

## **Energy integration in North America: perspectives for Mexico in the light of the energy reforms and NAFTA renegotiation<sup>1</sup>**

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The subject of my Wednesday seminar, with the title that appears above, was defined in September, at the beginning of my three months stay. I proposed then the following abstract:

The energy reforms of 2013/2014 focus on market and free trade, at the very moment when a discourse and new policies emerge that promote economic nationalism in the dominant partner of NAFTA. At the same time, the United States has reached a new dimension in the global energy field, especially in oil and gas, which has changed its relationship with its partners, Canada and especially Mexico. The renegotiation of NAFTA raises questions about Mexico's future role in energy integration and transition in North America. What will be its main connection? A "fossil energy connection", mainly conducted by political mechanisms and big energy actors? What future for renewables and environment?

After reading an article by Gordon Hanson (2010), I added a "case study" on which I will make some points later. So, for the seminar:

- I'll prepare a Ppt presentation;
- I'll distribute previously the commentary that follows.

### **Index for my Ppt presentation**

1. *Introduction*
2. Energy reforms, **market oriented**, and the North America **Free Trade** Agreement (NAFTA).
3. **Two central issues**: markets and infrastructure.
4. **A case study**: electricity prices in the process of integration.
5. *Final considerations*

#### **4. A case study: electricity prices in the process of integration. A Commentary**

I take as reference some points of Gordon Hanson's article (2010). One of the factor he analyses to explain poor Mexico's growth is input markets, especially the high prices for electricity:

*"Unfavorable conditions in Mexico's input markets, ....*

*In comparing production costs across countries, Mexico stands out for having high prices for electricity, ....*

*Surprising as it may seem for a country that exports oil, Mexico has relatively high prices for electricity. Since 2000, electricity prices per kilowatt hour in Mexico have exceeded those in the United States by 1.1 to 1.7 times.....*

*Electricity production in Mexico is the sole provenance of state owned companies.....*

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<sup>1</sup> Professor Gordon Hanson kindly agreed to a dialogue in the course of preparing this commentary. Graciela Márquez Colín, USMEX Fellow, and Y. Jimena Romero Herrera from UNAM Graduate Department of Economics made useful comments and suggestions to a preliminary version of this Commentary. I thank everyone, with the usual disclaimer: I am solely responsible for the content of this piece.

*While unfavorable conditions in Mexico's input markets are well documented, it is less clear whether they can account for Mexico's poor relative growth".*

It is worth noting that the article by G. Hanson, in which he relates the situation of electricity prices to the monopoly of state companies, was published before the energy reforms of 2013/2014. Those reforms opened the energy sector to competition: they are market oriented reforms. It is interesting to examine what is happening now that reforms are being implemented. To achieve the opening to competition, one of the main arguments advanced by the government was that the prices of electricity would fall.

With respect to the prices of electricity between Mexico and the United States. the most recent data show that prices for industry are approaching:

**Energy prices in USD/Unit (1st quarter 2017)**

	<b>Electricity for Industry (MWh)</b>
MEXICO	70.47
UNITED STATES	67.51

SOURCE: IEA, Key World Energy Statistics (KWES) 2017.

Additional tables and graphs are in the appendix as background reference<sup>2</sup>. In the last three years, they show that the gap between those prices is disappearing. Assuming this is the beginning of a firm trend –what is debatable–, the question is if reforms, i.e. competition, are bringing down electricity prices in Mexico. For now, I cannot propose a complete demonstration in one way or another; only some elements that I find indispensable to analyze.

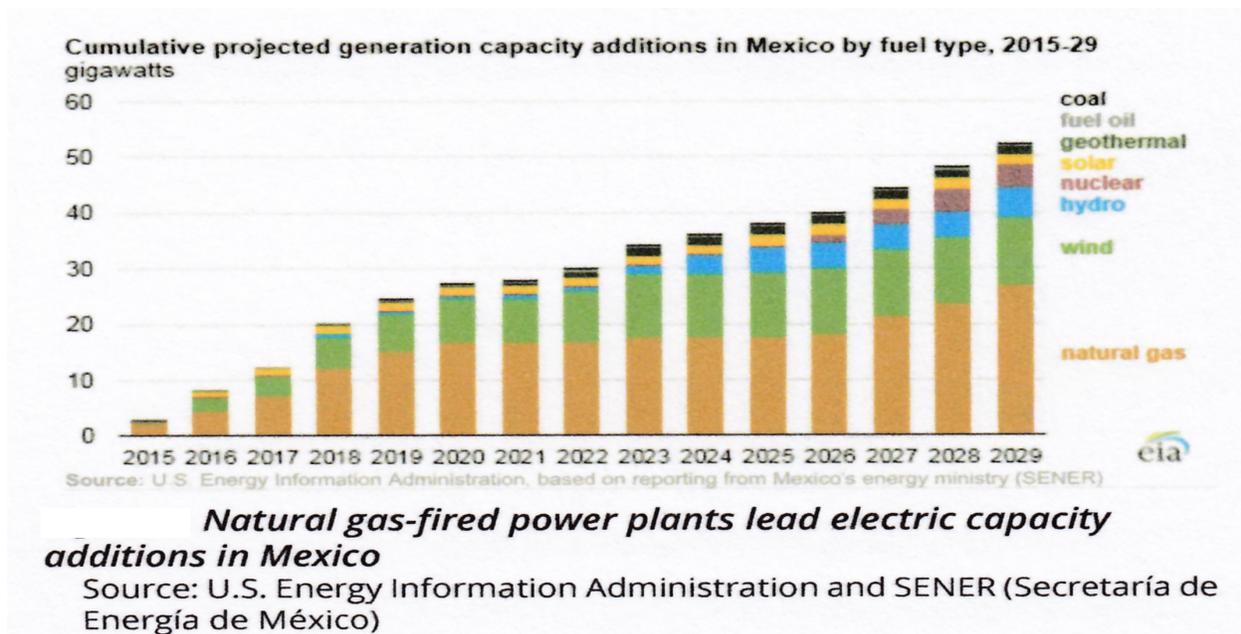
In this direction, it is useful to have some inputs, in a provisional way:

*"The industrial sector represents about 58% of domestic sales of electric power. The average price of electric power for these Qualified Users (medium and large industry) reached its historical maximum in February 2014 (\$ 170 cent / kWh), since then it started a downward trend and in January 2016 it decreased 30%, and reached the level of \$ 119 cent / kWh. ....*

*..... **Rates have not fallen as a result of the reform to the electricity sector, tariffs have been lowered by the reduction in the price of fuels used by CFE for the generation of electricity, by the increase in the use of natural gas in the generation portfolio and for the policy decisions that determined the application of various tariff adjustment measures "**. (Creel and Irastorza, 2016. Authors are talking about "peso cents. Translation from Spanish and highlighted parts: AVN).*

Electricity generation in Mexico, now and in the near future, is increasingly based on the use of natural gas. Gas fired power generation made up 54% of Mexico's power generating portfolio in 2015 (SENER, Mexican Ministry of Energy). Its projected share in future **additional** generation capacity could be appreciated in the following graph:

<sup>2</sup> I will not use them extensively in this commentary because they need to be analyzed with more time and care. In addition, it is necessary to obtain more detailed information about the various points on the border where the natural gas trade is concentrated and the prices are formed



Taking into consideration the importance of natural gas in power generation, its prices are an important element to study electricity prices. Infrastructure is a factor that needs to be taken into account: without infrastructure, there is no market. Additionally, considering that energy reforms seek to establish markets, but also to regulate them, it is necessary to address the issue of regulation, although it is not possible to deepen it here. Consequently, the three points I will address in this commentary are:

- Natural gas and electricity prices
- Infrastructure
- Regulation

### 1 - Natural gas and electricity prices

Taking into account the present composition of the power plant park and the tendency of the capacity that will be installed (see graph above), it is possible to affirm that natural gas prices are and will remain the most important *driver* of Mexican power prices<sup>3</sup>.

The question is whether natural gas prices will be determined at such levels as to have a favorable impact on electricity prices. Will the infrastructure follow in parallel? What changes and consequences can be expected from the new US energy and trade policies? Of the renegotiation of NAFTA (North American Free Trade Agreement)?

<sup>3</sup> That said without ignoring that they are not the only element that enters into the composition of electricity prices. Natural gas price is a key component in the cost of generating electricity, but in the price paid by the final consumer, industrial or domestic, there are not only production costs. It is also necessary to add the costs of transmission, distribution, and other plant-in-services, as well as plant operation and maintenance. However, it is important to focus on production costs and the fuel used because of the weight they have. As an approximation: in the United States, the former account for around 60% and the latter represents a third of the production costs.

At present, Mexico's natural gas imports are appraised in the wider context of free trade and investment flows in North America. Natural gas exports from US need an authorization, but under NAFTA it is virtually automatic. Energy reforms, having finished with the "energy exception"<sup>4</sup> the Mexican government claimed when NAFTA was negotiated, could be considered a major step in the path of energy integration. The opening and liberalization of Mexican gas markets, as well as new trunk lines and interconnections, are in harmony with the building of a single North American natural gas market, where natural gas molecules could move and be consumed everywhere at competitive prices.

This process is now being challenged by protectionist and economic nationalism positions expressed by the new US administration presided by Donald J. Trump. There is uncertainty about the future of NAFTA; both markets and infrastructure will be affected, but it is useful to see how things are working so far.

### *1.1. Electricity and Gas Markets*

In 1992, began the opening of the electric industry, but only in the generation phase. 25 years later, on the eve of the 2013/14 reforms, private generation accounted already for more than 40% of the total, but there was no electricity market. The establishment of this market is one of the main innovations of the 2013/2014 reforms<sup>5</sup>.

By 1995 the natural gas industry was partially opened (downstream). Since then Mexico has become a price taker, that is, it took the prices of a market in which there is open competition and where "good prices" come out: the southern hubs of United States. In this way, the entire internal natural gas prices chain is impacted. As a theoretical justification, it is stated that by linking prices with the most liquid gas market (in Houston) and adding transport costs, it is guaranteed to obtain competitive good prices for the country.

Prices referenced to South Texas do not necessarily respond to the behavior of national supply and demand. Anyway, Mexico has gradually been integrated into the natural gas market in North America, importing at present around 45% of the consumption of that energy, most from the U.S. via pipeline<sup>6</sup> (82% of natural gas imports in 2016). U.S is exporting about 4.1 Bcf/d of natural gas to Mexico valued at \$11.7 million per day (Th.N. Russo, 3d quarter 2017).

Mexico has benefited from the low prices brought about by the strong increase in natural gas production in the US, particularly since 2008. Will those low gas prices be maintained in the future? The outlook is uncertain, according to a recent report<sup>7</sup>:

- Current supply/demand conditions suggest that areas of supply shortage and/or transportation constraints could experience premium prices.

<sup>4</sup> At that time (1994), Mexico did not accept to include the energy sector, based on the provisions in force in the Constitution, relating to the property of the nation over the resources of the subsoil and to the exclusivity of the State in the energy industries.

<sup>5</sup> For a presentation in English of the legislation prepared to reform Mexico's electricity sector, see: Save Eric, Hindus Michael S., and Mcneecce III John B. (2014).

<sup>6</sup> SENER Prospectiva de Gas Natural y Gas 2016. Mexico also imports Liquefied Natural Gas (LNG) at higher prices; but until now those imports do not represent a significant percentage: 18% in 2016.

<sup>7</sup> Platts special report on Mexico's energy liberalization, 2017

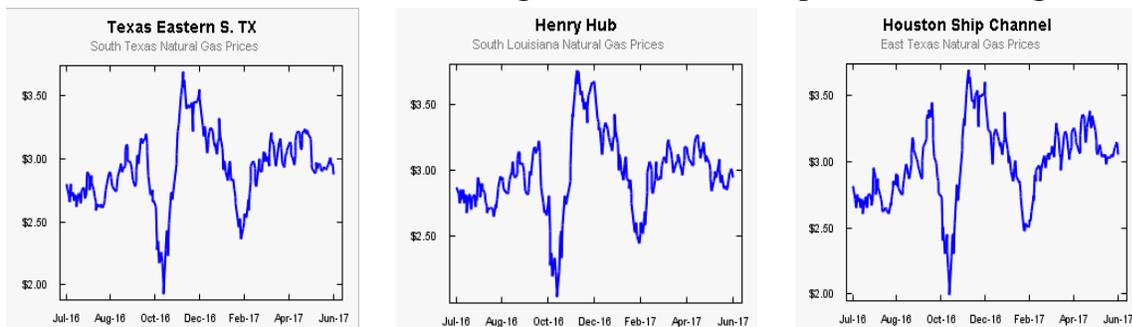
- Industrial customers have expressed concern about the recent lifting natural gas price caps on first-hand sales and the possibility of price spikes in some regions.
- Prices in constrained areas theoretically could increase a level near fuel oil **at roughly \$9/MMBtu**.

### 1.2. Volatile gas natural prices. Contradictory consequences

During the winter of 2000, in Henry Hub, **natural gas prices reached a maximum of 10 dollars** per million BTU (dls/MMBTU). By 2008/09, with the increasing production of shale gas in the US, **the price fell to 2 dls/MMBTU**, levels well below the rest of the reference markets. In 2017, prices reached an annual average of **3.01 dls/MMBTU**

In Mexico, where short-term emergencies often prevail, it seems that natural gas prices have become a central element, even for decisions that will have long-term consequences. It is forgotten that these prices are very volatile, as it appears in the following graphics:

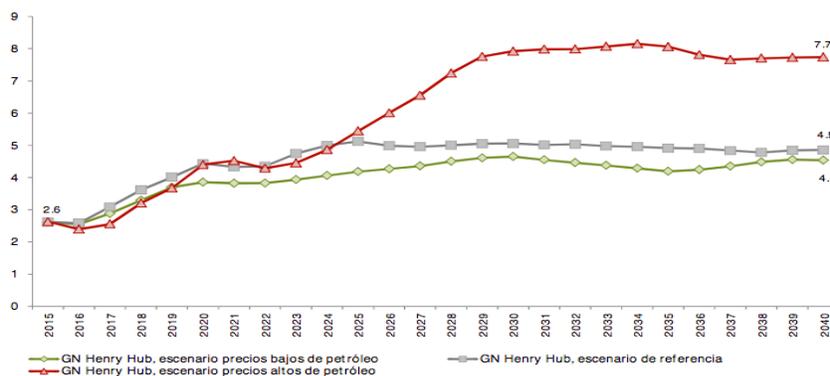
#### International references for the fixing of First-Hand Sale prices of natural gas in Mexico



Source: Natural Gas Intelligence Data. [http://www.naturalgasintel.com/NGI\\_Data](http://www.naturalgasintel.com/NGI_Data)

The Short-Term Energy Outlook (EIA, November) mentions that the expected growth in natural gas exports and domestic consumption in 2018 contribute to upward price expectations in Henry Hub, going **from the annual average of 3.01 dls / MMBTU in 2017 to 3.10 dls / MMBTU** in 2018. Values of NYMEX contracts for February 2018, marketed during a period of 5 days that ended on November 2, estimate that the price expectations of Henry Hub for next February covers **a range of 2.08 dls / MMBTU to 4.52 dls / MMBTU**, with a confidence level of 95%. For the Mexican Department of Energy (SENER) prices could be higher, as shown in the following graph:

#### Scenarios of natural gas spot prices Henry Hub, 2015-2040



Source: Sener. Prospectiva del mercado eléctrico 2016-2030.

The level of natural gas prices has consequences. When prices went up, a situation for which Industrial entrepreneurs in Mexico were not prepared, some plants had to close. When prices went down, this made unviable natural gas projects in Mexico. Since, in average, for fields that offer 20% of recovered natural gas liquids (condensates), at a price of 2.5 dls / MMBTU the profitability of the project would be -10%. To be positive at 10% the price of natural gas should have a minimum of 4 dls/MMBTU.

The priority option for natural gas in electricity generation has been argued in part with environmental reasons (it is a fossil energy but with lower CO2 emissions). However, in fact it is the low level of prices of imported gas from the U.S. the main reason. Betting on that, an accelerated development of the infrastructure took place, a situation that has consequences for the long term: inertias and lock-in phenomena related to the type of infrastructure that is being installed, but also consequences for the development of other options such as electricity generation with renewable energies.

Other possible consequences, which can be discussed, have to do with the nuclear program (of electric generation) about which so much has been talked for years. The combined cycle power plants with natural gas at the price of Henri Hub generate a lower cost per kWh than the costs of new nuclear power plants. The three new nuclear power units listed in the National Electric Development Programs (PRODESEN) of the last three years have been postponing their start and the decision will surely be left to the next administration.

## **2 – Infrastructure**

A condition for the existence of a competitive natural gas market is the existence of an extensive network of pipelines that allows the distribution and marketing to different players at competitive prices. With the energy reforms and the strong expansion of natural gas imports that has occurred in Mexico in recent years, the number of players in the country has increased. This greater competition requires the increase of the capacity of the transport and distribution networks to channel the energy to the areas of greater demand, as well as to the places where it is not accessible.

In Mexico, the growth of demand and imports has brought with it a significant expansion of the Mexican gas pipeline system, of its interconnections with U.S. pipelines at the border and from these to natural gas hubs in South and West Texas. More gas is needed considering the expected growth of industrial demand and the demand for electricity generation. As a result, greater transportation capacity will be required:

- Natural gas pipeline import capacity had grown 145% since 2010 to 10.8 Bcf/d
- By 2022, natural gas import capacity is expected to reach 14.2 Bcf/d, a near 50% growth.

Consequently, additional pipeline infrastructure will be built over the next 2 to 3 years or is already being built. This will allow the evacuation of gas from Western Texas to Northwestern and Central Mexico, and also augment the supply from South Texas. This new infrastructure is being developed by private investors, in parallel to the liberalization of domestic natural gas markets, a process being rolled out gradually beginning with the North of the country and followed by Central Mexico.

The national gas pipeline system has presented bottlenecks and inefficiencies in planning and logistics. CENAGAS (National Center for Natural Gas Control) is the body that must ensure in future that infrastructure meets the new needs of the market.

The biggest interest of the companies that participate in the market is in the points of injection of the natural gas from US to Mexico<sup>8</sup>, which connect with the national network of pipelines. There are currently 17 gas pipelines near the US-Mexican border and five new interstate pipeline projects are being developed in the U.S. to supply natural gas to new power generation plants in some states of Mexico. Some of them intend to export shale gas from Eagle Ford's play to the Central and Northeastern regions of Mexico (EIA, 2016).

### **3 - Regulation**

High electricity and natural gas prices, higher imports of natural gas and gasoline, fall in production and oil exports, all together with financial problems of CFE (Comisión Federal de Electricidad) and PEMEX (Petróleos Mexicanos), were the main arguments used by the government to promote an energy reform.

Before the Energy Reforms, both companies, especially PEMEX, reigned over practically the entire supply chain. After the energy reforms, the place and role of PEMEX and CFE, now “State Productive Enterprises” (SPE), are modified. The monopoly they exercised over oil and electricity is finally finished. In the new organization of the energy industries, the State maintains a direct presence with SPE that should behave, in principle, like any other company in a new competitive environment. It also maintains a presence through decentralized agencies of the federal administration such as CENACE (National Center for Energy Control) and CENAGAS, for the operational control of the electrical system and the administration of the natural gas transport and storage network, respectively. In principle, subsidies for fossil fuels must be phased out and renewable energies will not count for their development with such support.

Regulated markets will henceforth be responsible for obtaining better results than those achieved with the previous model, in terms of investments, the quality of energy products and services and, in general terms, a more diversified, secure, accessible, affordable and clean energy supply. These were the promises of the reforms a new governance of the energy sector will try to fulfill with three regulatory bodies: the Energy Regulatory Commission (CRE), the National Hydrocarbons Commissions (CNH), and the Agency for Safety, Energy and Environment (ASEA).

Regarding the main theme of this commentary, those new regulatory institutions seek to create conditions where competition between SPE and private companies generate a fall in prices. To reach this objective, a series of regulatory changes should be implemented in just under three years. It was assumed that there were robust regulators and the experience to ensure the welfare of consumers of energy products and services.

There is one specific issue related with this case study, pointed out especially by private investors: contradictions remain with the basic approach of the reforms and their real

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<sup>8</sup> The capacity of US gas pipelines for exports to Mexico has expanded rapidly in recent years: nowadays it amounts to 7.3 MMcfd, mainly to supply the Central and Northeastern regions of the country

implementation. State Productive Enterprises, for example, continue to maintain an interference in the fixing of prices; CFE continues to maintain virtually the entire generation park and is the main supplier of all users.

In this respect, there is a general issue concerning the place that SPE should maintain in the specific model that is being established in Mexico. In a more limited scope, what can be questioned is the capacity of regulatory institutions to elaborate and enforce an "asymmetric regulation".

As an example of this kind of regulation: the new infrastructure developed by private investors has been accompanied by the liberalization of domestic natural gas markets. Asymmetric regulation must reduce the incumbent's market share and Pemex already gave up its natural gas transport infrastructure to CENAGAS<sup>9</sup>. This agency conducted last April the first open season to auction capacity rights on the country's natural gas pipeline grid, for transport and border crossing interconnection capacity. Additionally, PEMEX will have to release 70% of its current contracts over a period of four years. After all that measures, coherent with a regulated market reform, there is a point that has not been addressed clearly: what will be the role of Pemex once the process of assigning contracts and the application of asymmetric regulations ends?

We will see it in the course of next future how pending points evolve, as this one concerning the future of PEMEX. Regulatory institutions have not yet acquired the necessary capabilities, strength and all the qualified human resources needed. More important: reforms such as those that were approved and sought to be implemented do not consist of processes with immediate results such as those promised to society. Not having clearly said this in the process of elaboration and approval of the reforms is now emerging as a crucial problem for reforms.

### ***Final considerations***

The topics covered in this commentary have technical, economic, and public policy dimensions, among others. One could even raise questions about the theoretical approach that underpins the current process of integration of energy markets, particularly between Mexico and the United States. In this paper, it has been preferred to keep the analysis within that framework to understand the logic of free trade, reforms and their implications.

Some observations that result from this work can be made explicit and further discussion of them may be fruitful:

- The opening and liberalization of energy markets in Mexico will deepen in principle the integration of markets in North America, with the consequences that it is supposed to have in terms of the convergence of prices, particularly electricity prices.
- Taking into account the current composition of the power plant park and the trends of additional capacity, a majority of which will be fueled by natural gas, it can be said that natural gas prices are and will remain the most important driver of Mexican electricity prices.

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<sup>9</sup> CENAGAS' existing pipeline system, formerly operated by PEMEX, is nearly 5,592-miles long. CENAGAS' 5-year plan project to add 1,926 miles to its pipeline system.

- If the process of establishing a natural gas market in North America is maintained and deepened, there may be a confluence of prices. That, however, is not automatic, and even less as an immediate result of the reforms. In this commentary some points that show difficulties for this to be true have been highlighted.
- One of them is the evolution of natural gas prices, one of whose characteristics is their volatility. In these circumstances, governments take compensatory measures to support certain consumers, such as industrial companies; Mexico has done it in the past. This raises substantive issues that can be expressed in D. Rodrik words:

*“While formal barriers to trade and capital flows have been substantially reduced over the last three decades, international markets for goods, services, and capital are not nearly as “thick” as they would be under complete integration (.....) National borders demarcate political and legal jurisdictions. Such demarcations serve to segment markets in much the same way that transport costs or border taxes do. Exchanges that cross national jurisdictions are subject to a wide array of transaction costs introduced by discontinuities in political and legal systems”.* Dani Rodrik (2000).

- The idea of a border tax, expressed by D. J. Trump at the beginning of his Presidency, has been rejected, not only because they distort prices, but especially because of the serious consequences that would have for the companies of his country. It is not clear yet, however, what will result from other proposals and from the renegotiation of NAFTA on energy trade. The expressions of the new President are framing in a new way the issues of energy trade ("energy dominance"), NAFTA ("a disaster", "one of the worst deals ever"), the relationship with Mexico, etc.
- In this context, it is necessary to ask some questions even if they seem out of place in the current context: What can be done to moderate the growing dependence on imports of natural gas and reduce the vulnerability in terms of energy security that this could entail? Is it possible to negotiate with the United States an agreement that strengthens the security of supply to Mexico?
- Precisely, one of the ideas of the integration in the field of energy was to favor the energy security of the three countries, taking into consideration the potential of each one, not only of fossils but also of renewable energies. In this sense, a process of integration of energy systems in North America has been taking place. This process seemed irreversible, but it now presents many uncertainties.

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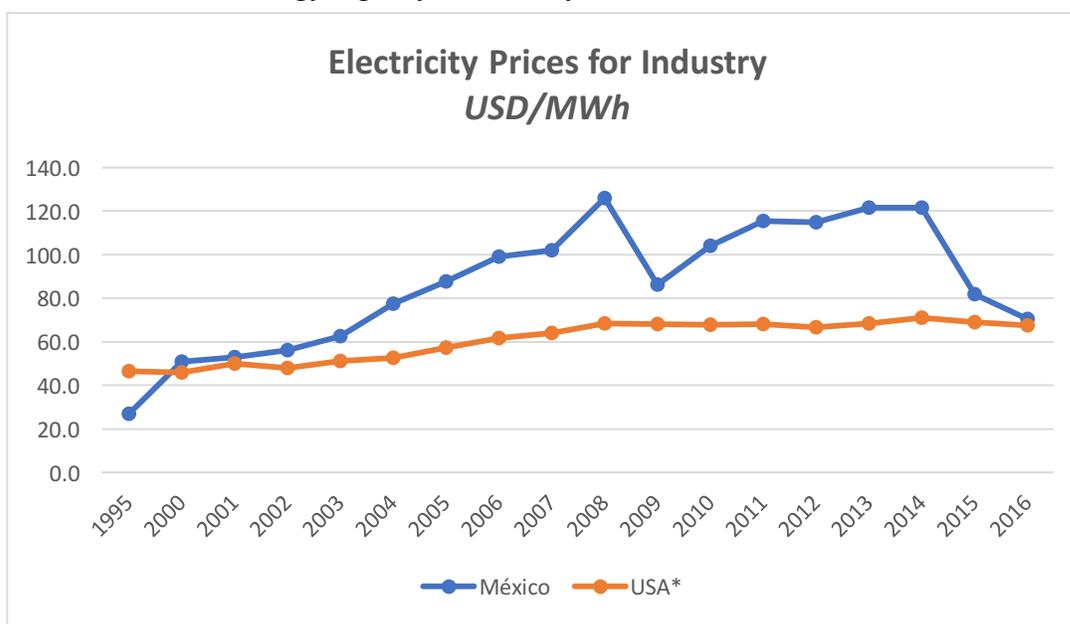
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## APPENDIX

<b>Electricity Prices for Industry</b>		
<b>USD/MWh**</b>		
	<b>Mexico</b>	<b>USA*</b>
1995	27.0	46.6
2000	50.9	46.0
2001	53.0	50.0
2002	56.0	48.0
2003	62.5	51.3
2004	77.5	52.7
2005	87.8	57.4
2006	99.0	61.6
2007	102.1	63.9
2008	126.0	68.3
2009	86.2	68.1
2010	104.0	67.9
2011	115.3	68.2
2012	114.7	66.7
2013	121.5	68.4
2014	121.5	71.0
2015	81.7	69.1
2016	70.5	67.5

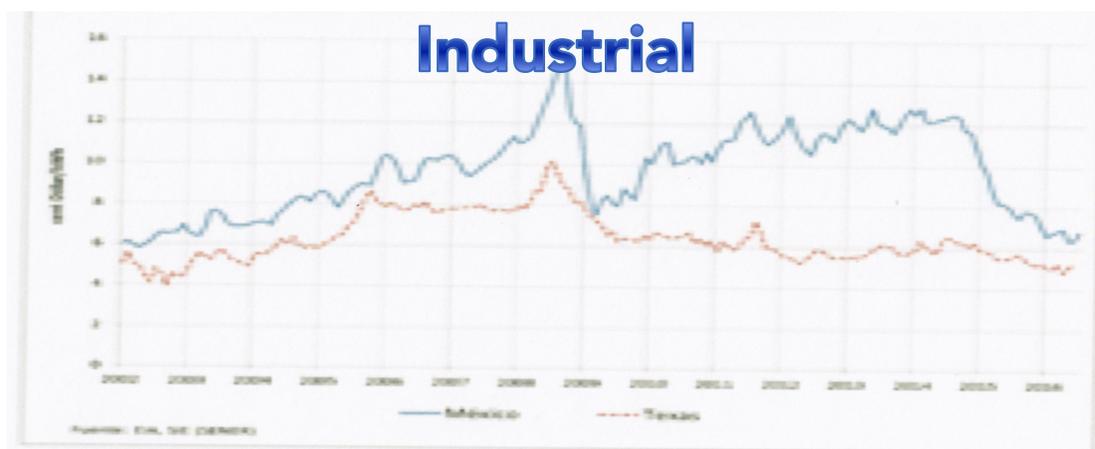
\* Price excluding tax for the United States. \*\*Prices are in current US dollars.

Source: International Energy Agency. Electricity Information. 2007, 2011, 2015, 2017.



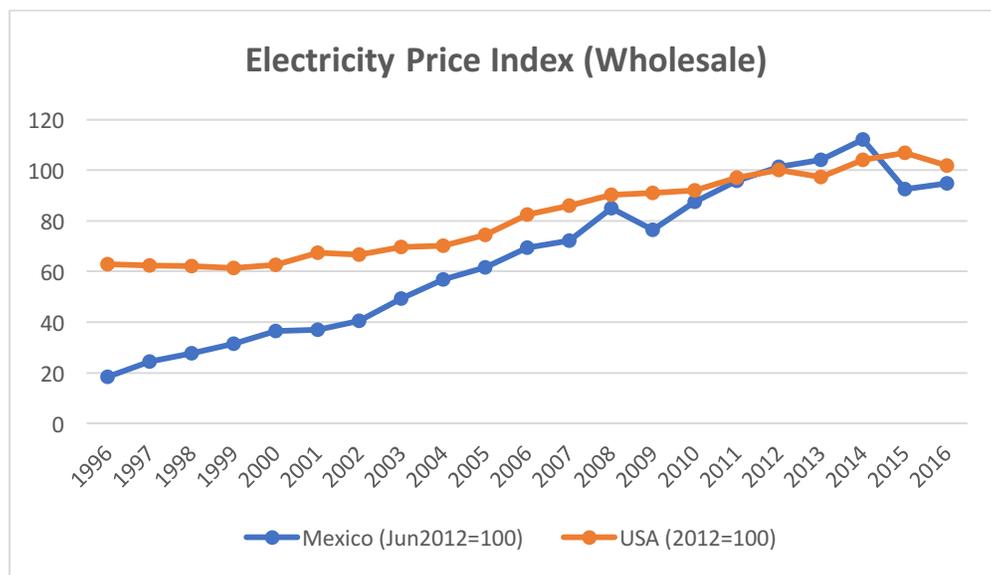
Source: International Energy Agency. Electricity Information. 2007, 2011, 2015, 2017.

## Precio medio de Electricidad al Sector Industrial



Electricity Price Index		
Wholesale		
	Mexico	USA
	(Jun2012=100)	(2012=100)
1996	18.4	62.8
1997	24.4	62.4
1998	27.7	62.0
1999	31.4	61.5
2000	36.6	62.7
2001	36.9	67.3
2002	40.5	66.7
2003	49.3	69.6
2004	56.9	70.2
2005	61.7	74.5
2006	69.4	82.4
2007	72.2	86.1
2008	84.9	90.2
2009	76.4	90.9
2010	87.4	92.1
2011	95.9	97.1
2012	101.4	100.0
2013	104	97.2
2014	112	104.0
2015	92.5	106.7
2016	94.7	101.9

Source: International Energy Agency. Energy Prices and Taxes. Third quarter 2017. p. 196, 291. For the USA series, the base year of the original series was changed to homologate it with the base year of the Mexico index.



Source: International Energy Agency. Energy Prices and Taxes. Third quarter 2017