



**GOBIERNO  
FEDERAL**

**SENER**

# THE ENERGY SECTOR IN MEXICO

## POTENTIALS AND OPORTUNITIES

Lic. Jordy Herrera Flores



**Vivir Mejor**

# CONTENT

**Energy Sector in Mexico**

**Energy Reform / PEMEX**

**Renewable Energy**

**Energy Efficiency**

**Taking Action**

**Investments**

# Energy Sector in Mexico

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Renewable Energy

Energy Efficiency

Taking Action

Investments



# Mexico's Energy Sector Structure

## Ministry of Energy



## Commissions



Comisión Nacional de Seguridad Nuclear y Salvaguardias.



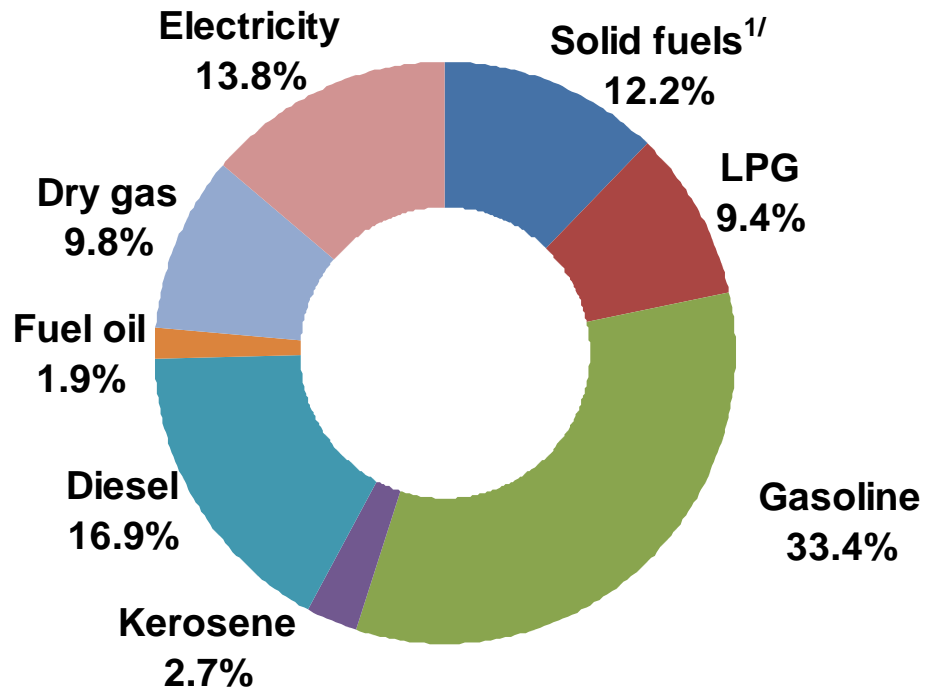
State-owned energy companies



Public energy research institutes

# Fuel Types

## Total energy consumption by fuel 2008

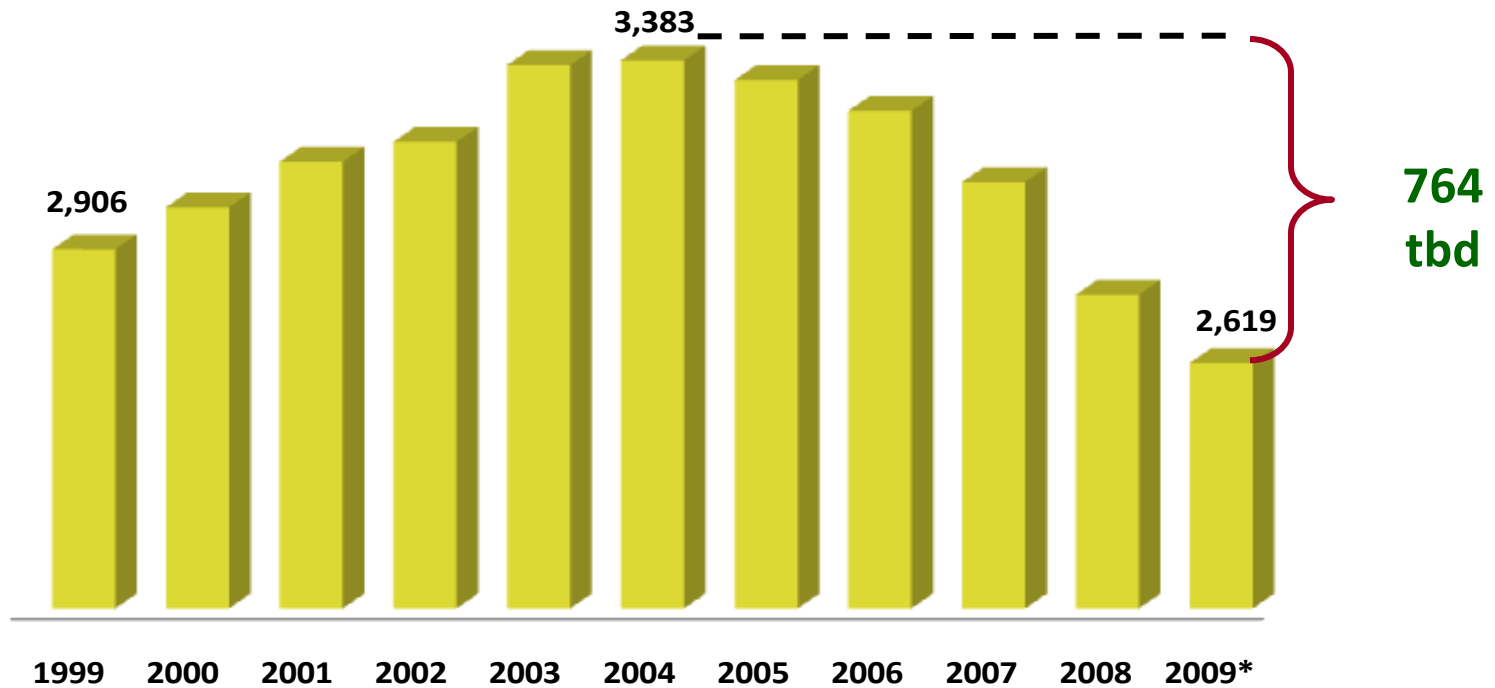


1/ It includes coal, wood, sugar cane, coking coal and petroleum coke.

Source: National Energy Balance 2008. Sener

# Mexico's oil production

## Crude Oil Production (Thousand Barrels / day)

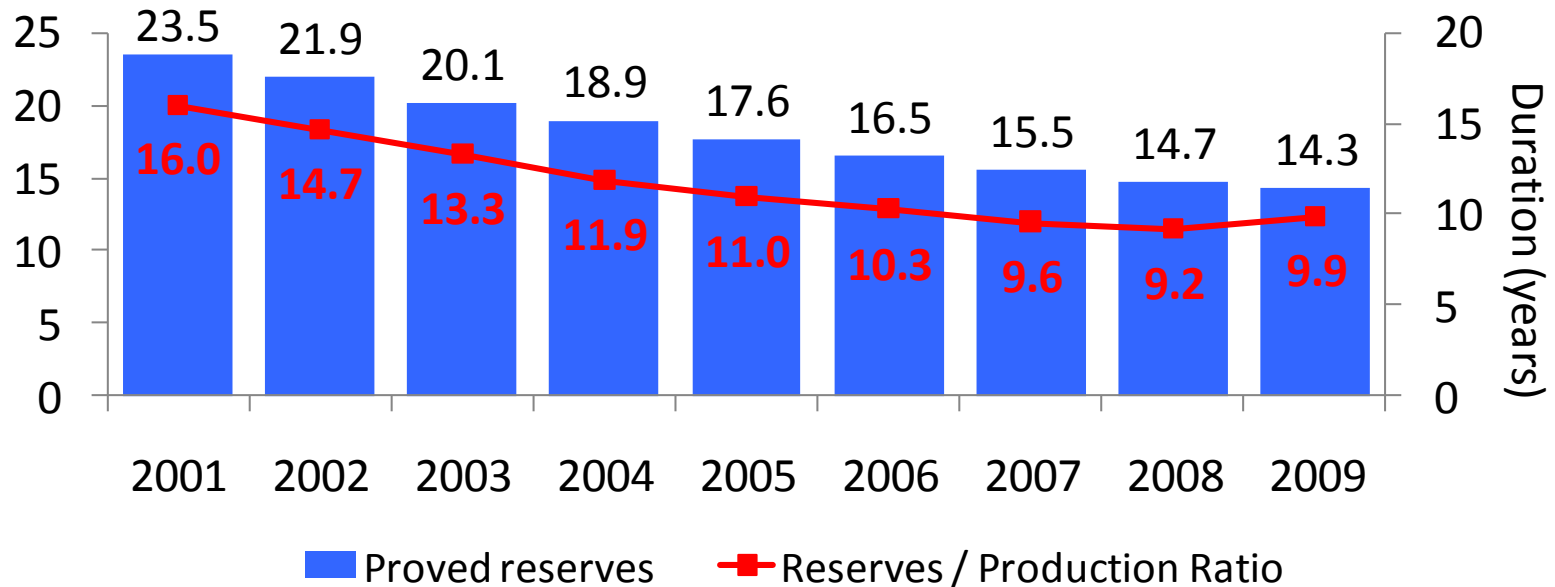


\*Jan-Jul 2009 average.  
Source: Pemex.

# Total fossil fuel reserves in Mexico

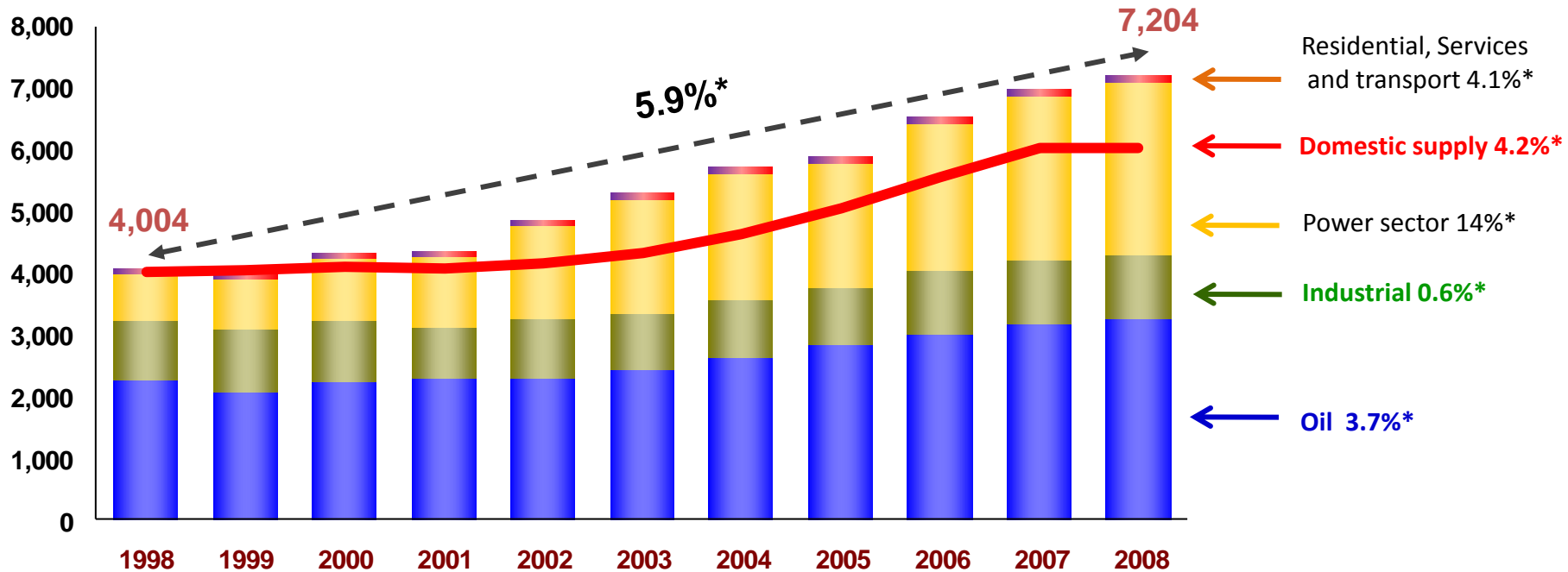
## Oil Reserves 2001 - 2009

(thousand million barrels of oil equivalent)



# Natural Gas Supply and Demand in Mexico

## Natural Gas Supply – Mexico (million ft<sup>3</sup>/day)

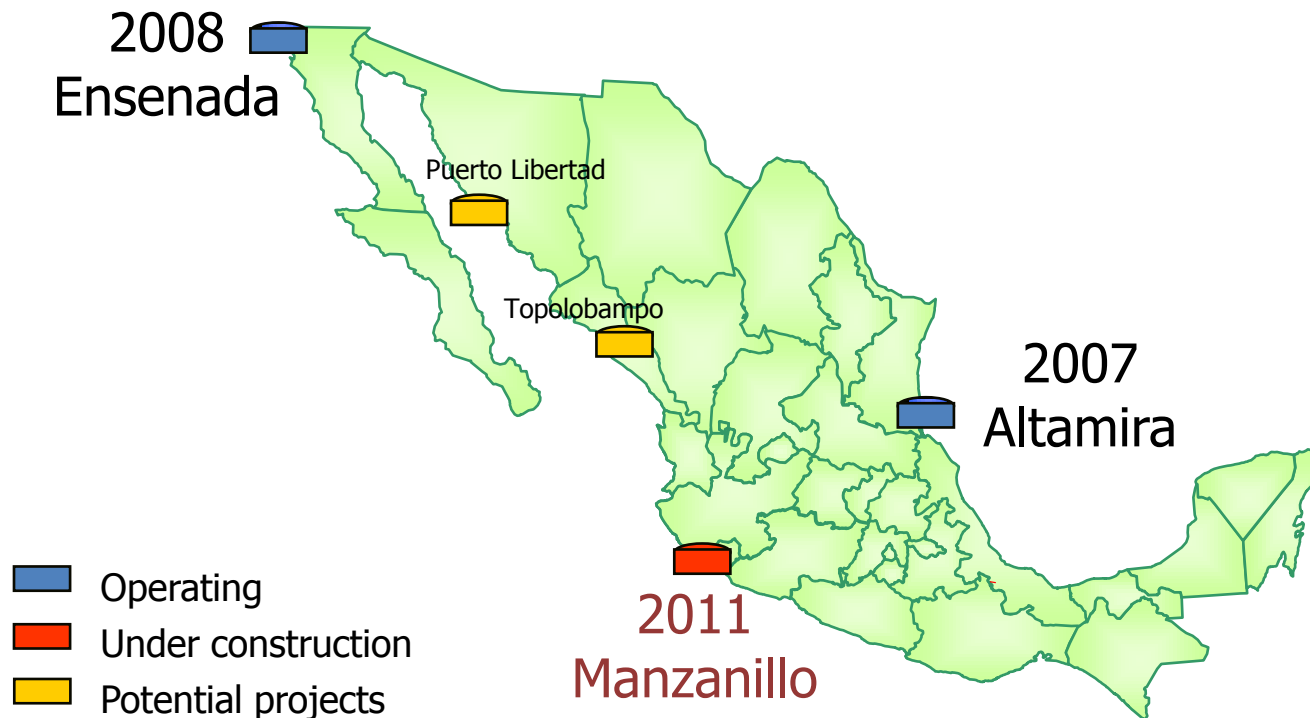


\*Annual average growth rate , 1998-2008

Source: *Prospectiva del mercado de gas natural*, Sener.

# LNG Projects in Mexico

One of the strategies for ensuring natural gas supply considers the liquefied natural gas (LNG) facilities.



# Gasoline Supply and Demand in Mexico

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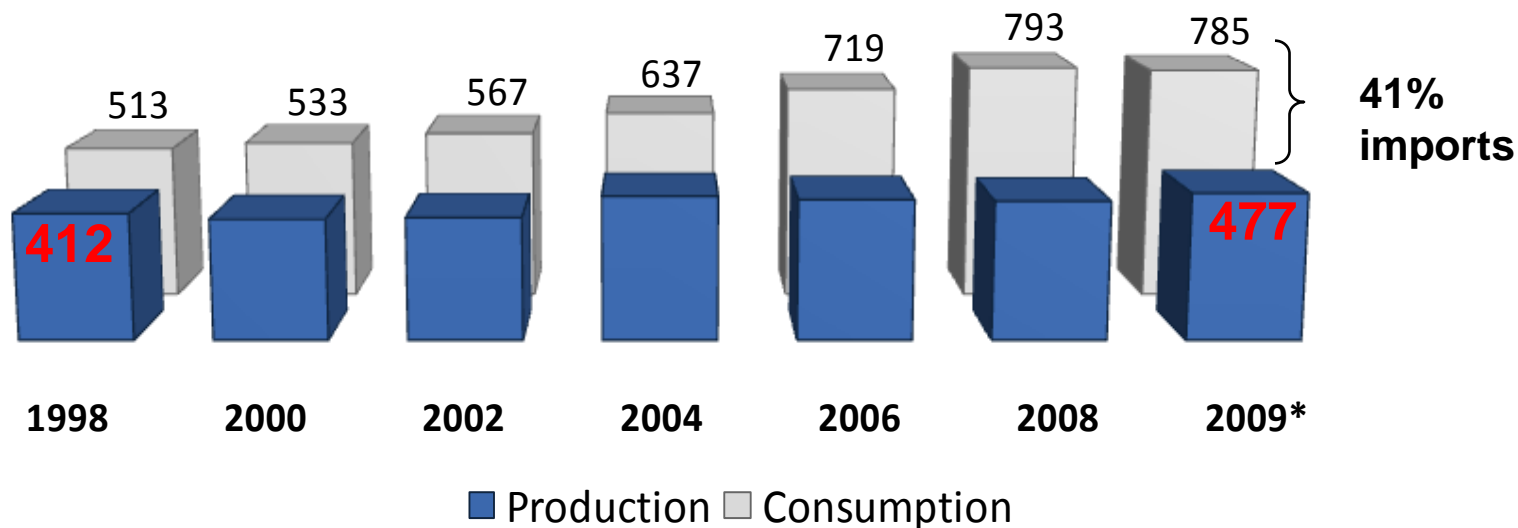
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## Gasoline Production vs Consumption (Thousand Barrels / day)



\*Jan-Jul 2009 average.  
Source: Pemex.

# Power Generation

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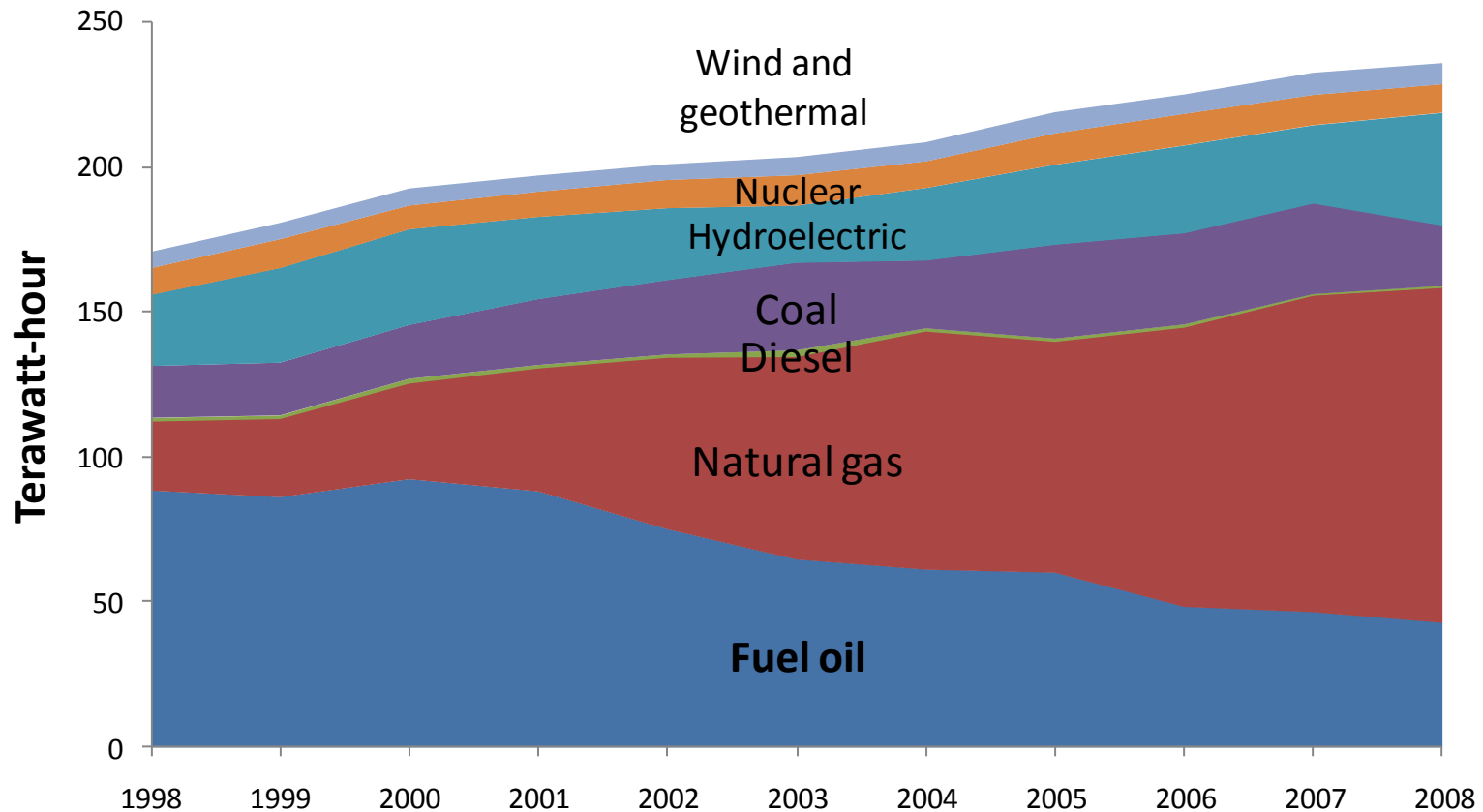
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## Power Generation by Technology (1998-2008)



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# Energy Reform Strategy

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## PETROLEUM INDUSTRY STRATEGY

## TRANSITION STRATEGY

### CHALLENGES

Increase Investment Skills

Increase Drive and Efficiency Skills

Incorporate State of the Art Technology



Strengthen Regulation and modify the Fiscal Regime

Conduct Energy Transition



### PEMEX - STRENGTHENING

Management Autonomy

Transparency and Accountability



Flexible Contracts

Sustainable Energy

Renewable Sources

### POSITIVE EFFECTS

PEMEX operated under a legal framework which had not been revised since the end of the 1970s until now.

## 1. Improving PEMEX's business practices.

- a) New and explicit mandate: **maximize value**
- b) **Freedom** to adjust or redesign its **organizational structure**
- c) **Flexibility** in setting its own budget
- d) **Procurement** schemes determined by the company
- e) Employee **rewards** linked to results
- f) **Independent** Board Members
- g) Provides **incentive-mechanisms** to foster agreements between Pemex and the private sector.

## 2. New Control Scheme in PEMEX

- a) Internal Control:
  - Auditing Committee (Independent Board Members)
  - Internal Control Body only to review compliance
- b) External Control:
  - "Citizen Bonds"
  - Reports with benchmarks to Congress by CEO / Board



# New Contracting Scheme

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## Broad applications in the Oil and Gas Industry

➔ **Remuneration in exchange of services provided**

➔ **Will not yield proprietary rights over fossil fuels and its production.**

➔ **Remuneration will consider performance, aligning the interests of PEMEX with those of its contractors.**

➔ **The contractor can be awarded certain additional compensations based on measurable gains for PEMEX in relation to the purpose of the contract.**

➔ **Agreements by which a contractor can carry out exploratory and exploitation activities in a specific area are permitted.**

# Estimated Investment

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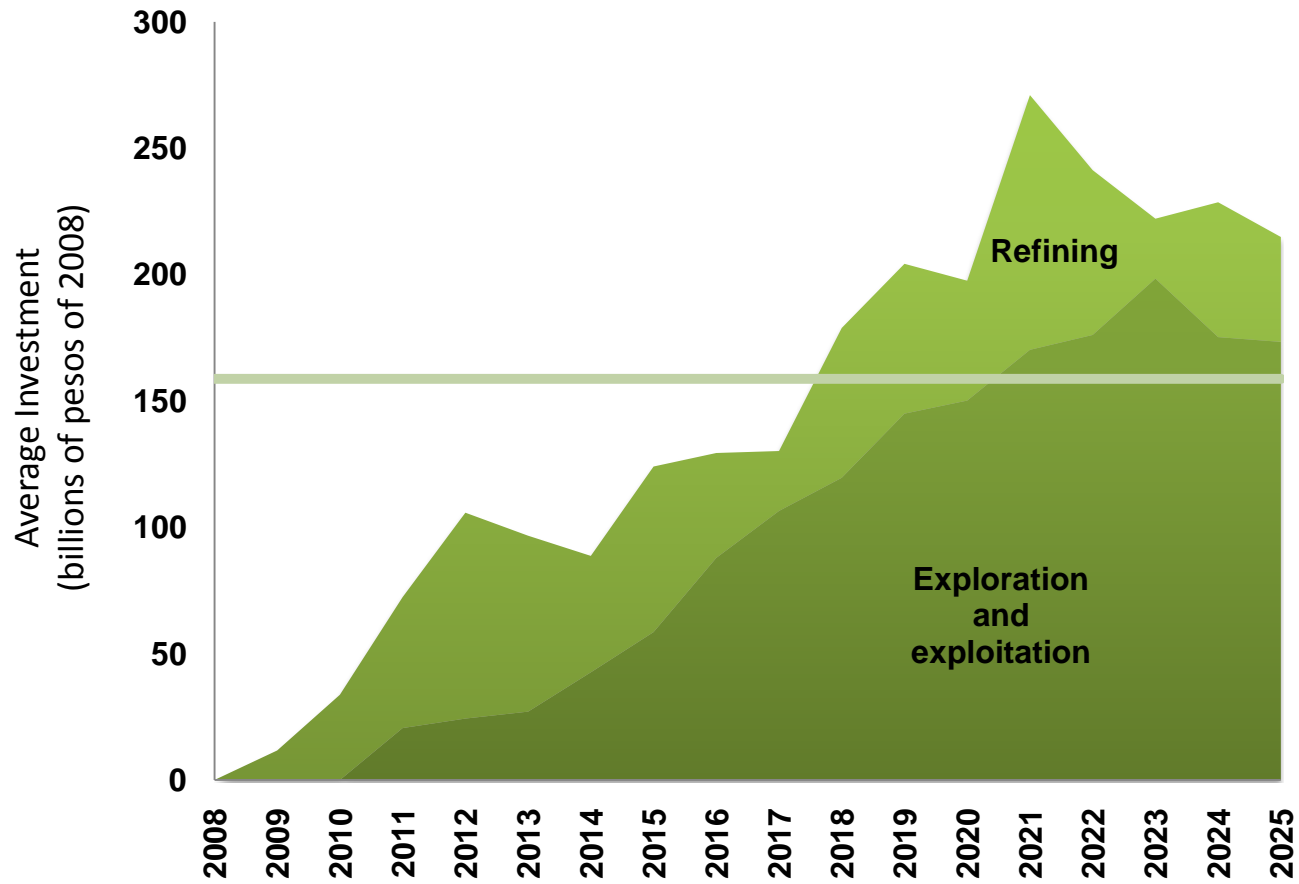
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## Additional Investment with the Reform



Source: SENER, 2009

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# Renewable Energy in Mexico

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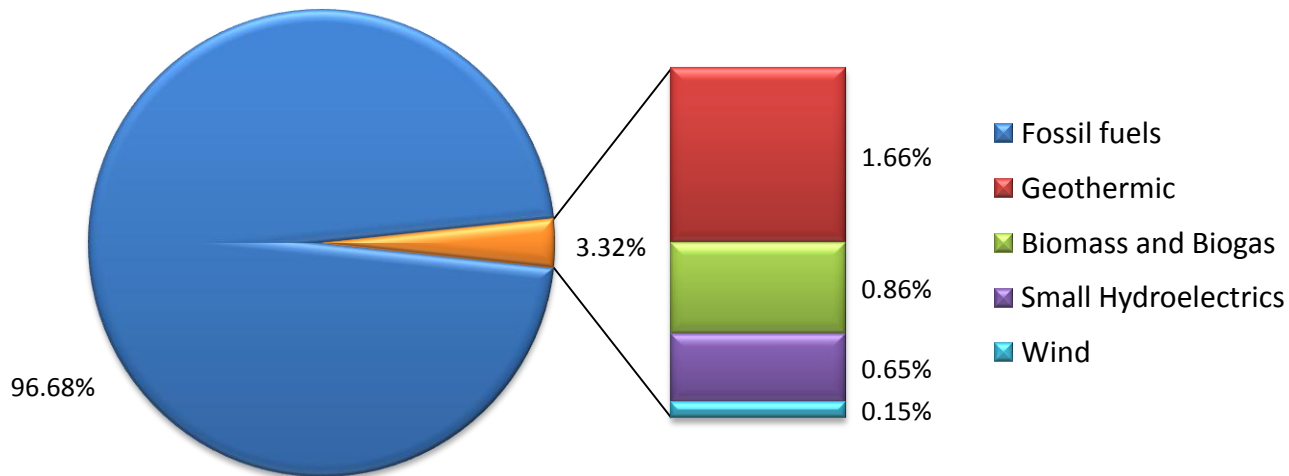
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## Current Situation

Mexico currently generates 1,924 MW by renewable sources, which represents 3.3% of the countries installed generation capacity<sup>1</sup>.

### Mexico's Energy Portfolio



<sup>1</sup>Ministry of Energy. Special Program for Renewable Energies (SENER. 2009)

# 2012 GOALS – Energy Transition

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Investments

## SPECIFIC GOALS – RENEWABLE ENERGY PROGRAM

GOAL	MEASURE	BASE LINE (2008)	GOAL	
Develop Renewables in Mexico	% Installed capacity by RE	3.3%	7.6% (2012)	Wind Energy: 4.3%
				Small Hydroelectrics: 0.77%
				Geothermal: 1.65%
				Biomass and Biogas: 0.85%
Extend electricity services to rural communities using Renewable Energy	# Communities with electricity from renewable sources	0	2500 (5 years after implementation)	

Source: *Renewable Program*,

## 1. WIND ENERGY

### Initiatives:<sup>2</sup>



- Open Season Project: interconnect 2,473 MW in Oaxaca (2009-2012).
- Economic incentives to connect La Venta III to the grid and development of a national wind map.

Potential areas in Mexico identified can provide up to 10,000 MW<sup>2</sup>

Goal 2012: 4.3%



<sup>1</sup>Asociación Mexicana de Energía Eólica.

<sup>2</sup> Prospectiva del Sector Eléctrico 2008-2017.

# Renewable Energy

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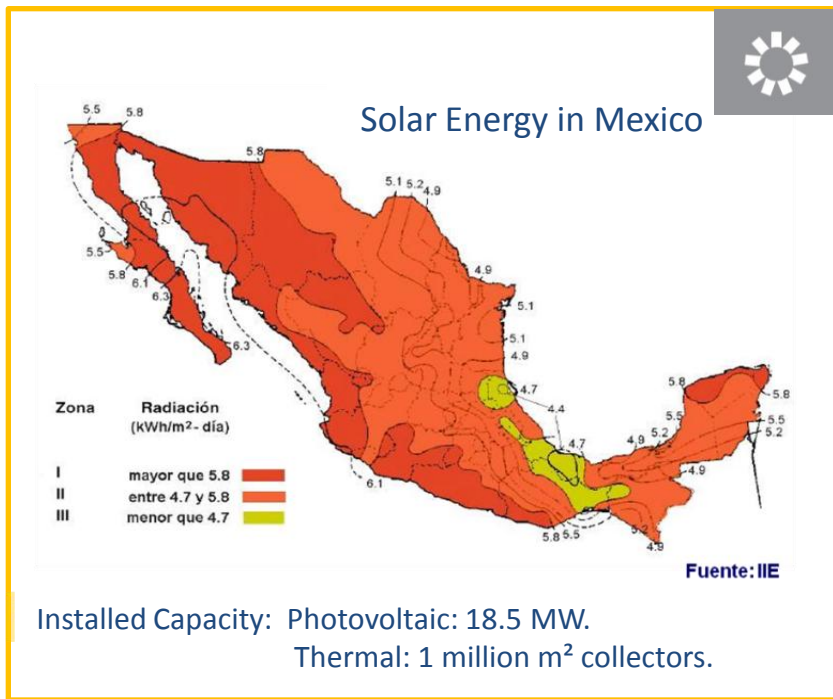
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## 2. SOLAR ENERGY



Mexico has an average radiation of 5kWh/m<sup>2</sup> per day

<sup>1</sup> Información de la CFE y de la CRE.

<sup>2</sup> Comisión Nacional para el Uso Eficiente de la Energía.

## 3. SMALL HYDROS

Total Installed Capacity: 376.8 MW

- 22 private central generators:  
83.5 MW
- 31 CFE centrals:  
270 MW
- 11 LyF centrals  
23.3 MW

**Small hydros:** capacity < 30 MW

The national small hydro potential is estimated at 3,250 MW<sup>2</sup>

Goal 2012: 0.77%

## 4. GEOTHERMAL ENERGY

There are 964.5 MW of installed capacity in Mexico, generating 7,057,76 MW<sup>1</sup>.



Geothermal potential is at least 1,395 MW<sup>2</sup>

**Goal 2012:**  
1.65%



<sup>1</sup> POISE 2009-2018. Pág.. 2-5. Cuadro 2.2.

<sup>2</sup> International Geothermal Association (IGA). Prospectiva del Sector Eléctrico 2008-2017

<sup>3</sup> Comisión Reguladora de Energía.

## 5. BIOMASS

### Initiative:

*International Energy Systems:* uses biogas liberated by a landfill to generate electricity with a 12.7 MW capacity in Monterrey.

There are currently 498.2 MW of installed capacity in electric generation from biomass.

The bioenergy potential in Mexico is between 2,635 and 3,771 PJ/year<sup>3</sup>

**Goal 2012:**  
0.85%



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**Energy Efficiency**

Taking Action

Investments

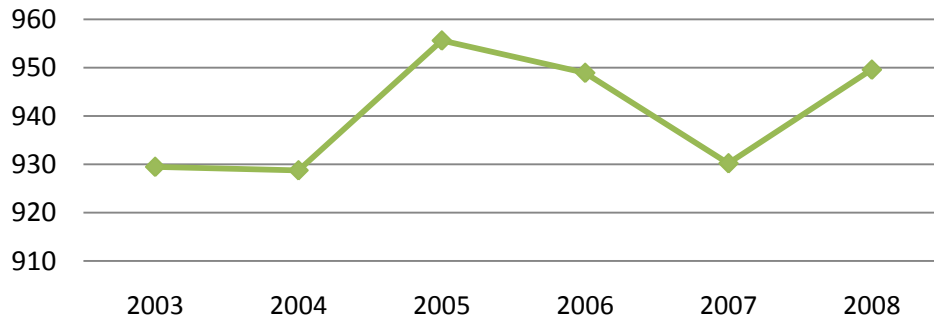


# Energy Efficiency Objectives

## To reduce the National Energy Intensity

In 2008 the national energy intensity was **949.58 KJ**, 2.1% higher than 2007.

**Energy Intensity** (KJ / \$ produced\*)

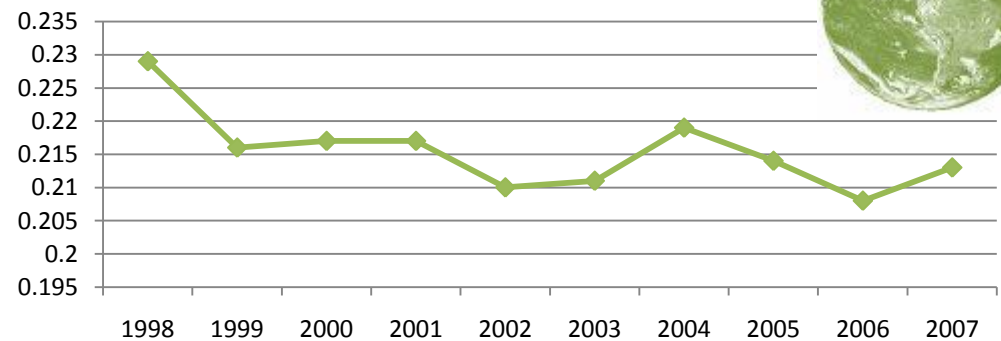


\* 2003 constant value

## Reduce energy consumption per capita in the country

In 2008 the national energy consumption per capita was **79.47 million GJ / inhabitant**, 2.6% higher than 2007.

**National Emissions Intensity** (TCO<sub>2</sub> / GDP)



\* GDP estimated by thousand pesos 1993

## To reduce the emissions of Greenhouse Gases

The total greenhouse gases emissions in Mexico show an annualized average growth rate of **2.2%** from 1997-2006.

# Energy Efficiency Programs

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Energy Efficiency

Taking Action

Investments

## Energy Efficiency for the Federal Government Program

All dependences and entities must implement **measures for the efficient use of energy and energy sustainability criteria:**

- buildings,
- vehicle fleets,
- industrial installations,
- procurement,
- leasing, and
- construction.



## Energy Efficiency Standardization Program

The **National Commission for Energy Efficiency** gathers manufacturers and equipment providers to standardize procedures and agree on required specifications.

## Public Lighting Program

The program will focus on providing white light to the population through public lighting.

It is a local municipal government program that involves social and environmental benefits.



Savings in energy consumption:

- 25 GWh/year,
- 7.2 million kg gas/year

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Energy Reform / PEMEX

Renewable Energy

Energy Efficiency

**Taking Action**

Investments



# Energy Efficiency Programs

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Energy Reform

Renewables

Energy Efficiency

Taking Action

Investments



## Electrical Appliances Replacement Program

Supplies energy efficient equipment to households.

- Savings from energy consumption: 3 520 GWh.
- Tons of CO<sub>2</sub> avoided: 3.01 million

## Light Bulbs Replacement Program

Consists in replacing bulbs, for compact fluorescent lamps in the next five years, benefiting a total of 17 million households.

**Pilot program in 2009:** 500,000 light bulbs will be replaced

- Savings in energy consumption: 21 500 GWh.
- Tons of CO<sub>2</sub> avoided: 14.3 million

An advertisement for the 'Ahorra Energía para Vivir Mejor' program. The ad features a yellow header with the text '¡En un 3x3 ahorra energía y mejora tu economía!'. Below the header, there is a large image of a compact fluorescent lamp (CFL) bulb. The text below the bulb reads: 'El Gobierno Federal se preocupa porque las familias puedan Vivir Mejor, por lo cual ha creado el Programa de Ahorro de Energía'. The ad also includes the website 'www.energia.gob.mx' and logos for the Government of Mexico, SEDESOL, FIDE, and the 'Vivir Mejor' logo.

# Renewable Energy Programs

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Renewables

Energy Efficiency

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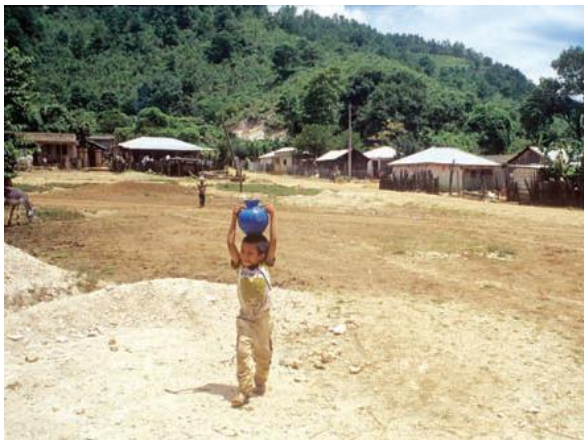
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The Mexican Government continues to support the development of private and public wind energy power projects.

## Large Scale Renewable Energy Project

Support development of grid-connected renewable energy projects, by addressing and reducing their barriers.

This program will help reduce green house gas emissions.



## Integrated Energy Services Project

Increase access to efficient and sustainable energy services in rural areas of Mexico

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Renewable Energy

Energy Efficiency

Taking Action

**Investments**



# Investments

Energy in Mexico




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Renewables

Energy Efficiency

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<b>Sector</b>	<b>Estimated Investment 2007-2012 (Millions USD)</b>
 Fossil Fuels	63,900.00
 Electricity	14,885.71
 Renewable Energies	6,828.57

Source: PEMEX and CFE. Notes from Pemex Exploration and Production, Annual Statement 2007 and 2008.

Estimated exchange rate: 14pesos/USD

# Actual Private Participation in the Power Sector

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The Power Sector Law allows private participation in:

- Cogeneration
- Self-supply
- Independent power production (IPP)
- Exports
- Imports for self-consumption

Type	Number of permits	Capacity [MW]	Energy [GWh/y]	Investment [Millions of USD]
Cogeneration	7	3,381	23,737	\$ 3,373
Self-supply*	646	7,053	32,015	\$ 9,994
Independent Power Producer	22	13,250	95,038	\$ 11,925
Exports	58	3,291	19,481	\$ 3,222
Imports	37	233	776	\$ 18
<b>TOTAL</b>	<b>770</b>	<b>27,208</b>	<b>171,047</b>	<b>\$ 28,532</b>

Source: CRE, June 2009

\* Includes self-supply and small production.

# Actual Private Participation in Natural Gas

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Private participation in natural gas market is allowed in:

- Transportation
- LNG Storage and Re-gasification
- Distribution

Type	Number of permits	Length [Km]	Compromised Investment [MMUSD]
Transport	176	13,117	\$ 2,399
Open Access	22	12,180	\$ 2,113
Self Usage	154	937	\$ 286
Distribution	22	41,848	\$ 1,790
LNG Storage & Regasification	3	2 [bcfd]*	\$ 1,831
<b>Total</b>	<b>201</b>	<b>54,965</b>	<b>\$ 6,020</b>

Source: CRE, June 2009

\* Regasification nominal capacity (billion cubic feet per day)

# Fossil Fuels Sector

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Renewables

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Project	Goal	Estimated Investment 2007 - 2012 (million dollars)	Status	End Date
<b>Cantarell</b>	<b>2009:</b> <ul style="list-style-type: none"> <li>• 820 thousand barrels / day</li> <li>• 1,350 million ft<sup>3</sup> of heavy oil / day</li> </ul>	<b>Total cost:</b> \$ 47,246.4 <b>Budget 2009:</b> \$ 3,956.5	Under development	2026
<b>Burgos</b>	<b>2009:</b> <ul style="list-style-type: none"> <li>• Produce 1,535 million ft<sup>3</sup> gas / day</li> </ul> <b>From 2009 to 2026:</b> <ul style="list-style-type: none"> <li>• Produce up to 6,868 billion ft<sup>3</sup> of gas.</li> </ul>	<b>Total cost:</b> \$ 32,515.7 <b>Budget 2009:</b> \$ 1,932.5	Under development	2027
<b>Integral Ku-Maloob-Zaap</b>	<b>From to 2002 to 2025:</b> Accumulated production of: <ul style="list-style-type: none"> <li>• 4,532 million barrels of oil</li> <li>• 1,726 billion ft<sup>3</sup> of gas</li> </ul>	<b>Total cost:</b> \$ 27,938.6 <b>Budget 2009:</b> \$ 2,292.8	Under development	2025
<b>Oil Field Antonio J. Bermúdez</b>	<b>From 2009 to 2025:</b> <ul style="list-style-type: none"> <li>• 950 million barrels of crude oil</li> <li>• 1,814 billion ft<sup>3</sup> of gas</li> </ul>	<b>Total cost:</b> \$ 9,840.6 <b>Budget 2009:</b> \$ 778	Infrastructure is being built continuously	2025

# Fossil Fuels Sector

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Energy Reform

Renewables

Energy Efficiency

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Investments

Project	Goal	Estimated Investment 2007 – 2012 (million dollars)	Status	End Date
<b>New Refinery</b> <b>Tula, Hidalgo</b>	<ul style="list-style-type: none"> <li>• Increment refining capacity</li> <li>• Increment supply of distillates, and</li> <li>• Diminish volume of imports</li> </ul> <p><b>Processing capacity:</b></p> <ul style="list-style-type: none"> <li>• 300 million barrels / day of heavy crude oil (Maya type)</li> <li>• 15 different plants, including a Coker</li> </ul>	<p><b>Total cost:</b> \$ 9,123</p> <p><b>Net Present Value:</b> \$ 3,086 (IRR of 17.5%)</p>	Conceptual design	2012
<b>Pipeline</b> <b>Tamazunchale –</b> <b>San Luis de la Paz –</b> <b>San José Iturbide</b>	<p>Construction of two open access pipelines</p> <ul style="list-style-type: none"> <li>• Provide additional route to increase supply to west and central regions of Mexico</li> <li>• Supply CFE's new power plants in Mexico's Valley and Salamanca</li> </ul>	<p><b>Total cost:</b> \$ 665 (through private investments)</p>	On August 25 the transport service tender's pre-criteria were presented to the interested firms	2012

# Manzanillo Project

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Project	Goals	Estimated Investment 2007 – 2012 (million dollars)	Status	Starting date
<b>Terminal for Liquefied Natural Gas Storage and Re-gasification</b>	<ul style="list-style-type: none"> <li>• <b>Storage capacity:</b> 300,000 m<sup>3</sup></li> <li>• Re-gasify and <b>supply CFE:</b> 14.16 million m<sup>3</sup>/day</li> </ul>	<b>Total Cost:</b> \$ 509.6	Under construction (overall progress of 26.02%)	September 2011
<b>Gas Pipeline Manzanillo – Guadalajara</b>	<ul style="list-style-type: none"> <li>• Open access gas pipeline</li> <li>• Deliver gas to CFE</li> <li>• Cover west and central regions of Mexico.</li> <li>• Connected to the National Pipeline System</li> <li>• <b>Transport capacity:</b> 500 million ft<sup>3</sup> natural gas / day.</li> </ul>	<b>Total Cost:</b> \$ 347.4	On May 2009, the contract for the construction and transport service of natural gas, was signed for a period of 25 years.	March 2011
<b>Thermoelectric power plant “Manzanillo I” units 1 and 2:</b> Redevelopment and associated transmission line	<ul style="list-style-type: none"> <li>• Satisfy demand on the west region of Mexico</li> <li>• Ensure required reserve margins</li> <li>• Increase 894 MW ( 15%) of net capacity , through the installation of gas turbines.</li> <li>• <b>Associated transmission line:</b> 240 Km-C of 400 kV.</li> </ul>	<b>Total cost:</b> \$ 1,192 <b>Budget 2009:</b> \$ 349.5  Both the power plant and the transmission line will be built as <b>public financed projects</b>	On June 9th 2009 the tender for the construction of the plant was published. The tender for the transmission line will be published shortly.	Ud1. 2011 Ud2. 2012

# Power Sector

Energy in Mexico

Energy Reform

Renewables

Energy Efficiency

Taking Action

Investments

Project	Goal	Estimated Investment 2007 – 2012 (million dollars)	Status	End Date
<b>Hydroelectric power plant La Yesca</b>	<ul style="list-style-type: none"> <li>• <b>Net capacity:</b> 750 MW</li> <li>• <b>Associated transmission line:</b> 279 Km-C and 116.6 MVAR</li> </ul>	<b>Total cost:</b> \$ 1,067.9 <b>Budget 2009:</b> \$ 352.7	<p>Construction work started May 22, 2008</p> <p>Under construction.</p> <p>The tender for the transmission line will be published shortly</p>	2012
<b>Power Plant (and Solar Field) Aguaprieta II</b>	<ul style="list-style-type: none"> <li>• Supply Northeastern region of Mexico</li> <li>• <b>Capacity:</b> 386.27</li> <li>• Solar field with an additional 12 MW capacity.</li> <li>• <b>Associated transmission line:</b> 185 Km-C.</li> </ul>	<b>Total cost:</b> \$ 702.9 <b>Budget for 2009:</b> \$ 339.4 <p>The complete project will be developed as a <b>Financed Public Investment</b></p>	<p>On June 11, 2009 the plant's tender was published</p> <p>The tender for the associated transmission line will be published shortly</p>	2012

# Renewable Energy Sector

Energy in Mexico

Energy Reform

Renewables

Energy Efficiency

Taking Action

Investments

## Wind Power Plants: La Venta III and Oaxaca I

**Capacity:** 101 MW each

The tenders for both plants have been awarded as **Public – Private Investments**.

**Construction Start Date:** July and August of 2009

Project	Goal	Estimated Investment 2007 – 2012 (million dollars)	Status
Wind Power Plants Oaxaca II, III y IV	<ul style="list-style-type: none"> <li>Meet the expected electric energy demand on the southwest region of Mexico</li> <li>Incrementing the country's renewable energy capacity</li> <li><b>Nominal capacity:</b> 304.2 MW 2%</li> </ul>	<p><b>Total cost:</b> \$ 512.1</p> <p><b>Budget for 2009:</b> \$ 279.6</p> <p>The project will be developed as a <b>Public – Private Investment</b></p>	<p>The project will be put out to tender shortly.</p> <p>Construction for the second phase of the associated transmission line to the projects, started in June 2009.</p>

# Project Map



# Conclusions

The **Energy Reform** allows greater planning and strategic control over the energy sector

**Pemex's modernization** seeks:

- Incentives
- New contracting scheme
- Third parties allowed in exploration activities;
- Additional investment by third parties.



The **energy transition** looks to diversify the energy portfolio including renewable energies, and promote energy efficiency and sustainability.

Mexico has great **Renewable Energy potential**.

Despite the current world economic situation, there have been **investments**, from both public and private sources.

Mexico has important oil resources; however, it is developing other energy sources to address **energy security** and the global **climate awareness**.



**THANK YOU**