

## Opportunities of Renewable Energies in the Mexican Legal Framework Strategy for Energy Transition in Response to International Environmental Agreements

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### Abstract

Electricity is one of the world's most primary resources. Its cost and availability, have a bearing on a person's quality of life. Mexico's ability to satisfy the public demand for energy from renewable sources has been between 8.5% and 10.9%. As one of the undersigned countries in multilateral environmental agreements, Mexico has created laws and development initiatives in name of sustainability. In this article we will analyze data on the current energy panorama in Mexico, taken from accredited national and international sources. This will allow us to have a holistic view of the current state implementation of technology which makes good use of renewable energy. In this way, we will be able to detect investment and development opportunities in Mexico.

*Key words: Sustainable energy, energy reform, multilateral agreements, energy transition, plans for development, investment opportunities.*

### 1. The energy sector in Mexico

Mexico has at its disposal a vast quantity of hydrocarbons, which means that throughout history Mexico's energy sector has come principally from fossil fuels-crude oil and natural gas. These sources provide nearly 90% of Mexico's total energy production nationally (PROSENER, 2013).

The main task of the energy sector is to provide an energy service that will be efficient at a competitive price for the entire population. This will help the country socially and economically. In case more energy is produced than is consumed, this surplus will fall due to the decline in the production of oil and natural gas, versus the grown in consumption of energy resources nationally - around 2.7% over the last decade (PNI, 2014).

To date, more than 20% of energy generated for the public comes from fuel oil and diesel (PNASE, 2014). This is considerably more expensive than clean energy sources and natural gas. Mexico has great potential for producing gasoline, diesel, turbosine, natural gas, among many others, but this is not well financed and, as such, the necessary processes of transformation and extraction are stifled. PEMEX is a good example of the inability to produce natural gas due to the great demand. Because of this, Mexico imports natural gas; paying more than it would if it produced its own natural gas.

The energy sector in Mexico faces great challenges. The cost of electricity is high and not competitive. Compared to the US, the cost of electricity is 25% higher in Mexico, even with a government subsidy. Without which, the cost would be 73% more expensive (PNASE, 2014). This hinders the Mexican economy given that electricity is a basic need for industry, business and other services.

The slow pace of switching from fossil fuel energy centers to clean energy centers is mainly due to the monopoly which the Federal Electricity Commission has over public energy sector. Although individuals are now permitted to participate in the industry, the Federal Electricity Commission still controls all large scale energy projects which are limited by state budgets. This has become a bottle neck that impedes the speedy development of potential sources that could generate low cost electricity.<sup>1</sup>

The statistics for renewable energy usage in Mexico was 8.9% (around 440PJ) in 2013, as shown in figure 1. Almost 60% of which was due to traditional biomass generation.

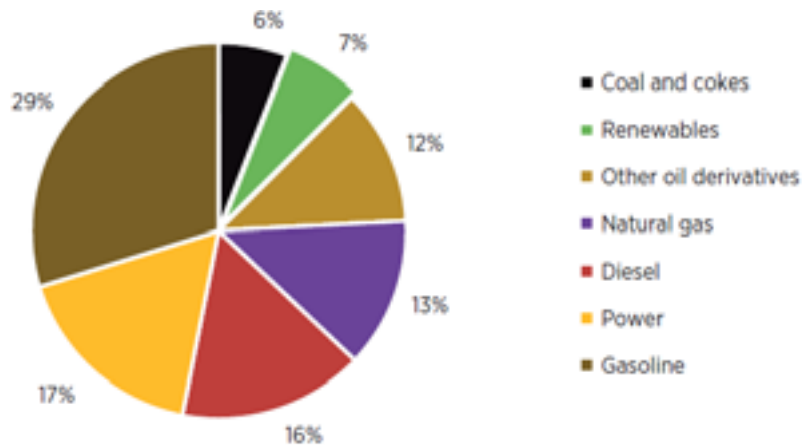


Figure 1: Total end energy consumption in Mexico, 2013 (Renewable Energy Prospects: Mexico, 2015)

## 2. Multilateral agreements on environmental matters

Globally, energy systems are among the biggest sources of emissions which severely compromise public health and cause global climate change.

With the aim of promoting international teamwork and implementing clean energy solutions in terms of the supply, delivery and energy demand which benefits people locally and globally, every country should implement national strategies that try to adopt production and consumption methods that protect the Earth's ability to regenerate. Countries need to be moderate and efficient in terms of energy use and try to depend more and more on renewable energy sources such as solar energy and wind energy.

According to the United Nations Framework Convention on Climate Change (UNFCCC) we must, as a country, take control of the emission of greenhouse gases into the atmosphere in order to avoid dangerous anthropogenic interference in the climate. For this, economic development must be sustainable.

The Cancun Agreements gave a boost to international negotiations which gave the developing world the necessary technological tools, finance, adaptation and mitigation that form the basis of a greater collective effort to reduce emissions which will bear fruits for all those involved. We need officially registered projects nationally and internationally as part of the UNFCCC.

Mexico has signed bilateral agreements with Canada, US, Germany, Norway, Korea, among others in which they agree on technical cooperation and research into clean energy sources (energy efficiency, capture and storage of carbon, electrical connections, intelligent networks) and into hydrocarbons (transport and chemical treatment of heavy crude oils, unconventional gas); furthermore, we seek an interchange of experiences on the best regulatory practices and methods for designing public policy. The same is true of projects and initiatives which are created to promote the use of renewable energy, innovative technology and energy efficiency as a means of combating climate change.

### 2.1 Business and the Environment

Essential negotiations concerning business and the environment are being treating in all levels, including: multilateral, regional, bilateral and national. This has presented a challenge for the undersigned countries, given that taking on these commitments if which you do not fulfill, will incur fines because it is not easy to implement a manner of organizing the environment that guarantees the effective fulfillment of environmental legislation and the adequate use of natural resources.

The main multilateral environmental agreements have been signed by most countries; international development banks and agencies Inter-American Development Bank, The World Bank, International Monetary Fund, to mention a few who contribute to the subject of the environment as part of their terms and conditions by donating resources or by giving credit away. The private sector has incorporated the question of the environment in their production processes and has even imposed restrictions on business. Proactive work on the environment is increasingly common in civil organizations working alongside the government; above all in

developing countries which have had to accept the environment as an important factor in regional and bilateral agreements when such agreements are reached with countries such as Canada or the US or with the European Union. In these cases the environment is included as a legal requirement (Murillo C., 2008)

### *2.2 North American Free Trade Agreement (NAFTA)*

The North American Free Trade Agreement is an important first step in terms of the environment as a concern for business. In this agreement environmental legislation is a priority. There is a commitment to making sure that countries respect and improve their own environmental legislation.

Despite the fact that the introduction of some topics about environment in negotiations was initially seen as an imposition, the agreement between Mexico, the US and Canada has been an important step in the development of the environmental subject in Mexico.

A notable contribution came from the promotion of public participation by means of an improved access to information, financing of public projects, public hearings for academic bodies, establishing mechanisms allowing people to report failures to follow national environmental law.

The influence of NAFTA in the institutional nature of the environment in Mexico has been unquestionable. Mexico has improved its public policies and the institutional nature of the environment and although not all changes were made to be adapted to NAFTA. To a great extent the requirements of this agreement are to enhance the process of change.

### *2.3 Perspectives on Renewable Energy in Mexico: REmap 2030*

In 2011, SE4ALL was launched with three related objectives that need to be reached before 2030: assure universal access to energy and modern energy services, double energy efficiency and multiply the universal budget for renewable energy resources. In this context, IRENA has developed a world route for renewable energy (Remap 2030), in which Mexico has decided participate and has declared its objectives for energetic reform before 2030 in which the increase of renewable energy would put Mexico on the right track for reducing greenhouse gases significantly given that it has the potential to reduce the carbon demand in Mexico by 62%, natural gas by 21% and oil by 6% by 2030 (PNASE, 2014).

Among the challenges that Mexico faces we find the raising of consciousness, improving information about renewable energies for politicians, manufacturers, project developers and installers and users. In this way, we will be able to show an idea of how high level renewable energy generation can be incorporated into the transmission system.

According to predictions made by SENER and the Asia-Pacific Economic Cooperation, Mexico has the potential to generate 280 TW hourly of energy from renewable sources in 2030. This represents a six-fold increase on the current level of 48 TW hourly, that could be achieved with a diverse mixture of wind, solar, hydraulic, geothermic and biomass energy.

Wind and solar voltaic energy combined would represent almost 60% of renewable energy generation in Mexico and 26% of the total generation in 2030 (PNASE, 2014). Photovoltaic solar energy could contribute 30 GW in energy generation. This would be 66 TW hourly annually by 2030.

## **3. Reforms in Mexican legislation**

In the energy sector we can identify the need to reach higher levels of production of primary energy, improve transport services, energy storage and distribution; make sure the supply is reliable; improve the efficiency and quality of the product and reduce the cost of electrical and its negative impact. The objective of this is to allow the country to make the most of its energy resources to a greater extent in order to benefit the population.

Until recently, the Mexican constitution hindered the participation of private companies in the production and extraction of energy sources from fossil fuels. This works against the development and adequate distribution of energy. Thanks to energy reforms and the secondary laws that were approved between 2013 and 2014 which allowed private companies to gain contracts the monopoly over the oil industry nationally broke, allowing PEMEX to strengthen its strategic role in the oil industry. It also acted to help competition and the implementation of a national strategy for sustainable industrial development. It also included sustainability as one of the important constitutional criteria to which private and public companies will have to adhere.

Likewise, energy reform takes into account the fact that the energy sector should act in a fashion that promotes

justice, equality, development, democracy and economic growth. In the same sense, the supply of energy should reach all the population. This will boost their potential for development in many senses. With this, we bolster the commitment to improve energy access to communities where it is not currently available. In 2011 around 20% of the population of the world didn't have access to electricity. Of this 20%, 85% were in rural areas. Also, one thousand million more only have intermittent access to electricity; their access is frequently cut (PSE, 2012).

As well as guaranteeing a good quality energy supply at competitive prices. Recent energy reforms have also sought to promote the participation of private generators and, in this way, benefit projects which allow the best use of renewable energy resources. By applying Energy Reforms we hope to gain private investment for energy generation projects and we hope that this private investment can reach 15% of the total investment in the year 2018.

While trying to promote investment into renewable energies, Mexico has worked to create and modify laws that incentivize their use and reduce the dependence on fossil fuels. In the National Plan for Energy we find an objective of 35% of electrical energy being generated with clean technology by the year 2024. The Law for Harnessing Renewable Energies and Financing the Energy Transition sets out the plans and objectives in the current availability and generation of electricity in the country. They follow the objectives set out in the National Development Plan.

Our goal as a country is to try to avoid the use of crude oil in the future. This comes from so-called unconventional resources such as shale gas and deep water. This severely damages the environment during extraction as well as increasing our dependence on fossil fuels for energy production.

### *3.1 General Laws on Climate Change*

The objective of this law is to promote efficient energy practices and the development of low carbon technologies. According to the national objectives for emissions reduction for the year 2020, we must create a system of subsidies that promotes the main advantages of the use of non-fossil fuels, energy efficiency and sustainable public transport. We must also build up a system of incentives that promotes and permits profitable energy generation through means of renewable energies; such as wind, solar and hydraulic energy managed by the Federal Commission for Electricity. The Energy Secretary working with the Federal Commission for Electricity and the Regulatory Body for Energy will promote electrical generation from clean energy sources for at least 35% by the year 2024 (LGCC, 2012).

### *3.2 Energy Reform*

Mexico has made substantial changes to the energy sector in an effort to increase productivity in the country. One of the main goals is to increase the level of investment and jobs available. Also, PEMEX and the Federal Commission for Electricity need to be given greater liberties to modernize. In terms of oil and gas, the reform aims to have a greater production at a lower cost. It also aims to improve competency in refining, transport and storage by involving private companies who adhere to state rules as well as the development of clean technologies.

With Energy Reform, articles 25, 27 and 28 of the constitution were all amended which opened the extraction and exploitation of hydrocarbons to private companies nationally and from abroad. This allows the state to make private service contracts which modernizes and strengthens PEMEX and the Federal Commission for Electricity without privatizing them. They remain completely Mexican companies.

Allowing the country to take full control over the planning and control of the national electricity system works to benefit a competitive system which lowers prices, provides more energy at better prices, guarantees international standards of efficiency, transparency and economic gain which will bring investment to the Mexican energy industry which will, in turn, help the country to develop. These are all other goals we hope to achieve.

In August of 2014 secondary laws on energy reform were passed. The most important of which are new laws such as: the Law on Profits Made from Hydrocarbons, the Law on Mexican Oil Reserves for Stability and Development, the Law on the Electricity Industry, the Law on Geothermal Energy, the Law on Regulatory Bodies for Energy, the National Agency's Law for Industry Safety and Environmental Protection in the Oil Sector, the Hydrocarbons Law, the Law on Mexican Oil, the Federal Commission for Electricity's Law. Other laws which were reformed include: the National Water Laws, the Law on Foreign Investment, the Mining Law,

the Law of Public and Private Associations; the Law of State Entities, Acquisition Laws, the Law of Public Sector Services, the Law of Public Building and Related Services.

### **3.3 Challenges for Energy Reform**

In the electricity industry, clean energy generation is not always the easiest option for the development of new projects. Resources with great potential are in rural parts and to transmit this energy and interconnect the two sites, large-scale developments are required. Furthermore, clean technologies present risks and challenges in terms of use and development.

The state must guarantee the constitutional right to a healthy environment. To achieve this, we must take measures to prevent the deterioration of the environment. We must also sanction those who harm the environment and they should pay for the damage caused. This should be strictly controlled and should allow the best use be made of the available resources. This is an important step on the road to sustainability.

We must take into account that according to the Law for Harnessing Renewable Energies and the Financing of Energy Reform, energy generation from fossil fuels shouldn't exceed 65% of the total. This is a challenging target for the energy sector. This will involve new technologies for generating electricity that use renewable energy resources, such as nuclear and co-generational energy. In this way, we will be able to face up to the challenges of diversification and safety in the energy sector (PNASE, 2014).

In recent years many projects and programs have been developed with the aim of guaranteeing Mexicans' rights to basic electricity services, this idea is supported by the PND. They also want to increase electricity coverage to a greater extent. At the end of 2012, 98.11% of the population had access to electricity. This means that Mexico, on a global scale, is one of the countries with best electricity coverage. However, there are still more than 2.3 million Mexicans who do not have access to this basic service. This is around 42,945 houses (PROSENER, 2013).

## **4. National plan for energy reform**

The national plan tries to regulate the harnessing of renewable energy resources and clean technologies for generating electricity not destined to the public. It also seeks to create a decent strategy with enough support and financing to help Mexico move along the road to energy reform. This includes the use of sustainable, low-carbon systems that help to combat the effects of climate change.

Through political incentives, programs, actions and projects that seek to increase the use of renewable energy resources and clean technology and as a response to the growing demand on energy resources and to the need to have a reliable energy system, energy efficiency is highly important.

The transition to a sustainable energy system requires diversification in the energy field, a boost in the use of clean technologies and an efficient harnessing of energy resources that we have at our disposal.

Diversifying energy sources prioritizes the extended use of non-fossil technologies, bio-energies or energy produced by sustainable technologies represent a viable alternative in the process of energy diversification and sustainable development given that they substitute fossil fuels and they also contribute to reducing greenhouse gases into the atmosphere.

Within this framework and with the backing of the Law for the Promotion and Development of Bio-energy and its Control, Mexico has set itself the target of creating a policy to support bioenergy.

We need to increase efficiency in the levels of energy consumption in all sectors to reduce energy losses in the production chain which will lead to a reduction in the environmental impact. A reduction in the use of energy while providing the same level of service contributes to a more rational level of energy consumption.

To reduce the environmental impact caused by the production and consumption for which the energy sector is responsible, we need to create a series of actions focused on prevention, contention, remediation and compensation for the effects it causes. Linking these objectives within the energy and environmental sector is extremely necessary to reduce the environmental impact. Creating projects with similar goals in terms of energy reform and the harnessing of sustainable energy are key factors.

Strengthening and modernizing the infrastructure in the energy sector as well as maintaining the reliability and integrity of the system involves efficiency, safety, sustainability, availability and reliability of the energy transmission and distribution lines. Projects focused on an economic infrastructure for electricity aim to create a

reliable and modern transmission network which allows for a better use to be made of Mexico's capacity for energy generation.

## 5. The potential to generate electricity from renewable resources

During 2013 SENER created the National Inventory of Renewable Energy in which, a geographic system provides information about the electricity generation inventory for public supply, where is possible to see the potential of renewable resources that can be used. In table 1, it is shown an example of the use of these data, in which renewable resources are classified as approved, probable and possible depending in its potential for generating electricity.

Tab 1: Potential for Generating Electricity with Renewable Resources (GWh). Source: PEAER, 2014

Resource	Geothermic	Mini-Hydraulic	Wind	Solar	Biomass
Possible	78799	N/A	87600	6500000	11485
Probable	60286	23028		N/A	391
Approved	892	2378	10513	843	592

### 5.1 Main projects for investment into renewable energies announce in the PNI 2014-2018

In an attempt to satisfy the increasing demand on the electricity system, we will need to develop a greater potential for generating electricity in accordance with predictions for electricity consumption nationally. In this sense, by using Energy Reform we will be able to complement the Federal Commission for Electricity's investment with the participation of individuals in electricity generation. Private investors will have the potential to generate electricity; with the exception of nuclear energy and form long term contracts with qualified experts in the area.

### 5.2 Wind farms in the South-East II, III, IV and V.

As a whole, they generate 1169 MW in the South-South-West region. For this project we expect an investment of around 25955 million pesos.

### 5.3 Small Scale Photovoltaic Solar Panel

This refers to a group of 14 plants each one with a capacity of 30MW to be developed in the north of the country. The total investment of each plant is around 884 million pesos. Together, they will generate 420MW and will require a total investment of 12378 million pesos.

### 5.4 Mexicali

In Mexicali there is a geothermic plant which produces 27MW. The project is designed to be built in Baja California. The total estimated cost is 267 million dollars.

## 6. Tenders for potential areas for development

Round Zero is an Energy Reform proposal that tries to directly assign resources for the exploitation of petroleum which guarantees a certain level of investment into PEMEX without the need to tender. This is the way it will work for private companies in later rounds.

Round one has two stages, each one with its respective tender. The first one took place on July 15 2015 where 14 areas of potential in deep waters. The second of these is planned for September 30th in which 9 plants, grouped into 5 contracts will need to be assigned. It is worth mentioning that this work will be coordinated by the National Commission for Hydrocarbons.

In round one, the committee will be made up of the following companies: Sierra Oil & Gas (Mexico), Talos Energy (USA) and Premier Oil (England). From this there were two blocks tendered on and the remaining twelve were considered deserted.

## 7. Conclusion

Mexico still does not have a clear idea what the implementation of renewable energy implies for the complete supply of energy. However, most laws and initiatives that have been created in the context of sustainable

energy and the substitution of fossil fuels are now considered important and almost obligatory. Possible future projects should include energy reform as something standard and obligatory to be considered.

Despite the fact that the transition to clean energy has been imperious for some years now, if it hadn't been for the international agreements in which Mexico forms part, especially the TLCAN which it signed just a year ago. Without this, Mexico would not have taken an important step on the road to energy reform. The insufficient energy supply at the Canterell Complex, among others, shows that despite having fossil fuels, we cannot continue to depend on them. This is equally true because of its cost of extraction economically as well as for the environment. We also need complex technology for their extraction.

Thanks to Mexico's fortunate location and diversity, it has enough potential to make use of different types of renewable energy. This potential is reflected in projects such as wind farms in Oaxaca and proposed projects for the Special Program for Making the Best Use of Renewable Energy. It is worth mentioning that we currently there are many available ways of gaining economic support for investors and researchers in the field of sustainability, energy efficiency and electricity from non-fossil fuels.

Allowing private investment forms part of the process of energy production and distribution opens the door to the inclusion of technological advances; this helps with efficiency and the use of renewable and fossil fuels given that it is not enough to generate energy purely from clean energies; we also need to make better use of the energy that is produced with the technology currently available. Despite the fact that energy reform was approved principally to allow technological cooperation and improve the production and distribution of energy generated from fossil fuels, it is opportune to allow private companies and national and international scientist to be part of the process. From this we will have a fair access to this service.

Mexico, to all intents and purposes is new in the field of energy from sources other than fossil fuels, it has its problems in Mexican law and the consequences of this are being lived today with unfavorable results from tenders from Round Zero and Round One. We see that there is a degree of mistrust on part of foreign and national investors. This may be the reason why expectations were not met.

As a developing country and as one of the undersigned on many international economic and environmental agreements, Mexico has to fulfill certain environmental commitments. Nevertheless, it has been shown that it is still incapable of reaching these agreements alone. There needs to be a greater role played by the population and the state to ensure that new production mechanisms can be implemented. This must also come from researchers by providing adequate conditions and support so that this task can be brought about. Also, in many international agreements on the environment we can see the role that developed countries should play in this process. This includes economic support but, more importantly, a greater level of cooperation working towards a better planet.

The bases for tenders should be changed and we should consider the conditions for their implementation by private companies that work to generate energy from different available resources. We should always keep the importance of national sovereignty in mind given that it is not easy to chain the system of energy supply so radically when the economy of the country is based largely on fossil resources. However, we need to create a decent productive reconversion program in which innovative programs for renewable energy and energy efficiency are supported.

Despite the legal deficiencies we may still be experiencing their possible future reforms, as well as economic instability, we have before us a great opportunity which we did not have previously. The opening of the market to private investors and the restructuring of the energy system which includes extraction and distribution, these tasks previously belonged exclusively to the state and are now allowing the support of third parties to reduce Mexico's technological stagnation.

Recently, it was declared that Mexico should have 35% of its electricity generated from renewable

resources. To reach this goal will require large scale legal reform. This work should be done in a team to achieve a higher percentage production from non-fossil fuels; in this way the Mexican government will be able to achieve its goals. In this regard, it is well known that Mexico has great potential and as such, it is an opportune moment to implement projects that meet current needs determined by programs designed to mitigate environmental damage and that help economically too. Investing in renewable energies is not particularly high risk given their high potential for development. In the same sense, for the proposed objective to be reached, adequate support is required for those who can help the country to reach its goals.

In conclusion, Mexico needs to improve in many areas: legislation, economy, energy supply, among others but if we do not allow and contribute to a generation of change by putting our faith in the country, it is very possible that the process of change will be severely held back.

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