10 years should also be noted. This is thanks to the expansion of the Cerro Prieto plant.

Energy Flow 1984–1987



Source: Own Calculations based on IEA Energy World Balances

Total Energy Consumption

Thanks almost entirely to the increase in petroleum production, total consumption grew 120% to reach 2,294 kboe/day. After the discovery of the Cantarell field, crude oil production increased 437% to reach 3,077 mbd, of which 1,574 were exported. Thus, crude oil consumption grew 151% to total 1,504 mbd and represent 66% of total consumption. It should also be mentioned that gas consumption grew 126% to represent 449 kboe/day. Geothermal energy consumption also grew significantly, although less than the growth of the previous sources mentioned: 1,467% but only totaled 47 kboe/day, about 2% of consumption. Coal consumption grew 69%, while hydropower, with the opening of Angostura (900 MW, 1976), Chicoasén (2,400 MW, 1981), El Caracol (600 MW, 1986) and Peñitas (420 MW, 1987), grew 41%. These two sources are 8% of final consumption.

Electricity

Given the rebound in crude production and the refining capacity of the country at that time, more than 64% of electricity generation consumption during this period was from liquid fuels, mostly produced domestically. Hydropower, geothermal and natural gas each represented around 10% of consumption for generation. Thus generated consumption reached 415 kboe/day, which produced 137 kboe/day (95,264 GWh) of electricity for a growth of 161%. This generated electricity came 60% from derived product, 23% from hydropower, 9% from natural gas, 5% from coal and 3% from geothermal.

Source	Inputs (kboe/day)	%	Electricity consumption (GWh)	Electricity consumption (kboe/day)	%
Coal	18.48	4.0%	5,152.50	7.37	5.4%
Oil products	266.03	64.1%	56,816.50	81.35	59.6%
Natural gas	45.78	11.0%	8,529.00	12.28	9.0%
Hydro	38.08	9.2%	22,046.50	31.53	23.1%
Geothermal	46.95	11.3%	2,719.25	3.96	2.9%
Total	415.31	100%	95,263.75	136.49	100%

Source: Own Calculations based on IEA Energy World Balances

Final Consumption by Sector

Once again, industry represented the largest portion of final energy consumption, with 34% and 535 kboe/day, almost double the previous average. This sector continued to use gas for the majority of its consumption, 43%. Transport, using only derivatives, grew 85% and represented 28% of final consumption with 438 kboe/day. Residential use, 42% derivatives and 42% biofuels, accounts for 12% of final consumption, just like the other sectors.

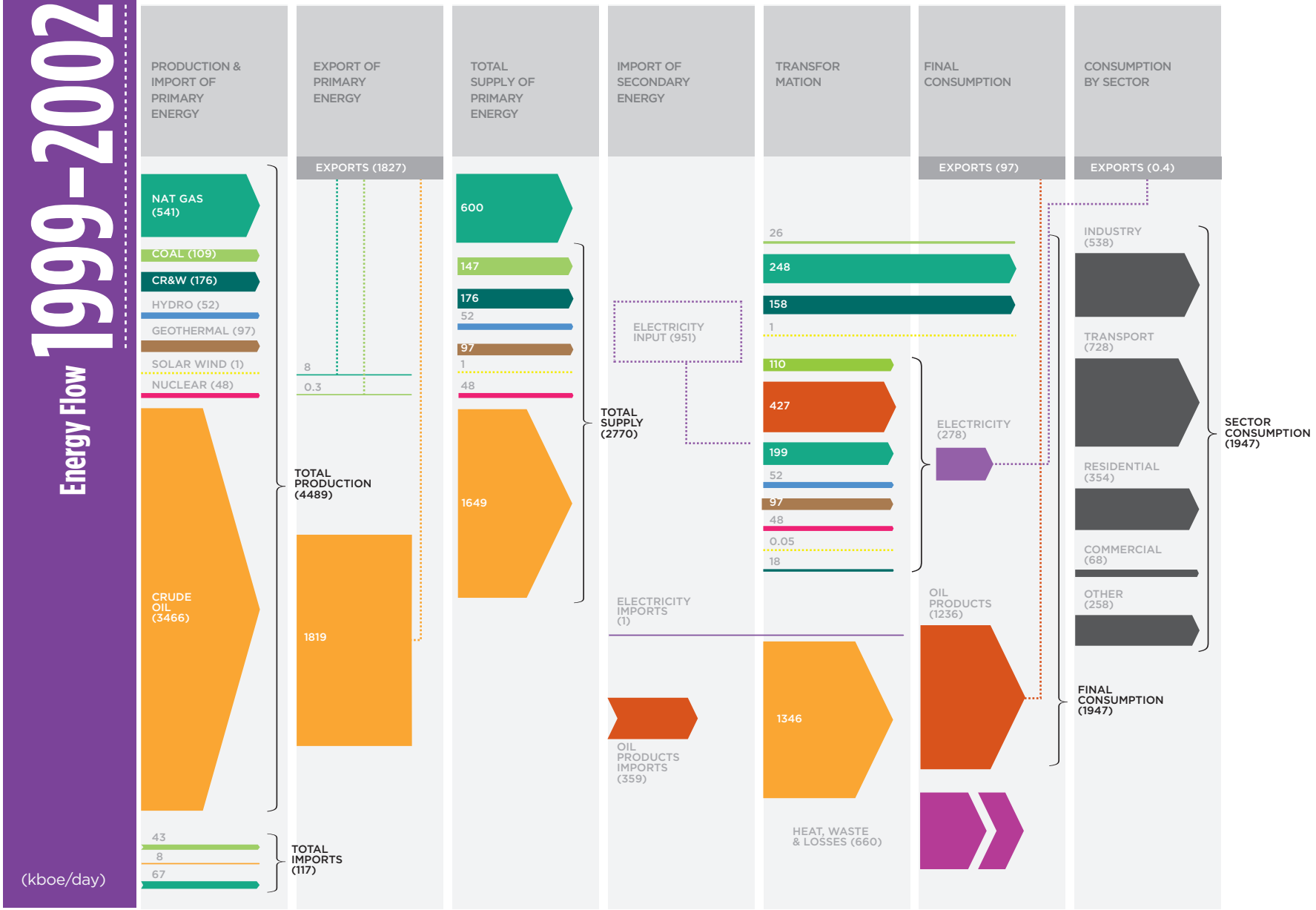
Consumption by sectors	Industry	Transport	Residential	Commercial	Others
Coal	6.8	0	0	0	0.1
Oil products	30.0	100	42.0	65.9	74.2
Natural gas	43	0	5	0	17
Biocombustibles	7	0	42.9	0	0
Electricity	13.5	0	9.9	34.1	8.9
Total	100%	100%	100%	100%	100%

Source: Own Calculations based on IEA Energy World Balances

1999–2002

By 1999, the matrix continued to lean towards the use of hydrocarbons so much that no other source represented more than 6% of consumption. After the initial exploitation of costal oil wells, the growth in this period was lower. Nuclear, wind and solar sources were also incorporated.

Energy Flow 1999–2002



Source: Own Calculations based on IEA Energy World Balances

Total Energy Consumption

With a total of 3,129 kboe/day, total energy consumption increased 36% from its previous average. Significant growth was registered in the import of petroleum derived product, from 50 to 359 kboe/day, in part explained by a small growth of 13% in domestic oil production. Although energy consumption continued to depend mostly on hydrocarbons – 53% crude, 11% imported derivatives and 19% natural gas – we should also mention the rise in coal consumption. This source grew 149% to reach 147 kboe/day. Geothermal energy doubled its contribution to consumption reaching 97 kboe/day, mainly thanks to the Cerro Prieto plant. The Laguna Verde nuclear plant opened in 1990 and totaled 48 kboe/day – 2% of total consumption. .

Electricity

The most significant change in this sector is the diversification of consumption in electricity generation thanks to the incorporation of nuclear, wind and solar energy. While derived product stay the same, by far, their advantage in generated consumption is noted in the duplication of natural gas consumption (21% of the total), as well as the almost 500% growth of coal (10% of the total). For the first time, liquid fuels are below 50% of consumption. In terms of generation, derivatives achieve 42%. They are followed by gas (24.5%) and hydropower (14.5%). Nuclear energy, 5% of consumption, represented 4.5% of generation – less than half the generation from coal, 10.8%. Combined geothermal, wind and solar are less than 4%.

Source	Inputs (kboe/day)	%	Electricity consumption (GWh)	Electricity consumption (kboe/day)	%
Coal	109.65	11.5%	22,180.25	30.03	10.8%
Oil products	427.12	44.9%	86,284.75	116.88	42.0%
Natural gas	199.42	21.0%	50,282.00	68.18	24.5%
Nuclear	48.01	5.0%	9,174.00	12.52	4.5%
Hydro	51.54	5.4%	29,842.00	40.35	14.5%
Geothermal	97.06	10.2%	5,622.25	7.51	2.7%
Solar, Wind & Others	0.05	0.005%	26.25	0.03	0.01%
Biocombustibles	18.45	1.9%	2,067.25	2.78	1.0%
Electricity	951.30	100%	205,478.75	278.29	100%

Source: Own Calculations based on IEA Energy World Balances

Final Consumption by Sector

During this period, transportation became the largest consumer with 728 kboe/day and 37% of the total – rising 66% and consuming only derivatives. Industry fell to second place, growing only 1% and totaling 538 kboe/day – 32% electricity and 27% derived product. The residential sector was 18% of the total, using 42% derivatives and 37% biofuels.

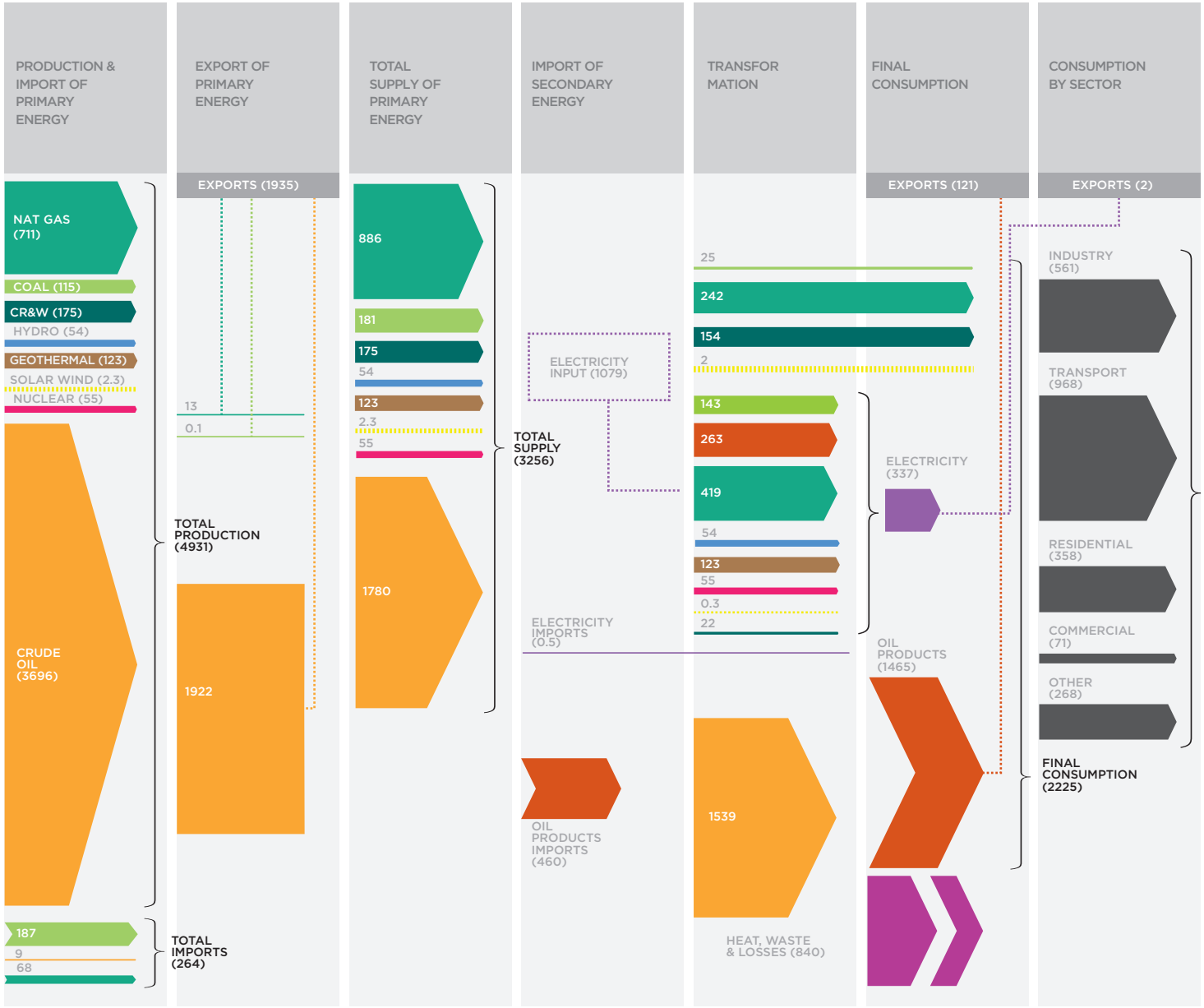
Consumption by sectors	Industry	Transport	Residential	Commercial	Others
Coal	4.8	0	0	0	0
Oil products	27.3	100	41.5	49.5	70.5
Natural gas	32	0	3	5	24%
Biocombustibles	4.7	0	37.3	0	0
Electricity	31.5	0	17.9	44.7	5.1
Total	100%	100%	100%	100%	100%

Source: Own Calculations based on IEA Energy World Balances

2005-2008

During this period crude production stagnates, and therefore there is the need to import growing quantities of derived product. Exports of crude increase only slightly, while consumption of natural gas and coal experience an important growth.

Energy Flow 2005-2008



(kboe/day)

Source: Own Calculations based on IEA Energy World Balances

Total Energy Consumption

The consumption of crude moved from 53% to 37% with 1,780 kboe/day. At the same time, due to the stagnation in production, imports of derived product grew due to internal market necessity. Derivatives grew 329% and represented 32% of final consumption with 1,539 kboe/day. Thanks to this increase, total consumption grew 53% between the two historic moments, reaching 4,795 kboe/day. However, the country remains highly focused on hydrocarbons, which are 87% of consumption. Coal and biofuels reach 4% - no other source passes 3%.

Electricity

Consumption to generate electricity grew 13% to reach 1,079 kboe/day. For the first time, derivatives were not the main source of generating consumption. With 39% and 419.45 kboe/day, natural gas occupied this position. It more than doubled its contribution and relegated derivatives to second place with 24% and 263 kboe/day – 40% less than previously. 253,109 GWh were generated, of which natural gas represented 46% with 115,950 GWh. It was followed by liquid fuels with 56,196 and 22%. Thus hydrocarbons were almost 70% of generation. Renewable energies (hydropower, wind/solar, geothermal and biofuels) totaled less than 17%.

Source	Inputs (kboe/day)	%	Electricity consumption (GWh)	Electricity consumption (kboe/day)	%
Coal	143.37	13.3%	29,530.00	39.39	11.7%
Oil products	262.71	24.4%	56,196.00	74.73	22.2%
Natural gas	419.45	38.9%	115,949.75	154.18	45.8%
Nuclear	54.82	5.1%	10,474.00	13.94	4.1%
Hydro	53.76	5.0%	31,126.75	41.41	12.3%
Geothermal	122.77	11.4%	7,111.00	9.43	2.8%
Solar, Wind & Others	0.28	0.03%	161.50	0.20	0.06%
Biocombustibles	21.56	2.0%	2,559.75	3.37	1.0%
Total	1078.70	100%	253,108.75	336.63	100%

Fuente: Cálculos propios basados en los balances de IEA

Final Consumption by Sector

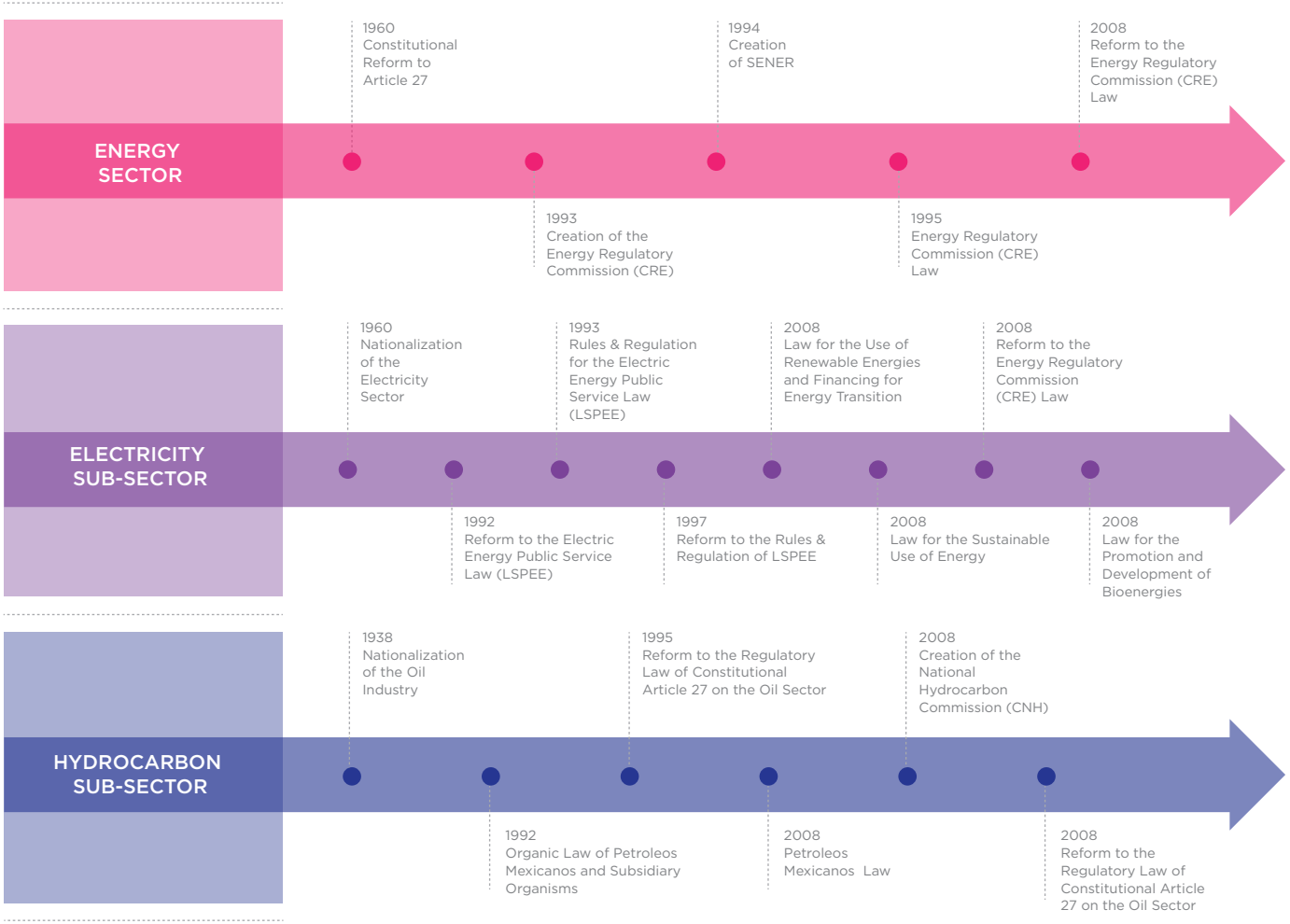
Final consumption reached 2,225 kboe/day – a growth of 14% driven primarily by the 1/3 increase in the transportation sector. This sector is 44% of final consumption with 968 kboe/day, entirely a product of derivatives. Growing only 4%, industry totaled 561 kboe/day and 25% of the total, while the residential sector consumed 358 kboe/day for a growth of only 1% over the previous period. It was 16% of final consumption.

Consumption by sectors	Industry	Transport	Residential	Commercial	Others
Coal	4.5	0	0	0	0
Oil products	26.6	100	38.3	44.4	67.8
Natural gas	31	0	4	6	19
Biocombustibles	4.8	0	35.4	0	0
Electricity	33.5	0	21.8	48.9	12.7
Total	100%	100%	100%	100%	100%

Source: Own Calculations based on IEA Energy World Balances

Institutional Development of the Energy Sector

Evolution of the Regulatory Framework for the Energy Sector, Electricity Sub-Sector and Hydrocarbon Sub-sector



Source: Author's work

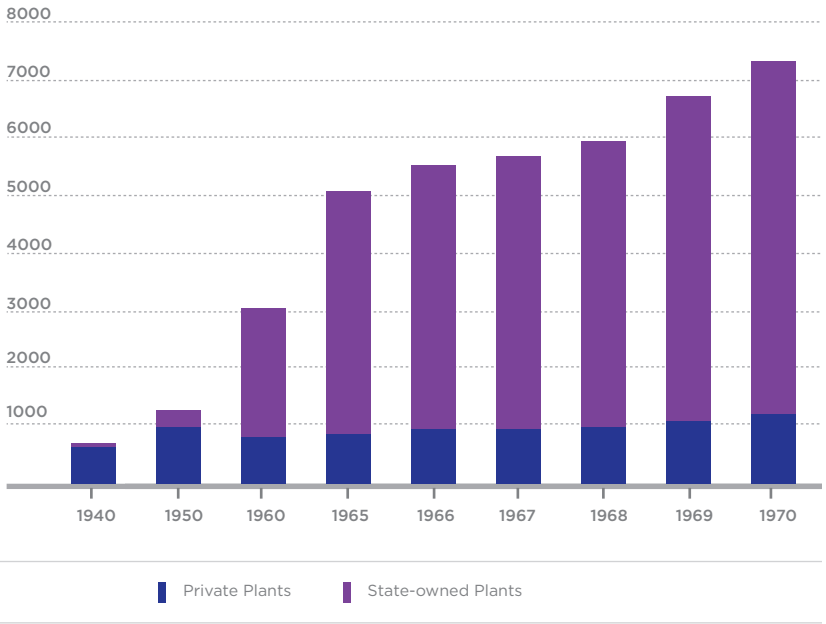
Main reforms

Energy sector industries in Mexico are now handled almost entirely by public companies. The State took control of the hydrocarbon industry in 1938 when Lázaro Cárdenas' government nationalized oil companies operating in the country and transferred their assets to the recently created PEMEX. Meanwhile, the electricity industry was nationalized in 1960 under the government of Adolfo López Mateos. The assets of private companies that existed at that time were transferred mainly to the Federal Electricity Commission (CFE) created in 1937.[1]

In the context of the nationalization of assets of electricity companies, article 27 of the Mexican Constitution[2]. was reformed. The text incorporated into this article established that the exploitation of hydrocarbon fields and all the stages of providing electricity should be the exclusive responsibility of the State, and that no concessions could be granted in any of these activities[3]. Graphic 1 shows how the CFE, since the time of nationalization in 1960, has experienced a process of accelerated expansion.

The accelerated expansion process of the electricity system included the construction, beginning in 1976, of Laguna Verde, a nuclear energy electricity generation plant. This plant has two 682.50 MW units. The first began to operate in 1990 and the second in 1995. Anticipating the development of nuclear energy, in 1984 the government of Miguel de la Madrid signed the decree to publish the Regulatory Law of Constitutional Article 27 on Nuclear Energy. It reserved all activities related to electricity generation with radioactive minerals for the State and created two institutions: one for the research of nuclear issues[4] and the other to promote and guarantee the security of all nuclear industry activities.[5]

Graph 1. Electricity Generation Installed Capacity in Mexico from 1940 to 1970 (MW)



Source: Author's work with information from MINAE, Direccion Sectorial de Energia

1 The Mexican Light and Power Co., which was also nationalized, became the Mexican Light and Power Motriz Company (LFM) and provided electricity to the Federal District and nearby regions. In 1960 the company represented less than 10% of the total energy offering in the country.

2 Political Constitution of the United States of Mexico. Published on February 5, 1917. The last reform was on October 13, 2011.

3 At the time this analysis was written, this restriction continued to form part of article 27 of the Constitution.

4 The National Institute of Nuclear Research is a public organization decentralized from the Federal Government with a legal character and its own history.

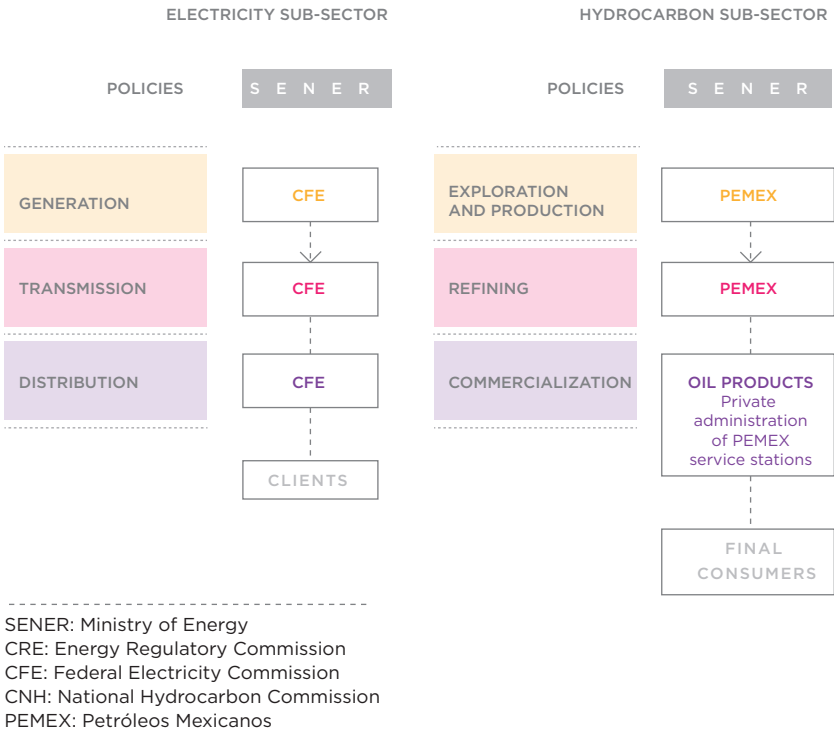
5 The National Commission on Nuclear Security and Safeguards is an autonomous body under the Ministry of Energy, Mines and State Industry.

The lost decade and urgent reforms

The complicated economic situation in Latin America and specifically the debt crisis in Mexico at the end of the 80s significantly reduced sources of financing to make investments in the energy sector. In 1998, investment in the sector only reached a little more than a fourth (28.5%) of the investment made in 1981 in real terms. This shrinking of investment was even more evident in the hydrocarbon subsector where it was only 23.5%, while in the electricity subsector it was 41.8%.[6]

The government of Carlos Salinas de Gortari, which assumed the presidency in November 1998, published the National Energy Modernization Program (PNME) 1989-1994. This plan establishes some policy guidelines for the electricity subsector such as the increase in generation capacity, the increase of energy efficiency in energy use, the diversification of energy sources and the adaptation of rate policies to the realities of the market. It also established guidelines for the hydrocarbon subsector, like the organizational restructuring of PEMEX, increasing the options for financing the state petroleum company, strengthening of the internationalization of PEMEX and improving the domestic market for oil derivatives.

Figure 3. Energy Sector Structure in 1990



SENER: Ministry of Energy
CRE: Energy Regulatory Commission
CFE: Federal Electricity Commission
CNH: National Hydrocarbon Commission
PEMEX: Petróleos Mexicanos

Source: Author's work based on CFE, PEMEX, SENER, and regulatory framework

The PNME estimated that the demand for electricity in the country would grow between 6.5 and 7.2% each year until 1994 and between 5.4 and 6.1% from 1995 to 2010, which implied a cumulative growth between 238% and 292%. Given this growth outlook and facing the

6 National Energy Modernization Program 1990-1994. May 7, 1990.

impossibility of making necessary investments with public funds, the government sees the need to design alternative mechanisms to accelerate the growth of electricity generation capacity. The solution comes with the reform to the Public Service and Electricity Law (LSPEE) that was approved by Congress on December 23, 1992.

This reform, which was much debated at the time, consisted mainly of modifying article 3, which established which of the activities related to electricity would not be considered a public service. This act thereby excluded them from the tax restriction in article 27 of the Constitution.

The original text of article 3 indicated that the production of electricity for self-supply should not be considered a public service. In the late 1992 reform, other modes of operation that remained were included and thus, excluded from the definition of public service. The modes included were cogeneration, small production (which are plants with a capacity less than 30 MW) and independent production referring to plants that have an installed capacity greater than this level, and their energy is sold exclusively to the CFE. In addition, it allows export on the part of any authorized operator and energy import by individuals, as long as it is only designated for their own use. The modification of the law and the 1993 publication of its regulations represented the first step towards the entry of private operators in the electricity sector, mainly in generation.

In 1992 there were 107 private electricity generation plants in operation that had an accumulated capacity of 1,942 MW. Of these total plants, only 41% had been granted operating permits (44 permits that totaled 462 MW) under the figure of permits for Continuous Own Use (UPC) that was limited to the specific use of owners of the plants[7]. During the four years following the new legislation, 22 permits were granted, 59% for self-generation plants, 36% for cogeneration and 5% for import. None were granted for independent producers or small producers. Around 70% of the permits granted for self-generation between 1992 and 1996 were for PEMEX plants that were in operation before 1992.

Given that the new regulatory framework allowed the participation of private operators in electricity generation, legislators considered the creation of a regulatory organism a priority. In consequence, the third transitional provision of the reform stated that the Federal Government should create a decentralized agency of the Ministry of Energy, Mines and State Industry called the Energy Regulatory Commission (CRE), which would complement the ministry in regulating the energy sector.

On October 4, 1993 the Government created, through presidential decree, the Regulatory Energy Commission (CRE) attached to the Ministry of Energy, Mines and State Industries. As Carlos Moreno indicated (1998), "in its origins, the CRE plays only an advisory role and its scope was limited to the electricity industry but lacked decision making power. Its tasks are limited to carrying out studies and reviewing and evaluating electricity issues, but always obeying the signs of the Ministry."[8]. In the future, new legal reforms would give this institution a more important role in the energy sector.

7 Figures from the Energy Regulatory Commission. Table of Electricity Generation and Import Permits Distributed on September 30, 2011. http://www.cre.gob.mx/articulo.aspx?id=171

8 Moreno-Jaimes, Carlos, 1998, "Institutional Autonomy and Regulation in Mexico: The Case of the Energy Regulatory Commission" CIDE's Working Paper, AP-72.

The first reorganization of PEMEX

There were also important changes in the hydrocarbon subsector. On July 16, 1992, the new Organic Law of Mexican Petroleum is passed, which substitutes the current organic law that had been in effect since 1971. This new law mainly sought to reorganize PEMEX. Its most important contribution is the creation of autonomous and decentralized organizations of a technical, industrial and commercial character with legal powers and their own heritage. These include:

- **Pemex-Exploration and Production:** exploration and exploitation of petroleum and natural gas; its transport, storage in terminals and marketing.
- **Pemex-Refining:** industrial refining processes; processing of petroleum products and petroleum derivatives that are likely to serve as basic industrial raw materials; storage, transport, distribution and marketing of products and their aforementioned derivatives.
- **Pemex-Gas and Basic Petrochemicals:** processing natural gas and artificial gas; storage, transport, distribution and marketing of those hydrocarbons, such as derivatives that are likely to be used as basic industrial raw materials.
- **Pemex-Petrochemical:** industrial petrochemical processes whose products do not form part of the basic petrochemical industry, as well as storage, distribution and marketing.

As Navarro noted (2007), "with the publication of the Organic Law of Mexican Petroleum and its Subsidiaries on July 16, 1992, it gave way to the new integrated structure by four independent public companies under the central leadership of a corporate body.[9] The subsidiary organization will be managed by the Board of Directors formed by eight members and a general director, all named by the Federal Executive. The new general directors would have certain autonomy to manage the operations of four subsidiaries.

Navarro (2007) explains the idea of these reforms. "This structural change included a dramatic flattening of hierarchies, partly with the intention of giving more power to middle management. The logic of these reforms originated in the belief that public companies would work better if they were open to the ideas and involvement of all workers.[10] This restructuring would be key in opening up some PEMEX subsidiary activities to private capital.

During the government of Carlos Salinas de Gortari, within the framework of the 1992 Program of the Modernization of Service Stations, it began the franchises of PEMEX. This program sought to create incentives to increase the number of service stations and to improve the existing installations. In 1991 it operated 3,164 stations, 68% of them in the hands of individuals and 32% run by corporations. In 2012, it was estimated that more than 10,000 service stations operated under the PEMEX franchise.

9 Navarro Arredondo, Alejandro. The organizational restructuring of Mexican Petroleum. Center of Social Studies and Public Opinion. December 2007.
10 Idem

In December 1994 the Government created the decentralized organization of Central Light and Power (LFC) through an executive decree. It granted the organization control of the assets of a series of companies in liquidation[11] that operated, since the signing of the "zoning agreement" of 1985, in the Federal District and in 48 municipalities of Hidalgo, 81 municipalities of the State of Mexico, two municipalities of Morelos and three of Puebla. The companies that joined the new decentralized organization should have been liquidated beforehand according to the 1974 decree, but this didn't happened for various reasons. The new decentralized organization was vertically integrated and had a monopoly on the provision of electricity in the aforementioned areas.

Deeper reforms in the energy sector

Ernesto Zedillo, who became the President of Mexico in December 1994, continued reforms of the energy sector. In the "National Development Plan 1995-2000" he established eight objectives[12] in the energy area. Two of those should be highlighted: the "rapid and efficient expansion of the sector" and the "contribution to the global competitiveness of productive plants."

Among the actions promoted by the new government to achieve the first objective, it established the promotion of private sector participation in electricity generation and in the transport, storage and distribution of natural gas. Similarly, to contribute to the competitiveness of plan productivity, it established lines of action such as an approach to price and rate policies which would allow the adequate capitalization of the sector, limit subsidies, develop new rate policies of the CFE and LFC, orient energy regulation towards mechanisms that favor competitive conditions in the market and consolidate the CRE institutionally.

In consequence, during the first months of the new Government, laws were signed that promoted reforms in the energy sector aligned with the execution of the National Development Plan. The first institutional reform occurred in December 1994 with the creation of the Ministry of Energy (SENER), which assumed functions previously attributed to the Ministry of Energy, Mines and State Industry. The government considered that the new institution would be more agile because it would no longer have responsibilities over activities that weren't directly related to the energy sector.

The process of institutional changes continued within a few months. On May 11, 1995 the reform to the Regulatory Law to Article 27 is published on the field of oil (LRRP or Regulatory Law), which allowed private sector participation in the transport, storage and distribution of natural gas. This reform is followed by the publication in November of the same year of the Natural Gas Regulation. Those two legal instruments allowed private participation in the natural gas market. Subsequently, in November 1996 the LRRP is reformed again to allow private participation in activities related to secondary petrochemicals.

11 Central Light and Power Company, S.A., Light and Power Company of Pachuca, S.A., Southern Mexican Power Company, S.A., and Light and Power Company of Toluca, S.A.
12 Development and Restructuring Program of the Energy Sector, 1995-2000.

In 1995 the Government, seeking to supplement the institutional design established in the development plan, publishes the law that regulates the operation of the CRE. This law would give the organization the institutional strength that it hadn't had since its creation. Specifically, the new law granted the CRE regulatory responsibilities over the natural gas and petrochemical market, which had not formed part of the original powers that were included when creating the regulatory body.

The CRE, using their new powers, issues guidelines and resolutions that seek to make the process of selling gas concessions transparent and predictable.[13] These legal instruments sought to regulate the commercial operations of concessions and, at the same time, reduce the discretion of the state monopoly on setting first hand[14] sale conditions for natural gas that basically put a limit on the price that PEMEX could sell natural gas to private operators. Similarly, it regulated the prices that could be offered to final users.

Seeking financing alternatives: Pidiregas

In parallel to the institutional reforms discussed above, the Government sees the need to design alternative financing mechanisms for public works projects. Since the 80s, Mexico had been experiencing a contraction in the sources of funding, which affected the availability of resources for investment in energy sector infrastructure. This situation worsened in 1994 with the economic crisis suffered in the country, which is why Ernesto Zedillo's government promoted a reform that incorporated new actors in the legislation that would allow an increase in investment in the energy sector through "Productive Infrastructure Projects of Deferred Impact in the Expense Program" or Pidiregas[15].

The reform made on December 21, 1995 was mainly based on the modification of article 18 of the General Law of Public Debt and article 30 of the Law of Budget, Accounting and Federal Public Expenditure (Budget Act). This reform modified the accounting mechanism that recorded debt incurred in works financed by Pidiregas so that it was not considered long-term debt and did not directly impact the national budget. This figure was known as "long-term productive infrastructure projects."[16].

Pidiregas was a mechanism for financing energy infrastructure based on the model of *project finance*. This mechanism was limited to investment projects, which it was hoped would report a positive income flow after the completion of construction (such as, for example, petroleum exploration and extraction projects or electricity generation projects). The mechanism allowed state companies to contract private firms to carry out specific works, conditional on the fact that they would have to finance the costs of project construction. Once the work was done, the State organization would pay this debt with future earnings that it would generate from the operation of the constructed installation. Under this mechanism, PEMEX and CFE didn't need to ask for approval from Congress to incur debt for infrastructure projects, thus expediting their investment plans.

13 Concessions: The holder of the permit for transport, storage and natural gas distribution.

14 First Hand Sale: The first sale of gas of national origin carried out by Mexican Petroleum to a third party for delivery in the country.

15 Posteriormente se les conocerán como "Proyectos de Infraestructura Productiva de Largo Plazo".

16 The modification of the General Law of Public Debt included a new figure called "contingent liability," which is generated from financing productive infrastructure that will generate a stream of income after the completion of construction.

There were two types of investment financed under the figure created by Pidiregas, (i) **direct investment**, which corresponded to turnkey projects once the construction is finished and the assets are turned over to the state company for its operation; and (ii) **conditional investment,** which corresponds to projects in which private companies were operating the project constructed in exchange for a promise to purchase the output of the facility, for example, the electricity generated or the nitrogen used for petroleum extraction.[17]

Incorporating the figure of Pidiregas contracts into legislation was an important complement to institutional reforms made in the period given that it allowed for the accelerated expansion of the energy sector. In the report prepared for Congress by the Center of Studies on Public Finance in 2005 it was estimated that, at that moment, the amount of investments financed with private funds reached 1.9% of the GDP and registered considerable growth of 0.1% in 1996.[18] Table 1 shows that in 2005 the total amount of debt was US$193,085 million, of which 79% had been incurred in the operation of PEMEX and the remaining 21% by the CFE.

Table 5: Investment financed under PIDIREGAS by institution till 2005

Company	Direct Investment		Conditional Investment		Total	
	Number of Projects	Total Amount (Million US$)	Number of Projects	Total Amount (Million US$)	Number of Projects	Total Amount (Million US$)
CFE	163	25,101	29	15,447	192	40,548
PEMEX	36	148,675	4	3,862	40	152,537
Total	**199**	**173,776**	**33**	**19,308**	**232**	**193,085**

Source: Center for the Study of Public Finances and own calculations.
These debts will be paid on a time horizon ending on 2041.
The exchange rate on 31 July 2005 was 10.64 pesos/US$

17 In the case of the CFE, direct investment contracts were called financed public works contracts and corresponded to the power plants that would remain under CFE control. Conditioned investment contracts are called self-financed foreign investment and correspond to independent energy producers that sell their electricity exclusively to the CFE.

18 Center for the Study of Public Finance. "Long-term Productive Infrastructure Projects (Pidiregas) 2005". July 2005.

First steps: renewable energy and energy efficiency

In 1997 an important reform is made to the regulation to the Law of Public Service and Electricity (LSPEE). The changes made relate mainly to the articles related to the procedures for adding or replacing generation capacity. The regulations to the original LSPEE establish in article 124 that "all adding or substituting generation capacity resulting from the prospective of the electricity sector should take advantage of electricity whose total long-term cost was less than for the Commission." The reform of the 1997 regulation changed the definition of the total long-term cost to the total long-term economic cost by incorporating variables into the calculation such as construction risk, the cost for the public sector to obtain the energy necessary for generation, the cost of the opportunity to allocate those resources to alternative investments and increased risk due to regulatory changes.

The new definition, which includes some variables that are not easily quantifiable, allows projects prioritized according to their costs to be aligned with energy policies designed by the SENER. As was discussed in meetings held in November 2012 with sector authorities in Mexico, "actually, the discriminatory use of this definition is a big disincentive to big investment in traditional generation because it raises the costs of some energy at the expense of others." In addition, further reform to the regulation is made and details the procedures for awarding bids for projects required by the SENER.

Similarly, measures are taken to promote energy efficiency. In 1999 the National Commission for Energy Savings (Cenae)[19] which was created in 1998, is granted autonomy and new powers. The central objective of the Cenae is to support State institutions in carrying out measures that seek to use energy more efficiently. This commission, which functions as a decentralized agency of the SENER, has mainly technical powers.

Results of the reforms until the late 90s

The reforms carried out during Ernesto Zedillo's administration allowed for the accelerated expansion of electricity generation capacity for public service. This occurred in spite of the fact that Congress rejected the reform proposal of articles 27 and 28 of the Constitution presented at the beginning of 1999, which would have meant opening up all electricity sector activities to private investment. It proposed to eliminate the vertical integration of the CFE.

As Díaz-Bautista[20] explains in his history of energy sector reforms in Mexico, the first round of 1992 reforms didn't manage to attract foreign investors to the sector. The main obstacle that interested companies

19 Diario Oficial de la Federación. Decree that creates the National Commission for Energy Savings as a decentralized agency of the Ministry of Energy. September 19, 1999.

20 Diaz-Bautista, Alejandro. International Experiences in Electricity Deregulation and in the Electricity Sector in Mexico. Plaza and Valdes Editors

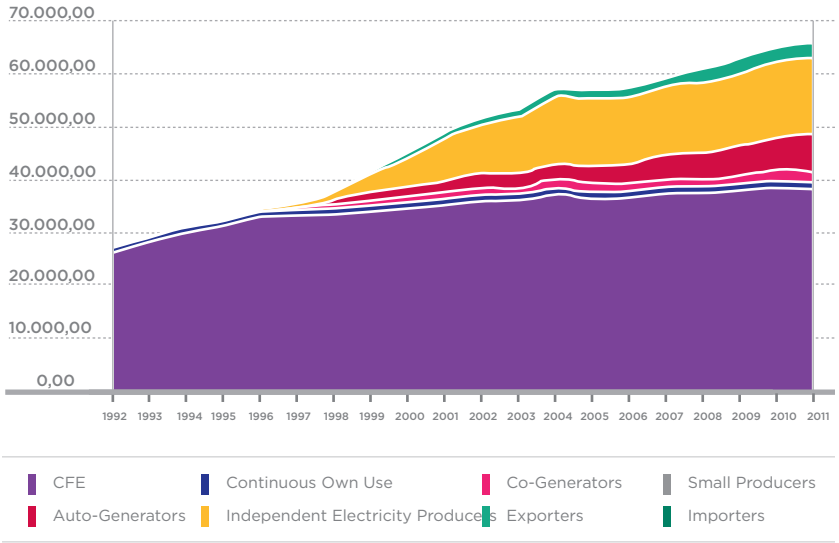
encountered was that they had to negotiate only with State institutions for the supply of fuel (PEMEX) and for the sale of production (CFE), which made any negotiation very sensitive to changes in public policies. In addition, the institutional strength of the Energy Regulatory Commission wasn't clearly established.

According to Díaz-Bautista, "the 1995 reform corrected many of the deficiencies of the 1992 reform and caused it to generate numerous investments in power plants," mainly due to the liberalization of the domestic natural gas market, the strengthening of the CRE and the incorporation of the figure of Pidiregas. It is therefore understandable that the first authorization to operate in the form of Independent Energy Producer (IEP) is awarded five years after the first round of reforms.

The first permit for generation under the figure of the IEP is awarded on February 19, 1997 to the North American AES. It was authorized to construct and operate a combined cycle natural gas and diesel power plant with an installed capacity of 531.50 MW. The plant opened in 2000

As shown in figure No. 2, the expansion of the electricity sector as a result of institutional changes promoted during that period was very pronounced. Since 1992, the installed capacity of plants operated by the private sector grew about 14 times, while the plants controlled by the CFE grew only 39%, adding 10,596 MW. On September 30, 2011, plants operated by private companies reached an approved capacity of 28,566 MW where 50% were Independent Energy Producers (IEP) that sold their production to the CFE. 96% of the total installed capacity under that mode was from combined cycle plants using natural gas and the remaining 4% were from wind farms.

Graph 2. Electricity Generation Effective Installed Capacity for CFE plants and Approved Capacity for Private Operators, 1992-2011 (MW)



Source: Author's work based on CRE and CFE

In 2000, which would be the last presidential term, the Government created the Fund to Stabilize Oil Revenues (FEIP). This mechanism mainly sought to protect oil revenue in the country from the price variations of oil by using international market financial instruments. This mechanism continues to be used at the time of the publication of this document.

2000 – 2006: Without a political agreement to advance further reforms

Businessman Vicente Fox, from the National Action Party (PAN)[21] was the winner of the 2000 presidential elections. Fox's triumph on a central-right platform represented the end of 70 years of presidencies dominated by the Institutional Revolutionary Party (PRI). The new government had seven guiding principles for the energy sector in its Energy Sector Program 2001-2006. Among those included were: maintaining the public character of State enterprises, the modernization of public sector institutions and the promotion of private investment.

The 2000 elections also resulted in changes in the members of both houses of Congress. In the Senate, the government party managed to get 47 seats of the 128 that make up the chamber, representing 36.7% of the elected senators[22]. The formation of the Chamber of Deputies, elected for three years, was more balanced. The PAN remained the second minority with 41.4% of the deputies. However, three years after, in the elections of deputies, PAN had 29.6% of the seats in the lower house.

Given the correlation of forces in Congress, where for the first time the government party had no qualified majority, the government of Vicente Fox failed to advance in its attempts to reform the regulatory framework of the energy sector. Therefore, the sector did not experience relevant changes in regulatory matters during this period.

The most striking change during the period was the change in the rate structure of the electricity sector, specifically for residential consumers. The agreement text[23] signed by the Ministry of Finance explains that the tariff structure prior to this agreement had a subsidy that was mainly benefitting high residential consumers and not the poor. This situation, in addition, was having an impact on the finances of State electricity companies (CFE and LFC).

The rate structure prior to this reform was established on December 18, 1995 through the SHCP[24]. agreement. It established six types of domestic rates (1, 1A, 1B, 1C, 1D, 1E), which depended on the geographic location of the home. Under the 1995 rate model, subsidies would be afforded to all residential consumers regardless of their level of consumption.

The 2002 rate model included a new tariff called the Domestic High Consumption Tariff (DAC), which applies to all users who exceeded certain levels of electricity use. With the change, they sought to target subsidies in homes with fewer resources and with low consumption levels. This model is still valid today. In addition, the 2002 Rural Energy Program[25], involves a transfer of money called an "Energy Fee" for farmers that use electricity for pumping water for irrigation.

21 The winning coalition, Alliance for Change, brought together the National Action Party (PAN) and the Green Ecological Party of Mexico (PVEM). It also had the support of the Authentic Party of the Mexican Revolution (PARM) candidate.

22 The first senate minority was controlled by the PRI with 59 senators and the third minority (16 Senators) was in the hands of the Revolutionary Democratic Party (PRD), a left formed by the split of the PRI. Together, the PRD and the PRI, with 75 deputies, were able to control 58.6% of the Senate.

23 Diario Oficial de la Federación. February 7, 2002. Agreement that authorized the adjustment, modification and restructuring of rates for the supply and sale of electricity and reduced the subsidies for domestic rates.

24 Diario Oficial de la Federación. February 7, 2002. Agreement authorizing the restructuring, adjustment and modification of rates for the supply and sale of electricity.

25 The program was created as part of the Rural Energy Law published in the Diario Oficial de la Federación on December 30, 2002.

Energy reform of 2008

Felipe Calderón's government, who won the presidency in 2006, set as among its priorities the restructuring of the oil industry. As president Calderón stated in his message to the nation on April 9, 2008, "Mexico is losing ground to international competition. If PEMEX is one of the most important oil companies in the world, today it is in 11th place. The causes are not only financial; they are mainly technological and operational. As a result, the country's oil reserves are declining."[26]. According to figures from PEMEX and the Ministry of Energy, the proven oil reserves that in 2000 were 32,614.4 million barrels of petroleum equivalent (Mbpe) in 2007 were 14,717.2 Mbpe. This represented a drop of 54.8% in seven years[27]. Total crude production dropped almost 300,000 barrels per day between 2004 and 2007[28] In 2007, around 40% of the gasoline consumed in the country was imported.

As a result, in April 2008 a set of proposals is presented for congressional approval. After some months of discussion and some changes, they are approved in October of the same year. The legal instruments include four new laws and six reforms:

- **(i)** Law of Mexican Petroleum[29];
- **(ii)** Law of the National Hydrocarbon Commission
- **(iii)** Law to Use Renewable Energy and Finance the Energy Transition
- **(iv)** Law to Use Sustainable Energy
- **(v)** Reform to the Organic Law of Federal Public Management
- **(vi)** Reform to the Law of the Energy Regulatory Commission
- **(vii)** Reform to the Regulatory Law of Constitutional Article 27 of the Petroleum Branch
- **(viii)** Reform to the Law of Public Services and Other Related Services
- **(ix)** Reform to the Law of Acquisitions, Leasing and Public Sector Services; and
- **(x)** Reform to the Federal Law of State Entities.

Second reorganization of PEMEX and comprehensive contracts

The package of reforms approved in 2008 mainly sought to rearrange the corporate governance and management of PEMEX. Since the adoption of the reform, greater autonomy and flexibility were given to the oil company in the management of its operation and finances. At the same time, it required greater transparency in the management of the company.

The Law of Mexican Petroleum incorporated new figures and made changes to existing institutions. The following should be highlighted:

26 http://www.eluniversal.com.mx/notas/496876.html
27 First Report on the Execution of the National Development Plan 2007-2012.
28 Ministry of Energy. Energy Information System.
29 Originally the Government introduced an initiative to reform the Organic Law of Mexican Petroleum (LOPM) that had been in effect since 1992. However, the congressional committees involved in the reform debate decided that the text of the LOPM didn't correspond to the organic law. Thus, it was repealed and replace by the Mexican Petroleum Law, which is currently in effect.

- Allows PEMEX the possibility of reorganizing its operational structure, as it would have the power to create the decentralized subsidiary agencies that it considers necessary for its operation. Previously, the Organic Law of Mexican Petroleum determined the subsidiary agencies.
- IIncludes four new professional members to the Board of Directors, increasing the presence of technicians. Previously, the board was composed of 11 members (six government representatives and five union) who were not required to have expertise in the area.
- Gives the Administrative Board the power to approve the business plan and investment program of PEMEX;
- Allows the oil company to issue a type of debt called citizen bonds[30] without having to ask for the authorization of Congress. Before the enactment of this law, PEMEX had to ask for authorization from the legislative body to issue debt.

However, the main contribution of the reform package approved in 2008 is described in the reform of article 6 of the Regulatory Law, which includes the following: "Mexican Petroleum and its subsidiary agencies may hold work contracts with individuals or corporations for the lending of services that are most fitting for their required activities[31]. The modification will allow the contracting of private sector companies for some oil industry activities on the condition that the contracts: (i) should establish remuneration in cash; (ii) may not grant property on hydrocarbons as consideration for the services performed and the works to be executed; (iii) cannot compromise production percentages or the value of hydrocarbon sales or its derivatives; and (iv) cannot compromise the percentages of the utilities of the contacting entity.

Looking to streamline the management of PEMEX in hiring private firms, the Law of Mexican Petroleum states that the Board of Directors of the oil company will have the authority to approve contracts related to the "Substantive Activities of Productive Character," which include all activities in the productive chain of petroleum and gas.[32] Following the approval of the reform package, PEMEX is exempt from compliance with laws relating to contracting works or services that govern the rest of the public sector[33] Its Board of Directors is empowered to design the rules of public works contracts, service contracts and extraordinary remuneration.[34]

The administrative rules issued by the Board of Directors include three types of contracts for works and services in the field of exploration and production, which are called:

- **Exploration contracts,** which have the object of providing services to seek, localize and delimit commercially viable deposits.
- **Contracts for the development of fields,** aimed at offering underground hydrocarbon extraction services, including primary, secondary or tertiary recovery

30 The design of Citizen Bonds indicates that they will be instruments paid depending on the gain performance of PEMEX, plus a fixed return. Two thirds of the bonus will be fixed income and the third remaining part will depend on the performance of PEMEX. The SHCP is the institution responsible for issuing the provision of citizen bonds.

31 Regulatory Law of Constitutional Article 27 of the Petroleum Branch.

32 Article 3 of the Regulatory Law defines the activities that compose the petroleum industry. This article excludes secondary petrochemicals as part of the petroleum industry. This is why in the definition of "substantive activities of a productive character" the legislature expressly incorporated secondary petrochemicals.

33 Prior to the enactment of this law, PEMEX had to fulfill their hiring with the same requirements as the rest of public entities. To relieve PEMEX of this obligation, energy reform included changes in the Law of Public Works and Related Services and the Law of Acquisitions, Leases and Public Sector Services.

34 On January 6, 2010 the Procurement of Administrative Provisions (DAC) is published. It establishes the mechanisms for contracts and bids for PEMEX.

- **Comprehensive contracts for exploration and production,** whose aim is providing hydrocarbon exploration, development and extraction services.

As stated before, the aim of the 2008 energy reform was to achieve an increase in oil industry activity. Hiring private companies would help PEMEX in areas where it didn't have enough expertise, such as the reactivation of fields, the development of the heavy crudes of Chicontepec and the development of potential in the deep waters of the Gulf of Mexico. On January 1, 2010, PEMEX calculated that the 3P[35] reserves in deposits that meet some of the aforementioned characteristics reached 16.7 Bboe[36], equivalent to 38.8% of the 3P reserves of the country, totaling 43 Bboe.

In 2011, the first process of awarding three comprehensive contracts for three zones located in the south east of Mexico (Magallanes, Carrizo and Santuario) was carried out. The winners of the open bid were two European companies Petrofac Facilities Mngt. Ltd. (Magallanes and Santuario) and Dowell Schulmberger (Carrizo). In the areas granted to the two companies there were six mature petroleum fields with a total production of 13.6 Mbd. Later, in 2012, there was a second round of bidding in which six other areas were offered, of which five were awarded and one was declared void.

35 3P Reserves: The total of proved reserves and possible reserves. PEMEX Glossary.
36 Billions of barrels of petroleum equivalent.

Creation of the CNH

One of the most important goals of the reform was the institutional strengthening of oil exploration and exploitation activities. Seeking to improve the management of the oil industry in these activities, the National Hydrocarbon Commission (CNH) was created, which would have mainly technical work. As the document that accompanied the legislative initiative explained, "the Commission is constituted as an instrument of technical and operative support to the Ministry of Energy through which it will find, evaluate and verify the operations related to hydrocarbon exploration, exploitation and the quantification of its reserves and compliance with applicable technical provisions for these activities, in order to achieve success in the exploration and recovery of hydrocarbons".[37]

The 2008 reform package also included approval of the reform of the Law of the Energy Regulatory Commission. In the words of Francisco Salazar, the president of the CRE, the 2008 changes, "extended the regulatory powers of the CRE and strengthened its autonomy".[38] The senior official of the CRE lists and highlights aspects related to institutional strengthening:

- Autonomy of the Commission (Art. 1): It grants more autonomy to the regulatory body by incorporating self-management and decision making, adding these to the technical and operational autonomy that it already had.
- Regulatory jurisdiction (Art. 4): It eliminates the possibility that those affected by a decision adopted by the commission

37 Reform initiative submitted to Congress on April 8, 2008.
38 Private documents and personal interviews

can directly sue the commissioners for alleged damages or economic losses.

- Planning the spacing in the naming of commissioners (Art. 6): Clarifies procedural times in case of a vacancy of any of the commissioners.
- Accountability (Art. 7, F. VIII): Establishes the obligation of the commissioned president to annually present a report to Congress about the performance of the functions of the commission.
- Interpretative ability of the law (Art. 13): Grants the CRE the legal authority to interpret and apply the law.

Strengthening of the CRE

Just like the CRE is institutionally strengthened, the 2008 reform also expands some of its powers and includes new responsibilities within its scope. As Francisco Salazar explains, "the CRE is now responsible for regulating other aspects of the sectors that it already regulated, as well as new sectors of the industry in which it didn't previously participate: petroleum, basic petrochemicals and bioenergy." The changes referred to grant it:

- Power to issue some regulatory instruments that it previously only approved.
- Sanctioning power over hydrocarbon sector activities. This is included in the reform of Article 15 of the Regulatory Law.
- Responsibility for determining exclusive geographic distribution zones.
- Responsibility for setting the terms and conditions to which they are subject for comprehensive transport and storage systems, as well as the corresponding fees.

In terms of the new activities that the CRE will regulate from 2008 forward, Francisco Salazar specifies:

- **LP Gas.** Storage in linked systems to pipelines or import or distribution terminals with economies of scale relevant to the market.
- **Derived Oil Products** (fossil fuels derived from refining: gasoline, diesel, jet oil and fuel oil). Setting the first hand sale price of fuel oil exclusively; transport and distribution by pipelines, such as storage in systems linked to these or in import or distribution terminals with relevant economies of scale for the market, for all oil.
- **Basic petrochemicals** (alkanes up to heptane, premium material for coal fillers and gases). To set the first hand sale price and transport and distribution via pipelines, such as the storage in systems linked to these or in import or distribution terminals with relevant economies of scale for the market
- **Bioenergy.** Transport and distribution via pipelines and storage in linked system or in import or distribution terminals with relevant economies of size for the market.

Renewable energy and energy efficiency

A group of members of Congress who participated in the energy reform discussions made their support contingent on the incorporation of a discussion of laws concerning renewable energy. Therefore, together with legal acts passed in 2008 referring to the hydrocarbon sector, the Law to Use Renewable Energy and Finance Energy Transition (Renewable Energy Law or LAERF) and the Law for Sustainable Energy Use (LASE) were incorporated.

As article 1 of the Renewable Energy Law indicates it, "aims to regulate the use of renewable energy sources and clean technologies to generate electricity for purposes other than the provision of public electricity service." Thus, it mainly regulates electricity generation by private companies. The energy sources that LAERF covers are: wind, solar radiation, the movement of water[39], ocean energy, the heat of geothermal deposits and bioenergy.

The law gives the Ministry of Energy the authority to define policies on renewable energies and the gives regulatory authority to the Energy Regulatory Commission. The Secretary of the Special Program to Use Renewable Energy defines policies. For its part, the Commission has among its powers the following: (i) determining the compensation incorporated into generation contracts from renewable energy; (ii) requesting the National Energy Center[40] to make necessary amendments to the rules of the office; and (iii) to issue methodologies for determining the contribution of generation capacity of renewable energy to the National Electricity System. The legislative instrument also created the Fund for Energy Transition and Sustainable Use of Energy, which had as its aim to promote the energy sector via projects, programs and actions to achieve the greater use and development of renewable energy sources and clean technologies. The fund initially had 3,000 million pesos.

39 It excludes hydropower with the capacity to generate more than 30 MW.

40 The National Center for Energy Control is located under the control of the Office of Operation of the CFE and is in charge of the handling of energy in the National Electricity System.

Pidiregas as a problem

In 2008 there was a national debate on the desirability of maintaining the mechanism of Pidiregas for project financing. The Center for Study of Public Finance calculated that the debt acquired by PEMEX and the CFE from projects financed through these mechanisms reached 1.9 trillion pesos (approximately US$ 139 billion)[41], representing around 18% of the GDP. Of this debt, 84% corresponded to projects contracted by PEMEX. The Center calculated that similarly, in 2008, the revenues generated by projects financed by Pidiregas represented 27% of public revenue.

Given the magnitude of the debt owed to Pidiregas and the relevance of the topic to public discussion, in November 2008 the Government requested that Congress reform article 32 of the Law of Budget and Fiscal Responsibility. The reform was made to include a text that would prohibit that PEMEX continue using the figure of Long-term Infrastructure Projects to finance investment in projects.

41 Data from the Center for the Study of Public Finance. December 2007 Report. Exchange rate on December 31, 2008 was 13.725 pesos/US$.

As a result of this change, all of PEMEX's debt that was incurred via Pidiregas becomes part of its financial statements, considerably reducing the debt capacity of the public company. This reform didn't eliminate the potential that the CFE would continue to use this mechanism

Luz y Fuerza del Centro: dissolution postponed since 1974

An important event that occurred in the electricity sector in the six-year term that ended in November 2010 was the liquidation, in October of 2009, of the decentralized organization Luz y Fuerza del Centro (Central Light and Power, LFC). As previously indicated, the vertically integrated agency had a monopoly for the provision of electricity to Mexico City and some surrounding areas. As part of the liquidation of the organization, all the assets of LFC were transferred to the CFE, and all of its personnel were fired. In 2009, 22.6% (44,299 GWh) of the total electricity energy sales to final users were carried out by the LFC.[42]

The reasons for the end of Central Light and Power were explained by a decree published on October 11, 2009. Among the most outstanding are: (i) the high level of energy losses, which reached 30.6%; (ii) the financial losses with costs that doubled its payments during the 2003-2008 period; and (iii) the high overhead of the works carried out by the LFC, which represented 176% of the cost incurred by the CFE to execute similar work, among others.

42 Annual report of the CFE 2010.

Reforms to the renewable energy laws

In mid-2011, the last important energy legislation reform is passed. This reform modifies the articles to the laws of Renewable Energy and the LSPEE. The changes are mainly intended to adjust both legal instruments to the new aim of advancing the use of more renewable energy in the energy matrix.

There are two very important additions to the aforementioned laws. The first is the incorporation of the concept of environmental externalities in the process of evaluating the energy sources that are to be included in the grid. This is important given that renewable energies could be favored when compared to traditional energy sources, which would allow the incorporation of more clean technologies in electricity generation.

The second important modification of the June 2011 decree is included in the law of renewable energies. It has set a goal for the participation of fossil fuels in the electricity generation matrix. According to the decree, electricity generated with fossil fuels should not exceed 65% in 2014, 60% in 2035 and 50% in 2050. Given that in 2009 the electricity generation matrix in Mexico depended 77.6% on fossil fuels, this goal, included in the law, would force authorities to quickly incorporate more non-fossil fuel generation plants.

07

ENERGY DOSSIER
MEXICO

IDB