

Mexico

1. Overview of National Energy Policy

The regulatory and political context in Mexico was based on a sustainable development agenda defined by the National Development Plan of the Federal Government. Mexico ratified the Climate Change Convention in 1993 and the Kyoto Protocol in 2000 and thus the Energy National Plan establishes a goal, for 2006, of 1,000 MW of additional installed capacity based in Renewable Energy (not including big hydro).

In addition, the Federal Government has the commitment of increasing the electricity provision from 95 to 97% of the 100 million inhabitants, which means that grid extension is needed and RE systems installed for some 5 million people.

As stated in the Mexican Constitution, the state is the only one authorized for electricity generation and distribution for public service, however the private sector is allowed to generate in two cases: Self/consumption and Independent Power Producer of energy, sold only to the state-owned companies (Comision Federal de Electricidad (CFE) and Luz y Fuerza del Centro (LyF)). The state companies must provide the electricity at the lowest possible cost to their customers

Mexico Energy Policy Objectives related to Renewable Energy (RE) are:

- Increase the quality of life of the Mexican people;
- Promote a rational use of resources in the context of sustainable development and intergenerational equity;
- Promote investment in productive and feasible projects for Mexico;
- Increase productivity in the sector;
- Achieve a competitive pricing policy.

Regulatory Framework based on Self-production (auto-production) and Independent Power Production (IPP)

- Auto-Production
 - Electricity produced to satisfy the generator's own needs.
 - No sell to third parties allowed.
 - Creation of self-generating companies with third parties allowed.
 - Surplus electricity can be sold to the grid
 - Electricity swaps with the national utility allowed
- Cogeneration for auto-production only
- Independent power production (IPP)
 - Electricity generation with no capacity limits
 - For sell to CFE (state owned) only
 - In compliance with CFE's expansion plans
 - Bidding for least energy cost (US\$/kWh)

2. National Programs/Policies and Targets for Renewable Energy

The Energy National Plan establishes a goal of 1,000 MW of additional installed capacity based in Renewable Energy (not including big hydro) by the end of last year.

The creation of a Program for the Use of Renewable Sources of Energy setting a minimum percentage of 8% in renewable energy contribution to total power generation is established as a goal for 2012 (again, does not include big hydroelectric plants). Besides this, there are no specific targets for Mexico.

In summary, current policy framework establishes State-control of electricity transmission and distribution. Private sector participation is limited to Independent Power Producer (IPP) and self-supply (auto-production) and the existing electricity law (being improved) presents barriers to RE development as the national utility, the Federal Electricity Commission (CFE), follows a least-cost principle, which does not includes social and environmental value to the energy price.

Mexico has implemented several energy efficiency programs and standards, both developed by the National Commission of Energy and the Environment (CONAE), which was designated as a decentralized body of the Secretariat of Energy (SENER).

The objectives of the Commission are to develop energy efficiency standards and promote the development of alternative sources of energy. CONAE's efforts represent one of the most comprehensive energy efficiency programs in Latin America. Energy efficiency standards have been issued for a number of electronic and electric devices, including freezers, refrigerators, fluorescent lamps, washing machines and others.

In the early 1990s, CONAE began a series of energy studies and audits in different sectors. The energy studies consisted basically in an assessment of the lighting systems and equipment based on energy audits.

In 1992, CONAE established a "Sub-Commission for Energy Savings in the Public Sector," involving twenty federal agencies, to address federal buildings and vehicles.

By 1996, more than 120 energy audits and studies had been performed on federal buildings. This experience showed that the largest potential for energy savings was in lighting systems.

Energy-saving activities, especially in public buildings, have gone through an evolution from scattered energy studies to a large-scale program with substantial results. Table below shows energy savings and new generation capacity needed that was postpone with EE since the year of 2003.

Table 1. Energy Savings and New Generation Capacity

Description	2003	2004	2005	2006
Reduction in new generation (MW)	1,886	2,219	2,567	2,926
Saving of Electrical Energy (GWh)	10,800	12,490	14,250	16,065
Saving of Thermal Energy (TJ)	16,930	20,211	23,691	3,064

Below a list of Programs for RE in Mexico

- Green fund(USD\$ 70 Million, grant from GEF)
 - Performance incentive for power generation (MWh), not for installed capacity
 - Access to incentive through a competitive process for Independent Power Producers
- National Program for Rural Energy (USD \$110 Million mix funds)
- Action plan to overcome barriers for wind generation development in Mexico (UNDP*-GEF: US\$12.5M)
- Acknowledgment of capacityfor Renewable Energy
- Fiscal incentives: accelerated depreciation
- Resource evaluation: Geographic Information Systemfor Renewable Energy and maps of resources
- Regulation for Solar Hot-water Systems

Table 2. Relevant Decrees, Regulations, Policies, and Laws Affecting the Mexican Energy Sector

Law / Decree	Status	Purpose
Accelerated Depreciation for Environmental Investment. (Depreciación acelerada para inversiones que reportan beneficios ambientales)	1995	Investments in environmentally friendly technology, including renewable energy technology could benefit from accelerated depreciation. Investors are thus allowed to deduct 100% of the investment after one year of operation, as defined in articles 21, 22 and 23bis of the General Law for Ecological Equilibrium and Environmental Protection
Grid interconnection contract for renewable energy (Contrato de interconexión para fuente de energía renovable)	2003	This regulation sets the requirements for the interconnection of renewable energy sources with the national grid. It also establishes the general conditions for the judiciary acts among the parts related to the generation and transmission of electricity.
Project of Bill to Promote Renewable Energy. (Iniciativa de Ley para el	2004	This bill was introduced in Congress with the purpose of creating a law for renewable energy, compatible with the existing Law of Public Electricity

Aprovechamiento de las Fuentes Renovables de Energía).		Service. This bill also includes non-electrical applications of renewable energy, considered to be fundamental to the development of the nation.
Project of Ecological Norm for Wind Farms	2005	This project of norms establishes technical specification for the protection of the environment during the construction, operation and decommissioning of wind farms.
Project of Electricity Reform in Connection with Renewable Energy (Iniciativa de Reforma Eléctrica en lo Referente a Energías Renovables)	2003	This initiative was introduced to Congress with the purpose of adding a chapter on electricity generation from renewable energy sources to the already existing Law of Public Electricity Service.
Public Electricity Service Law (Ley del Servicio Público de Energía Eléctrica)	1975	This law deals with all aspects of electric energy for public service, including generation, transmission, distribution, and transformation and supply. The law establishes that public electricity service is of the exclusive competence of the Mexican State, through the national electricity companies, and must be provided on a least-cost basis.
Methodology to establish service charges for transmission of renewable electricity. (Metodología para la determinación de los cargos por servicios de transmisión de energía eléctrica para fuente de energía renovable.	2003	This policy seeks to develop a clear methodology for application by the Federal Commission of Electricity (CFE) and the Power and Light Company (LFC) to establish the service charges for transmission of electricity from renewable energy resources
Wheeling Service Agreement for electricity from renewable energy sources (Convenio para el servicio de Transmisión de energía eléctrica para fuente de energía renovable)	2004	The Wheeling Service Agreement for electricity from renewable energy sources establishes the basis, procedures, terms of reference and conditions that must be applied for the wheeling of electricity produced by renewable energy sources, from the interconnection point of the generator with the national grid to the load points of the self-supplier.

National Program for Renewable Energy: The goal of this program is to reach 50,000 homes from 2005 to 2008. The first phase of this program was to be implemented from 2005 to 2006, with 10,000 homes. Resources will be provided from Federal, State, and Municipal sources, and a grant was awarded from GEF. The National Program for Renewable Energy will be a joint effort between SEDESOL, CDI, and CFE. Technologies to be considered include grid connection, solar, biomass, wind, minihydro, hybrid, and more.

U.S. Presidential Clean Energy Initiative (CEI): On February 23, 2007, the government of Guerrero and the Secretaría de Energía (SENER) signed a Memorandum of Understanding to provide electricity to isolated rural communities using solar, wind, and micro-hydro technologies. This will be a joint effort between the U.S. and Mexican governments and the private sector under the U.S. Presidential Clean Energy Initiative (CEI). The ultimate goal of the project is to provide electricity to 50,000 homes. The pilot program is planned to be replicated in Oaxaca, Chiapas, and Veracruz with the hope that these will serve as models for other states in Mexico.

REEEP: The Mexican Secretary of Energy, the Undersecretary of Environmental Regulation, and authorities of the United Kingdom signed the Official Entrance of Mexico to the Renewable Energy and Energy Efficiency Partnership (REEEP) on March 15th, 2005. This partnership will aid in Mexico making necessary changes to its regulatory and legal frameworks at the pace necessary to expand their energy efficiency programs. Ultimately, Mexico will be an example of the mission of REEEP and will aid in replicating the program in countries that face similar challenges. Thus far Mexico has applied for REEEP funding to look into improving its methodologies of estimating the contribution of intermittent renewable energies to the capacity of the National Grid System. This will be crucial to initiating wind energy projects.

Primary energy in Mexico (2006): According to the Secretaria de Energia, the breakdown of primary energy in Mexico in 2006 is as follows:

Oil	68.6 %
Natural Gas	19.31 %
Hydro	2.84 %
Firewood	2.52 %
Coal	2.20 %
Other hydrocarbon	1.87 %
Nuclear	1.20 %
Cane bagasse	1.06 %
Geothermal	0.75 %
Wind	0.001 %

The Future of Renewable in the Mexican Power Sector: The Grupo de Hidrogeno y Celdas de Combustible makes the following predictions for renewables in Mexico for 2010:

Fossil	75.90%
Hydro	19.95 %
Nuclear	2.40%
Geothermal	1.57 %
Wind	0.18 %

Solar PV: Through the Mexican Renewable Energy Program (MREP) 206 pilot PV water pumping systems were installed in Mexico as part of MREP from 1994 to 2000. MREP is sponsored by USAID and DOE and is being managed by Sandia National Laboratories.

Biomass/biofuels: On September 14th, 2007, the Mexican President, Felipe Calderón, vetoed the Biofuels Law. The law was to establish biofuel production in Mexico. Calderón stated it focused too much on producing ethanol from maize and sugarcane and did not consider new technologies such as seaweed, bacteria, enzyme and cellulose biofuels.

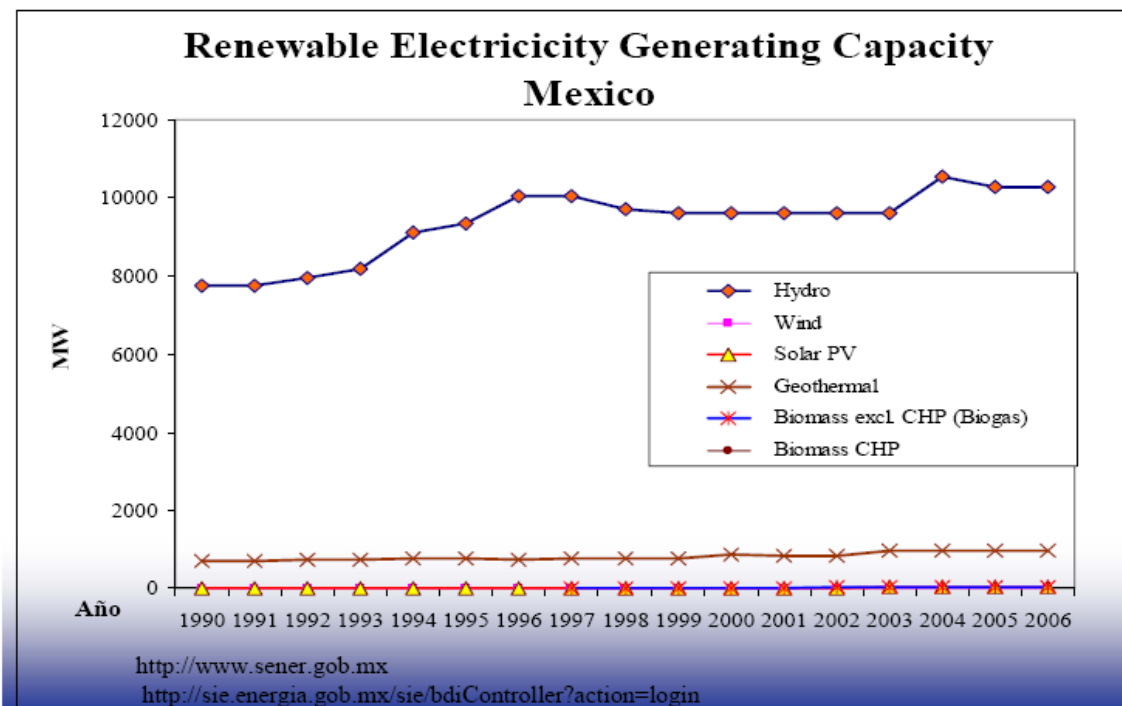
Geothermal: IIE provides support to the Federal Electricity Commission in Mexico through exploration, development and utilization of its geothermal resources. IIE has developed several projects and has also collaborated with Pemex in studying oil fields. IIE lists its projects as such; tracer tests in the northern part of Los Azufres geothermal field, geo-scientific studies of the Hidalgo Polygon in the Cerro Prieto geothermal field, hydraulic models of steam-pipe networks and Maya crude transportation, and experimental studies to determine the petrophysical parameters of core samples from the fields of the Ku-Maloob-Zaap Integral Asset.

Hydrogen: The Hydrogen Mexican Society (HMS) has; been involved in international, bilateral (USA & Mexico), and Trilateral (USA, CAN, & Mexico) representing Mexico, organized forums with government officials to integrate hydrogen into Mexico's Energy Agenda, and represents Mexico as an observer in the Partnership for Advancing the Transition to Hydrogen (PATH).

According to the Grupo de Hidrogeno y Celdas de Combustible, establishing energy policies that incorporate hydrogen is not a problem. However, obtaining commitment from the government to support components such as educational and RD&D programs is a challenge. As such, a hydrogen national plan is not included yet. Ongoing research and development programs are occurring in Universities and Research Centers. PEMEX has divided opinions Hydrogen Producers are interested Government commitment is unclear.

Hydro: Over-all, hydro is the largest contributor to Mexico's Renewable Electricity Generating Capacity. See chart below

Figure 1. Renewable Electricity Generating Capacity



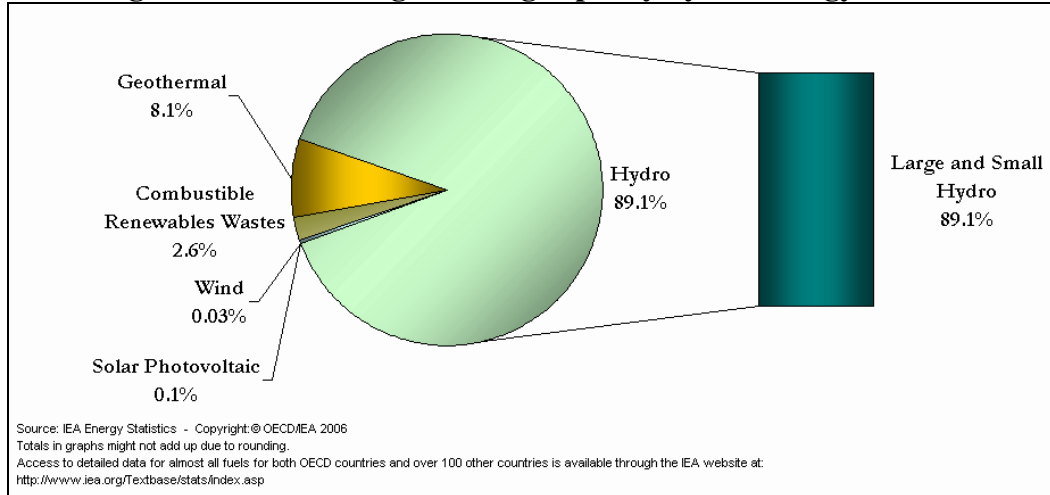
In 1997 non-conventional RE (all but large hydro) accounted for nearly 4% of all energy generation in Mexico.

Installed capacity with Renewable Energy in 2000 was 10,460 MW, as divided bellow.

- Hydro: 9,600 MW (90.6%)
- Geothermal: 845 MW (8%)
- Solar 12.2 MW (0.12%)
- Wind 2.0 MW (0.02%)
- Biogas 18 MW (0.17%)
- Minihydro 8 MW (0.08%)

Based on renewable energy generation capacity as off 2004 and shown in the next graphic, the share of large hydro generation continue representing nearly 90% and geothermal almost 8.1% of all RE generation in Mexico. Figure very close to the ones in 2000.

Figure 2. Mexico RE generating capacity by technology in 2004.



On the other hand, according to World energy outlook - International Energy Agency 2004, RE share (excluding large hydro) in Mexico decreased nearly 2% from 1997 to 2004. The incremented need of energy to supply Mexico demand was absorbed by both fossil fuels and large hydro plants.

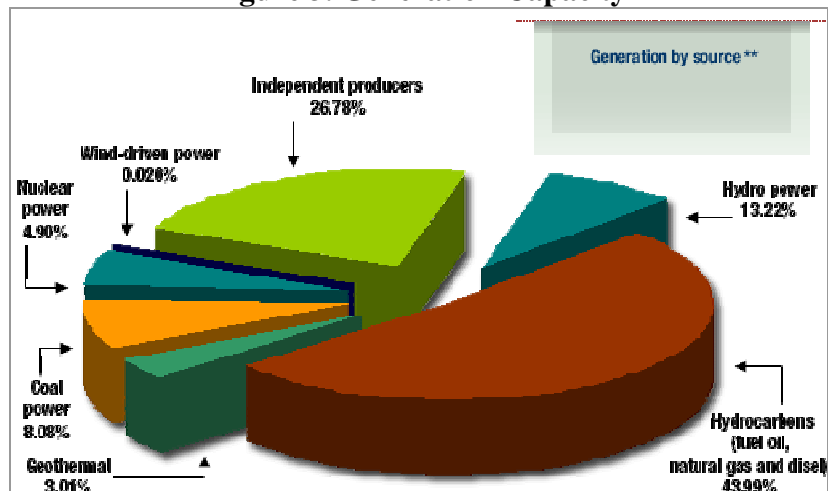
Through the years, the Federal Electricity Commission (CFE) generation capacity has increased as shown in the table below. As noted, the IPP started operation in 2000.

Table 3. Federal Electricity Commission

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Capacity (MW)	CFE	33,920	33,944	34,384	34,839	34,901	36,236	36,855	36,971	38,422	37,325	37,470
	IPP	-	-	-	-	484	1,455	3,495	6,756	7,265	8,251	10,386
	Total	33,920	33,944	34,384	34,839	35,385	37,691	40,350	43,727	45,687	45,576	47,857
Generation (TWh)	CFE	149.97	159.83	168.98	179.07	188.79	190.88	177.05	169.32	159.53	170.07	162.47
	IPP	-	-	-	-	1.20	4.04	21.83	31.62	45.85	45.56	59.43
	Total	149.97	159.83	168.98	179.07	190.00	194.92	198.88	200.94	205.39	215.63	221.90

Graphic below shows how the above generation capacity is met by CEF by source of energy.

Figure 3. Generation Capacity



According to Mexican Energy Secretary, in the next 10 years the expected demand growth rate for energy demand will be approximately of 6.3%. This new generation will be met by private projects, which are growing at an annual rate of 14.2%.

The demand growth will be faster in industrialized regions:

- Northeast, 6.5%
- Baja California, 7.2%
- Yucatán Peninsula, 7.6%

Also, the demand growth requires more than 28,862 MW of additional generation capacity by 2011. Nearly 50% (14,228 MW) of this new capacity have already been bided or is in process to (mostly from geothermal, hydro and combined cycle – NG).

A. Progress/Barriers

Wind energy development has increase in Mexico in the past 2 years. In 2005 CFE began the construction of La Venta II, the first large-scale wind power plant in Mexico (83 MW) located in the state of Oaxaca. This plant initiated operations in October 2006.

In the coming months the Federal Electricity Commission (CFE) will bid La Venta III, a 100 MW plant to start operating by 2008. CFE programmed four more tenders for La Venta IV, V, VI and VII, with 100 MW each – all are expected to begin operation between 2009 and 2012.

Additionally, CRE has granted eight permits to install a total wind capacity of 1076 MW for self supply purposes: 716 MW in the state of Oaxaca and 360 MW in the state of Baja California.

The Integrated Energy Services for Small Rural Communities (SIEPRCM) Program will bring electricity up to 2009 to 50,000 rural households isolated from the national electric grid. Including in the methodology the consideration that the provision of training for the development of energy related productive activities to the pilot populations fundamental to achieve results.

Mini-hydropower Technology has been implemented by Comexhidro (Mexican Company) using the existent agricultural dams. The mini-hydroelectric Chilatán, a 14 MW plant located in the State of Michoacán, began operations in 2005. The most important project of the enterprise, “El Gallo”, in the State of Guerrero, will have a 30 MW capacity, and has been under construction since 2004. The project is using the new regulation on interconnection for intermittent sources of energy.

Biomass has been mostly used for self supply, adding up to 40 MW of additional capacity. CRE approved to cogeneration plants for steam and electricity with biomass, one with bagasse (10MW) and the second incinerating black liquor (10 MW), both on paper mills industry. Three more permits (CFE granted) are in operation based on biogas from landfills (18.2 MW) and a fourth one using biogas from the industrial process (1 MW). One more project is under development, and has been authorized to generate power using biogas produced by anaerobic fermentation of cow manure (10.6 MW).

CFE plans to bid this year (2006) the installation of a new hybrid power plant (combined cycle + thermo solar). The plant will be located in Agua Prieta, with 240 MW of thermal capacity, and 30 MW of thermo solar capacity.

One of the main issues related to RE is the need to increase the power transmission capacity and infrastructure in order to allow the evacuation of electric power generated by independent power producers.

Other important component slowing down the development of RE in Mexico is related to capacity building and training needs. SENER has participated in the development of the Action Plan to eliminate barriers for the development of wind energy generation in Mexico. Yet, there is limited human resource base both for project identification and development and for systems engineering and construction.

Basically there is no RE industrial infrastructure installed in Mexico; this also delays development progress. In addition, financing Renewable Energy projects is more complex than conventional power generation.

On the policy front, the approval of the Law for the Use of Renewable Sources of Energy (LAFRE) by the Senate is still pending. There is a limited role for the private sector in Mexico's vertically integrated utility structure. Although several steps have been taken to increase the role of RE and the private sector and the proposed Renewable Energy law would further enhance the contribution of these technologies.

A barrier to progress is that there is strong emphasis on market creation but too little effort on local capacity building. According to IIE, the human resource base to identify and develop projects and for systems engineering and construction is too limited. Additionally, there is “basically no renewable energy industrial infrastructure and there are very few technological stocks.” There also exists legal, institutional, and policy issue. According to IIE the following are barriers:

- Renewables are not considered national assets by the constitution
- Direct sales to CFE is done on a \$/kWh basis, which is not always competitive
- The distributed green power is at odds with the bigger is better paradigm. The main concerns over green power are intermittency, power quality, safety, and cost.
- Regulatory framework needs to improve
- There is long administrative red tape for new projects

3. National Programs/Policies and Targets for Energy Efficiency

There are no specific targets for EE in Mexico. Several activities have been implemented in the past decade to reduce energy consumption at the end use level.

From 2004-05, PEPS completed a municipal energy-efficient procurement pilot project with eight cities, building on ICLEI's Cities for Climate Protection (CCP) network. The municipal component is expanding and the program is partnering with Mexico's Energy-Saving Commission (CONAE) to expand to the state and federal government level.

4. National Programs/Policies and Targets for Other Clean Energy Technologies

Commitments of Mexico in the Kyoto Protocol as a non annex I:

- No quantitative obligations to reductions in emissions
- Must implement GHG mitigation programs
- Needs to decrease emissions intensity
- Can attain benefits through participation in Clean Development Mechanism to promote projects that reduce GHG and commercializing them in the international carbon market.

Clean Development Mechanism: According to the National Ecology Institute (INE) Mexico has the potential to reduce its GHG emissions by 81 million tons of carbon dioxide during the first commitment period of 2008 to 2012. Most of this would be achieved through renewables. The energy sector can participate in the Clean Development Mechanism through several ways;

- Renewable Energies such as wind, biogas, biomass, mini-hydro, etc. and applying renewables in the rural sector through PV and mini-hydro.
- Energy Conservation through CONAE, FIDE, PEMEX, PAESE, etc.
- Geological sequestration of Carbon. Mexico is a member of the Carbon Sequestration Leadership Forum.
- Hydro-electric re-powering

Nuclear: Mexico has two nuclear reactors. Its first commercial nuclear power reactor began operating in 1989. There is some government support for expanding nuclear energy to reduce reliance on natural gas. However, there have been no new projects or targets have been proposed recently.

Natural Gas: Mexico has significant untapped reserves of natural gas. However, the Mexican government does not have the resources needed to develop them has been unsuccessful in attracting foreign capital. Pemex, is allowed to have any ownership interest in Mexico's natural gas reserves, which makes participation in the development of Mexico's resources unattractive to foreign investors.

Clean Coal: Mexico is one of eight countries participating in the project *Investigations into Advanced Analytical Techniques and Basic and Applied Research* with the International Energy Agency (IEA). According to IEA, "The key objectives of this agreement are to promote research on coal, from the science of coal combustion, conversion, and utilization to co-firing and bio-co-processing. To this end the participating nations in the Implementing Agreement for a Programme of Research, Development, and Demonstration on Clean Coal Sciences have developed a variety of means to share and develop coal combustion technology.

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