Capítulo 24

The national strategy of energy in México

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Abstract

The global economic crisis is affected by the energy crisis characterized by high oil prices and a strong global dependence on energy from hydrocarbons whose rate of decline is increasing. Approximately 90 percent of the energy comes from nonrenewable fossil resources and at this scenario, several countries have incurred into the search for alternative energy sources and Mexico is no exception. In response, Mexico has established strategies for both deepwaters oil exploration and for the diversification of forms of getting energy, and to this, ambitious goals for the participation of renewable sources of energy must be set, so some observations to the Secretary of Energy have been made that the goal should be the order of 41 percent by 2020 and 75 percent by 2050, excluding hydroelectric plants. This is a strong challenge not only technically possible but economically viable.

24 Introduction

The Mexican economy is highly dependent of the resources obtained from its energetic industry; however the annual report of Petroleos Mexicanos (PEMEX) shows that the extraction of oil continues to decline (standing at 2.5 million barrels per day) and faces great difficulties for stabilization. In response, Mexico has established strategies to strengthen its energy industry, both in the field of oil exploration, and the diversification of the industry through other forms of energy production. The first strategy estimates that 58 percent of the prospective resources are concentrated in the deepwaters of the Gulf of Mexico and that these can become reserves through a successful exploration activity, for this, it plans to increase the likelihood of commercial success focusing on the exploration in priority areas. These explorations will operate at depths ranging from 450 to 2.500 meters. A statistical estimate of the success rate in these perforations would be about 33 per cent, this means 8 to 10 new fields discovered and between 20 and 24 failures. In the diversification strategy, an ambitious goal for the participation of renewable sources of energy must be set, for this, some observations to the Ministry of Energy have been made, that the goal should be of 41 percent by 2020 and 75 percent by 2050 , excluding hydroelectrics. There is a race against time and a great challenge to strengthen the Mexican energy industry, both to increase oil production and to discover new sources of energy. Thus, this research is about the strong challenge that this represents and the ways and strategies being implemented, as well as improvement proposals to the industry are established.

24.1 The place of Mexico in the global energy industry

The energy has always been essential to the development of any society. And as a country progresses in development, its energy needs increases. For this reason, energy consumption raises at the same rate of development, so that the supply of energy is considered a strategy of national security for many countries, and Mexico is no exception. National energy security is defined as the natural resources which enable it to ensure a steady pace of economic and social development without using external sources to acquire them. This second element, the natural resources and their good management are and will be fundamental to achieve national security in strategic areas for food, energy, economic development and environment in coming years and decades (Dorantes, 2008).

Energy security is now one of the basic themes in the world because it essentially affects the economies and security policy of the States. The international background is changing and the prices of oil and gas will not be easy to predict.

Added to this, the increasing emissions of greenhouse gases that come from the production and use of such energy is another key factor that is affecting the planet.

Finding the balance between security of supply and environmental impact and pricing is the key to future energy policy that is linked to other objectives such as the strength of domestic companies or consistency with other policies.

The energy sector in Mexico is a key factor that strategically affects the economic, productive and social development and therefore is transcendental to the Mexican economy. This sector has a strong participation in public finances, as well as in the development of infrastructure and human capital, so it is of utmost importance to have future successful goals in the medium and long term. In recent years, important projects and public policies have been developed, seeking to consolidate strategies to strengthen the national energy industry in a phase of great change and transformation.

De Quinto (2007) emphasizes that the final energy[159] such as electricity, gas, gasoline and diesel are important assets for any country since the lack of these can generate negative external effects of great magnitude in the economic and social level, so it can cause a collapse of both people and goods. Lack of energy mainly generates the absence of services such as transport and also affects perishable products in storage, and creates significant discomfort (as being hot or cold) as well as lowers security at all levels ...Even the lack of *an input,* such as electricity, can have serious consequences on other supplies: the service of incubators in hospitals, vital for the survival of newborns, gas stations cannot work because they are unable to pump, possible discontinuities in plants of regasification… Energy supply chains have very different characteristics and these chains interact with each other in a crisis. Thus, the security of the national energy system is essential to the degree of development that the world keeps today.

In addition, it must be considered that Mexico is subject to the events in the global energy field and must be shown what its place in the world is. So, the most significant events in the global energy sector are listed beforehand: High oil prices that have broken historical records in nominal terms and real terms.The stagnation characterized in the ratio reserves/production of oil since there has been higher production and fewer discoveries for over a decade. And while high prices and improved technology favor the discovery of new reserves, the policies of re-nationalization of the resource, environmental constraints and foreign investment make them unfavorable. Therefore, predicting the evolution of the *ratio* is not easy (De Quinto, 2007).

On the one hand, it is worth to say that Mexico has benefited from high oil prices since it is a producer. On the other hand, Mexico is also a country with stagnation in the *ratio* reserves / production of oil due to increased production without further discoveries of new oil wells.

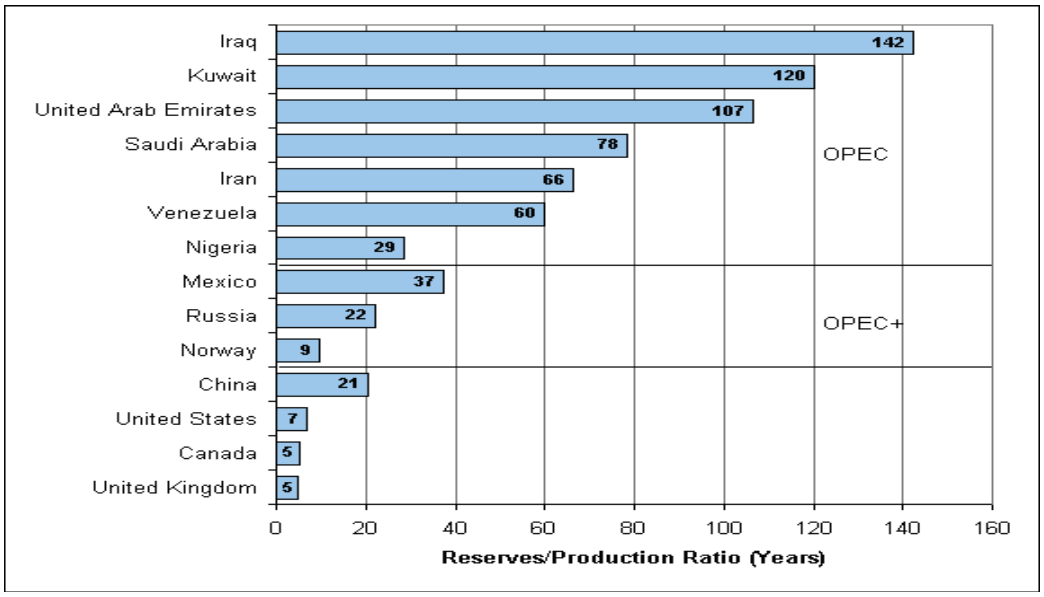
[159] The final energies are those that have been processed in the processing industry of energy and are ready for final consumption and have no feasible substitutes, at least in the short term. Cars, buses and motorcycles use petroleum products as gasoline or diesel and although there are vehicles that use natural gas or hydrogen, the car that we use cannot be changed in the short term. And at the industrial level, a process that uses electricity would be expensive to change to a supply of natural gas or vice versa in the short term (De Quinto, 2007).

The relationship between the reserves of production R/P indicates the relative measure of the resources available in the different oil producing countries. At current rates of production, known reserves of crude oil would last between 29 to 142 years in countries of the Organization of the Petroleum Exporting Countries (OPEC), being Iraq, the country, with the largest share of 142 years, the second Kuwait with 120 years and the third United Arab Emirates with 107 years of availability R/P and Mexico with R/P of 37 years, while the share R/P is only 7 years for the United States.

However, these calculations do not include estimates of undiscovered oil, which are uncertain but would substantially increase future exploitation of the remaining years of oil. At the same time, these data are relative because it must be taken into account that oil demand will increase, and as a result the number of years of availability will decrease (Figure 1).

Moreover, the Mexican energy industry was considered among the world's leading producers according to the last survey made by the World Trade Organization (WTO) in 2008, it was the sixth largest producer of crude oil globally in 2006. PEMEX, the largest oil industry in Latin America in terms of sales, reached 1.062 billion pesos in that year, achieved an average production of 3.3 million barrels of crude oil and approximately 5,400 million cubic feet of natural gas. It is also important to mention that the Mexican energy industry has a problem because the rate of decline of its hydrocarbon reserves declined in recent years, the relationship between proved reserves and production had a fall of 20.6 years to 9.6 years between the 2001 and 2006 (WTO, 2008: 116).

Figure 24.1 Relantionship of reserves / production of the major oil producing countries in the world

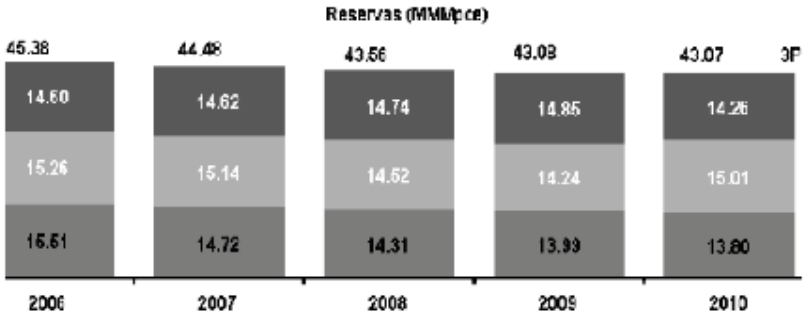


Source: Source: Calculations by J. Maples, Trancon,Inc. using data from U.S. Department of Energy, Energy Information Administration, International Energy Annual 1998, January 1999.Production for 1998: Table G1 ; reserves as of Jan. 1, 1999: Table 8.1, the original source Oil & Gas Journal. http://www1.eere.energy.gov/vehiclesandfuels/facts/favorites/fcvt_fotw125.html

On the other hand, PEMEX was placed at number four after Saudi Aramco, the National Iranian Oil Company (NOIC) Iran and British Petroleum in total production according to what was published in the Statistical Yearbook of 2008 of PEMEX. However, in a matter of proven oil reserves, Mexico ranked number 16. PEMEX has 14 thousand 310 million barrels of crude oil equivalent of proved reserves in the international comparative, while maintained an average production of 3.1 million barrels of crude oil equivalent, during 2008 (oil and gas.). Noting that the oil companies that provide higher levels of production are: first Saudi Aramco with 9 thousand 369 and NOIC second with 3 thousand 924 million barrels per day of production.

The third place is for the private oil company British Petroleum which increased its production significantly, 3 million 800 thousand barrels[160].

Figure 24.2 PEMEX reserves from 2006 to 2010 in billions of barrels of crude oil equivalent



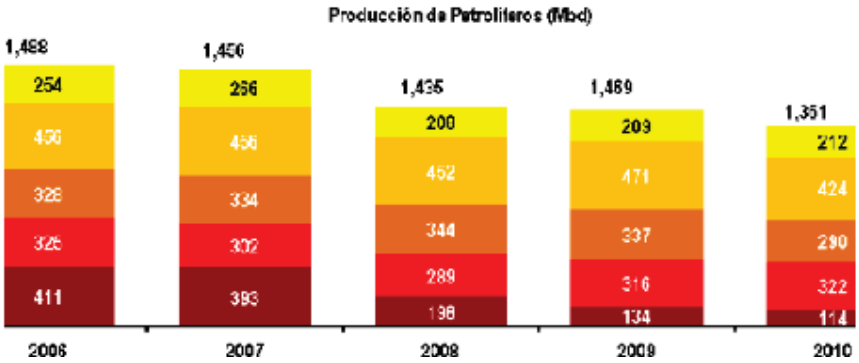
Source: PEMEX figures in 2011 consulted in:
http://www.pemex.com/index.cfm?action=content&sectionid=1&catid=11421

It is noteworthy that in recent years, PEMEX has achieved the best financial results in its history, as its gross profit (income before interest, taxes and use) increased to slightly more than 57 billion U.S. dollars in 2006. Nevertheless, PEMEX'S total liability has increased, reaching 1.165 billion pesos in 2006 as profits are channeled to public spending in other sectors of the economy. Thus, PEMEX increasing liabilities, its high tax burden and the accumulated net losses have deteriorated the assets of the company. So, for the first time in the history of PEMEX assets turned negative. (WTO, 2008: 117)[161].

[160] But we found that this information differs from that published in the section "International Comparisons" from PEMEX statistical document, which reports that Mexico is ranked number six in the production of hydrocarbons over other nations, after Russia Saudi Arabia, United States, Iran and China.

[161] Figures in current pesos.Accessed at:
http:/www.pemex.com.mxindex.cfm?action=content&sectionID=2&catid=159&contentID=166).

Figure 24.3 Oil production in Mexico (Millions of barrels per day)



PIW 2009 Rankings, December 2010. Petroleum Intelligence Weekly. Source: PEMEX in 2011 figures found at: http://www.pemex.com/index.cfm?action=content&sectionid=1&catid=11421

In data from the last trade policy review of the WTO said the energy sector increased its contribution to exports, which so far remains crucial to public finances. Unfortunately, a heavy tax burden and consumer subsidies have resulted in both the oil company, PEMEX, and the electricity sector companies face growing problems to finance the investments required. It is therefore essential to carry out structural reforms both in the hydrocarbons sector and the electric sector to ensure the financial viability and increase the efficiency of operators, as well as to improve the utilization of energy resources in Mexico.

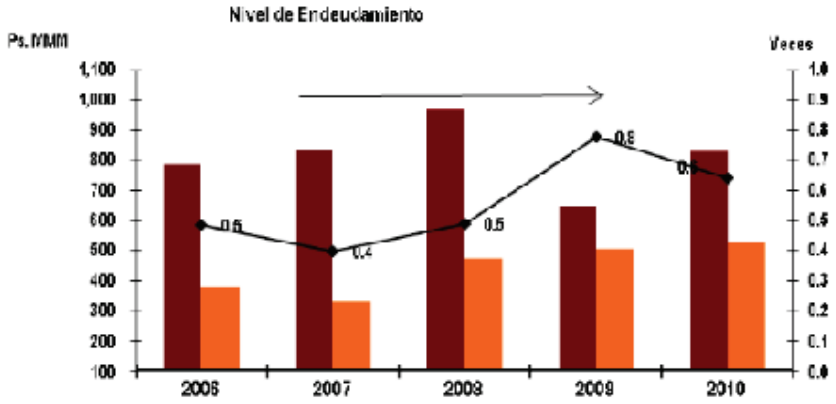
The Mexican energy sector has contributed with approximately 2.6 percent of GDP in México and 15.5 percent of the value of total goods exports in 2006[162]. Between 2001 and 2006 primary energy production increased at an annual rate of 1.7 percent, of which hidrocarbons represented a 90 percent, primary electricity 5 percent, biomass 3 percent and coal 2 percent[163]. The total investment in the energy sector grew at an average annual rate of 12 percent in 2001, and in 2006 reached a value of 192 billion pesos. The Government suggests that annual investments of about 264 billion pesos during 2007-2012 ought to be required to maintain the confidence of energy supply which corresponds to an increase of 38 percent compared to 2006[164] (WTO, *2008).*

[162] The data for the energy sector including oil and its derivatives, basic petrochemicals, gas distribution and electricity. Federal Executive (2007) Viewed at: http://www.informe.gob.mx/ESTADISTICAS_NACIONALES/ . In WTO, Trade Policy By Sectors, Mexico. Power supply, which equates to a 38 percent increase compared to 2006.

[163] For more information see the Energy Information System of the Department of Energy. Viewed at: http://sie.energia.gob.mx/. In WTO, Ibid, p. 115.

[164] For more information, see the National Program of Infrastructure 2007-2012 in: www.infraestructura.gob.mx. In WTO Trade Policies by Sectors, Mexico, p. 116.

Figure 24.4 PEMEX indebtedness level



(*) The total consolidated debt is documented debt of Petróleos Mexicanos.
(**) Total Debt - Cash and cash equivalents. Source: PEMEX in 2011 figures found at:
http://www.pemex.com/index.cfm?action=content&sectionid=1&catid=11421

24.2 Zenith and decline of oil production in Mexico

The public policy established in Mexico for the energy sector was shown in the 2007- 2011 Development Plan which explains the current state of the hydrocarbon sector and it is stated that one of the key challenges is to stop and reverse the unfavorable trend of hydrocarbon reserves.

At the rate of current production and consumption, proven reserves of crude oil will be exhausted in 9.3 years and natural gas in 9.7 years. The Cantarell field[165], is the most productive with a contribution of more than 50% of domestic production of crude oil, but this well has begun its decline stage for a couple of years. With respect to natural gas production, even though the trend shows a growth in recent years, this increase has not helped to reduce imports of energy.

In spite of the privileged place of Mexico as a producer in the last three years, PEMEX has registered a decline of 14 percent in its production, mainly due to the decline of Cantarell field. Oil production in this mega site fell 47 percent in the last three years, from 1 million 787 thousand barrels per day to 940 thousand 493 in 2008. This situation has led the decline of Mexico's total production, although this decrease was not so severe due to the input of the second largest deposit of PEMEX, the well known Ku Maloob Zaap well. Despite this, total production decreased from 3.2 to 2.6 million barrels per day, which means a decline of about 19 percent during 2006 and 2008 according to statistics from the Energy Information System of the Secretary of Energy. The 2008 Statistical Yearbook shows that PEMEX has had to intensify the search for oil wells drilling over time, but the success rate to become producers has been declining. In regard to natural gas, the international context shows that in terms of proven reserves of energy, Mexico is located at No. 35 (Development Plan 2007-2011).

[165] The Cantarell Complex is a reservoir of oil, is located in Campeche, Mexico .It is considered one of the most important worldwide, ranking second, only surpassed by the Ghawar complex in Saudi Arabia.

Mexico has a high dependence on the exploitation and sale of hydrocarbons as a source of funding, for two decades, oil revenues have accounted, on average, one third of public sector resources (Moreno, 2006). Furthermore, because the public sector revenues depend on the highly volatile international oil market, it is difficult to accurately estimate future revenues and government spending plan.

The profits from the sale of hydrocarbons has sustained the Mexican economy, so PEMEX has faced a major problem, the tax regime that was subject this state company, Petroleos Mexicanos (PEMEX), allowed to retain only 30 percent of the profits from the sale of oil. Because of this, PEMEX´s fiscal regime was reformed in 2005 and entered into vigor in 2006.The main objective of the reform was to release resources for PEMEX could reinvest their gains from the sale of hydrocarbons. Thus, under the new regime, PEMEX has a lower tax burden and will pay lower rights to the federal government. Due to PEMEX resources were not sufficient to cover operating expenses of the company and to reinvest in its modernization, It has led the company to acquire debt, so PEMEX's liabilities have become over a trillion pesos which has placed it in an unsustainable financial situation (Moreno, 2006).

In addition to the seriousness of this situation, PEMEX does not have the technology to develop ultra-deepwater resources and also faces restrictions on the exploitation of fields in frontier deposits. Therefore, it should take steps to reverse this problem and avoid facing further deterioration in its finances as well as a decrease in the hydrocarbon sector's contribution to public finances. On the one hand, another problem to solve is the refining capacity in Mexico and that has remained fairly constant over the past 15 years. Gasoline imports have grown significantly and in 2006 almost four of every ten liters consumed in the country were supplied from outside. On the other hand, there is a disintegrated industry in petrochemical with high production costs and low competitiveness, resulting in insufficient amounts of investment and increasing imports.

Four factors have contributed to declining reserves and production levels of Mexican crude, in first place, the decline of Mexico's main reservoir, in second place, the financial failures, thirdly low technological investment that PEMEX has had to develop most of its prospective resources found in ultra-deepwater and in fourth place, the constraints of the current regulatory framework regarding the incorporation of new sources of investment. Another aspect is that although Mexico currently has six refineries, divided into basic petrochemical and secondary petrochemical, they have failed to fulfill their potential. For this reason, the National Development Plan 2007-2012 and the National Infrastructure Program promote strategic alliances with the private sector, domestic and foreign, in order to attract additional investment and promote investments in the secondary petrochemical industry (open to private investment) and reactivate the operation of petrochemical facilities owned by PEMEX, (*National Development Plan, 2007-2012,* p.125-135).

24.3 Characteristics of the energy industry and strategies for Mexico

The specific characteristics of the Mexican energy sector are listed as follows:

1. The hydrocarbons in Mexico are the main source of energy produced in the country: in 2006 represented 89 percent of the energy produced and 85 percent in 2009.

2. The largest consumer of energy is the transport, particularly gasoline.

3. The energy sector in Mexico is characterized by high level of exports of primary energy sources, without processing or transformation, such as oil, and high import of secondary energy sources, already processed and value-added, such as gasoline.

4. The country's energy sector has a strong decline in proven reserves of crude oil, which show no improvement in technology or mayor levels of production, is expected they last just under 10 years.

5. In Mexico, the main challenge is to bring electricity to all homes in the country. Even though there has been progress in recent years, in 2005, there was more than 2.5 million people living in homes without electricity (Foundation this country, 2008).

The energy produced by the Mexican energy industry comes mainly from primary energy sources and lesser extent from secondary energy sources: In 2006 primary energy production was 10.619 petajoules (PJ) and secondary energy was 5236.9 PJ. From 2000 to 2006, primary energy production increased 9.4%, going from 9,702.9 to 10.619 PJ. The hydrocarbons were the main source of primary energy in Mexico: in 2006, hidrocarbons generated 89.9% of the energy produced in the country. After oil, gas is in the second place; hydropower in third and wood is in fourth place in importance of the primary energy: it accounted for 2.3% of the total in 2006. Moreover, the major secondary energy sources produced in Mexico were dry gas (25.5% of total), gasoline and naphtha (18.1%), electricity (15.5%), fuel (14.6%) and diesel (12.4%) in 2006.The secondary energy production increased by 6.4% from 2001 to 2006, going from 4,920.7 PJ to 5,236.9 PJ (Foundation this country, 2008).

With all the performance of the sector during 2009 indicates that about 85% of the energy produced was generated by fossil fuels: oil and condensate 44.7%, 40.6% natural gas. If you look at other renewable energy sources like coal and nuclear power, the proportion will increase to just over 90% (Domínguez Reyna, 2008).

The strategic project in Mexico is also on the priority areas for exploration in the deepwaters of the Gulf of Mexico where it is estimated that 58 percent of prospective resources are concentrated and these can be converted into reserves through successful exploration activity, allowing them to increase the likelihood of commercial success. These explorations should be run by drilling at depths ranging from 450 to 2.500 meters, with a statistical estimate is calculated that the success rate would be about 33 percent, from 8 to 10 new fields discovered and between 20 and 24 failures. Oil exploitation in deepwater Gulf of Mexico will cost 2.190 million dollars just by concept of the daily rent of 4 drilling platforms in the next 3 years. It is noteworthy that these resources are 3.19 times higher than those that will be used to increase the energy transition. In response, Greenpeace makes a strong criticism of the Mexican bet for more investment in deep water; it proposes that these resources could be used to promote renewable energy sources (Greenpeace, 2011).

Mexico is eminently an oil country, whose economy is heavily dependent on this energy. This is why the government and institutional logic relies on the search for more oil as first strategy. With the results of the intensive search for new deposits is expected the oil drilling platform will reach 3.3 million barrels by 2025, and the bet is on it. Meanwhile, we note that both the annual report of PEMEX, as their monthly reports show that extraction keeps falling (it is located at 2.5 mbd) and there are great difficulties for stabilization.

In reply, the Mexican government through the National Strategy of Energy 2011 also plans to increase and maintain a level of proven reserves replacement 1P of at least 100%, considering the growth of the production platform. 2009 PEMEX'S report recorded that the reserves replacement 1P reached 77 percent[166] (Greenpeace, 2011).

The National Strategy of Energy states as one of the objectives, the increasing participation of clean technologies in the installed capacity to 35 percent. It draws the attention what large hydro, nuclear and clean coal generation are classified as "clean", which is strongly criticized by Greenpeace. Both the Law on the Use of Renewable Energy and Energy Transition Funding, as the Special Program for the Use of Renewable Energies not define or consider these types of technologies as" clean" sources of energy. Therefore, it is suggested that the National Strategy of Energy must set clear goals for the participation of renewable sources of energy according to the potential that the Secretary of Energy has estimated in the country. In reply, Greenpeace has established the following proposals to amend the National Strategy of Energy in Mexico:

- Nuclear power must be ruled out as an option for electricity generation, due to its high danger, costs and minimal contribution to mitigating global warming.

- Highly risk projects to the global climate must be set aside as carbon capture and clean coal technology. Safe options for power generation must be chosen with high positive impact in reducing Greenhouse gas emissions.

- Ambitious goals for the participation of renewable sources of energy should be set, according to the potential of the Ministry of Energy. This goal should be of the order of 41 percent by 2020 and 75 percent by 2050, excluding hydro. This is not only technically possible but economically viable.

- The National Strategy of Energy should give legal support to the objectives of reducing greenhouse gases internationally subscribed: It must rethink an approach oriented towards mitigation of climate change, starting with energy efficiency measures to moderate the unbridled growth of energy demand in the coming years (Greenpeace, 2011).

The National Strategy of Energy in Mexico defines nuclear power as a clean alternative, safe, reliable and economically competitive to solve challenges of diversification, security of supply and environmental protection, for its zero emissions to the atmosphere of greenhouse gases and reliability. In reply, Greenpeace (2011) prepared a document with recommendations for Mexico, which reiterates that nuclear energy is not considered clean or safe after the nuclear accident in Japan, and insists that Mexico's energy strategy should be aimed at ensuring energy security and environmental sustainability of the country until 2025, which would be highly desirable. Among the data that this document points out: According to the PEW Environmental Group. Mexico is one of the countries of the Group of 20 (G20) that invests less in renewable energy.

[166] For more information consult BENITO Osorio, Sergio. National Strategy of Energy 2011.Available at: http://energiaadebate.com/estrategia-nacional-de-energia-2011/ in Greenpeace, 2011)

Regarding the Mexican Interconnected System in 2010 had a reserve margin of 42.4 percent[167] and the National Strategy of Energy specified as one of its goals the reduction of it to a level of 22 percent[168], so it is questioned the investment in more infrastructure for power generation based on nuclear energy, with the drawback that is dangerous and costly, above all, having a reserve margin so high, nuclear power would be little justification for Mexico. In addition, in Mexico has not been public debate around the different energy options with which the country can count as strategies in the middle and long term. And to keep the same policy raised in the National Strategy of Energy, based on fossil fuels and nuclear energy, Mexico would have increasing responsibility with global warming on the one hand, and on the other, increase risks of nuclear accidents. Also could not meet the commitments it supported under the Kyoto Protocol (Greenpeace, 2011).

At present the participation of nuclear power in mitigating emissions of greenhouse gases is not globally significant. Nuclear energy contributes less than 6 percent of the total energy consumed in the world. According to the International Energy Agency, even quadrupling the existing nuclear capacity by 2050, its participation in the global energy consumption would still be below 10 percent. In terms of reducing carbon dioxide emissions, the contribution would be just under 4 percent[169], and require the construction of a new nuclear reactor every 10 days from now until the year 2050, which would be extremely costly since it would require an investment that would exceed 10 billion dollars, considering the current prices[170].These data indicate that nuclear energy is not the optimal outcome to develop an energy project for any country within medium or long term because it is expensive and high risk.Another wrong solution could be coal mining; the National Strategy of Energy suggests the use of this fuel as an option for diversifying the energy matrix because of its vast reserves worldwide. So, it intends to focus on developing better technology for washing coal, which permits separation and sediment the impurities, desulfurization systems, special burners restricting the oxygen and controlling the combustion process to prevent the formation of sulfur dioxide and nitrogen oxide.

This type of technology is far from being a true alternative of clean electricity generation since coal is the fuel that more emissions of greenhouse gases provide from combustion processes and only represent a distraction from the real solutions to climate change, far from making a real commitment to energy diversification, renewable energy sources which are considered cleaner and safer options of energy.

It should be noted that the National Strategy of Energy can become one of the main legal instruments to detonate the renewable energy market, promote economic growth, generate green jobs, guarantee energy security and effectively trace the route to the mitigation of global warming, however, the exponential growth in renewable energy investment over the past six years (over 600% compared to 2004) can be explained by a simple fact: where policies to support renewable energy are adopted, investments come alone.

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[167] More information is available in the National Strategy of Energy 2011-2025, p. 25 in Greenpeace, 2011.

[168] IEA figures obtained on p. 82 of Greenpeace document, 2011.

[169] Available at Energy Technology Perspectives 2010, IEA / OECD, June 2010 in Greenpeace, 2011.

[170] Figures based on estimates from Moody's on nuclear energy, $ 7.500 per kilowatt of installed capacity in Greenpeace, 2011.

Development opportunities and businesses triggered by this energy revolution are immense but so are the challenges the energy sector faces to turn them into reality and to ensure sustainability.

The current trends of the energy matrix diversification allow us to anticipate that the markets will be radically different to the end of this century, when just beginning the great transformation of this sector. The problems or challenges faced by each country of the region in its energy sector depends mainly on their particular conditions, however they have many common features that allow grouping around five main themes:

The consolidation of regulatory and structural reforms undertaken during the first half of this decade;

The extension of modern energy options in accessible terms to all inhabitants;

The development of production patterns, efficient energy use and compatible with the environment;

The attraction of foreign and domestic capital needed to finance the sector and

The integration of energy markets in the region as a key element in their processes of economic integration (Vives and Millan, 1999)

It should be noted that both the population growth as the economic development of the country generate greater energy demand, so it is estimated that the region will continue to increase their energy demand. During the last decade, the demand for oil grew at an average annual rate of 3.5% as a result of car use, and is considered to be further accelerated by urbanization and rising living standards of the population. Demand for electricity also continues to grow in the order of 6% annual average, but begins to slow due to an eventual saturation of markets and increased efficiency in end use. It is estimated to need between 80 and 85 GW of new installed capacity by 2009. Faced with this energy challenge, both the form and the sources to obtain energy must be balanced with the environment and able to safely meet the needs of the country (Vives and Millan, 1999).

The medium-term trends for the energy industry are:

Exploratory activity will increase both for oil and natural gas. This will require investments in the entire production chain: exploration, transportation and distribution.

Major changes in the energy matrix will begin to occur from the first decade of the century.

Clean energy and efficiency in end use will constitute real energy options

Environmental concerns and the impacts of emissions of greenhouse gases as well as high oil prices will continue promoting the development of clean energy technologies (Vives and Millan, 1999).

The development of the Mexican energy sector faces significant challenges that if the appropriate measures are not taken could risk its sustainability both economic as financial, environmental, social and political.

While it is true that the specific way to face these challenges and policy measures to be implemented to carry out long term goals for the energy sector will be vital for the country. There is no doubt that the diversifications of the energy matrix, the consolidation of regulatory and structural reforms, undertaken over the last decade, are a prerequisite for its sustainability.

One of the biggest challenges, arising for Mexico, is to make the reform process and that this does not become a threat to the environment, but on the contrary, this can be an opportunity to achieve environmentally sustainable development. This environmental sustainability depends on the point to achieve patterns of production patterns and cost-efficient energy use, but compatible with the environment.

In addition to the forms of production and use of energy, the transport sector, including urban transport, is the main cause of environmental effects worldwide and Mexico is no exception, in large cities the concentration of air pollution has become high risk for the population and has had substantial economic costs. Hence, in Mexico the policies that intend to combat urban pollution and climate change must focus on improving fuel used in the transport sector with multisectoral impact. To this challenge, the Mexican government on the one hand is trying to make structural changes in the energy industry and on the other is trying to diversify the energy matrix through renewable energy.

The new millennium has been characterized by generating major structural changes in energy industry worldwide. These changes are generating profound changes in industry structure, in the markets, the actors and their behavior as a result of new economic paradigm. These modifications are essential mainly in diversifying the composition of the energy matrix, consumer habits driven by technological change, the need to face the challenge of declining oil production and the challenge to the commitments for the environment (Vives and Millan, 1999).

In Mexico there is much to do about renewable energy. Some insights indicate that renewable energy could amount to 22% within the global energy matrix by 2030. Comparing the integration of the energy matrices of Mexico with that of some South American countries there is significant disparity in the share of alternative energy sources among countries. In Brazil, 47.6 percent of the total energy supply is renewable, while in Argentina is 9 percent, 4 percent in Venezuela and Mexico's participation in green energy only represents 8.2 percent, and observing the current development of clean energy production in Mexico, an insignificant growth in the short term is expected (Dominguez, 2011).

Thinking of the great challenges that Mexico has, on one hand the commitment made in the Kyoto Protocol, on the other hand, the necessary diversification of the Mexican energy with a decrease in the production of hydrocarbons, and with a view that the production of these last only 9.6 years, Mexico must continue the process of promoting the production of energy through renewable sources. Two factors are of vital importance in this process: first, the development of an efficient regulatory framework that allows a healthy performance of the green energy market and second, to promote adequately the development of technologies that generate the greatest economic and social benefit for the country (Dominguez, 2011).

24.4 Conclusions

Globally, the trends of diversification of the energy matrix are changing the sector markets and is estimated that these will be radically different by the end of this century. The problems or challenges faced by each country in its energy sector depend greatly on their particular conditions and the consolidation of regulatory and structural reforms undertaken during the first half of this decade.

The energy industry in Mexico is a key factor that affects strategically on the economic, productive and social development and therefore it is transcendental to the Mexican economy have successful goals about the future in the medium and long term.

It is vital to strike a balance between security of energy supply, environmental impact and prices. It is the key to future energy policy that is linked to other objectives such as the strength of domestic firms and consistency with other policies.

Mexico faces great challenges in the field of energy, with a decrease in oil production, and with a view that finds that the production of these lasts only 9.6 years. Hence, it is necessary to promote PEMEX strategically through new investment, on the one hand, exploitation of new oil wells and on the other hand, diversification of the Mexican energy matrix and promotion of energy production through renewable sources, all this through the development of an efficient regulatory framework and promoting the development of technologies that generate greater economic and social benefit for the country.

The National Strategy of Energy can become one of the main legal instruments to trigger both oil exploitation in deep waters and renewable energy market to promote economic growth, diversify the energy matrix, generate green jobs, ensure energy security and fulfill the commitments entered Mexico under the Kyoto Protocol.

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