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Tracking the Progress of Mexico's Power Sector Reform

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Tracking the Progress of Mexico's Power Sector Reform

"[The focus on Mexico's energy reform] is typically on hydrocarbons but in fact the most consequential part for further energy integration may very well be electricity."[1]

- Ernest Moniz, U.S. Secretary of Energy

I. Power Sector Reform 101

Mexico's 2013 landmark energy reform is overhauling the country's electricity industry by allowing private investment throughout the energy value chain.

The changes in the energy markets represent a paradigm shift. The power sector is transitioning from a vertically integrated industry with a dominant state-owned utility to a decentralized market open to both public and private companies. The reform is comprehensive and imposes significant changes throughout the electricity supply chain: power generation is set to become a fully competitive activity; an independent system operator will run a wholesale electricity market; and open access to the power grid will be guaranteed to all market participants.

The power sector reform also means a more proactive role for government agencies and regulators. The Mexican government will oversee the industry's transformation, promote competition, and enforce transparency measures. Furthermore, Comisión Federal de Electricidad (CFE) –the incumbent utility– will unbundle and compete on equal terms with incoming private companies. To help CFE compete, the reform has granted the utility greater operating flexibility, and CFE will be able to partner with the private sector through joint ventures and bilateral agreements in order to optimize its investment strategy.

Mexico's electricity sector will become increasingly complex. Over the next ten years, new companies will enter the market; wholesale transactions will increase sharply; and industry growth will accelerate. This report tracks the progress of the transformations taking place along the electricity supply chain and describes the next steps in the reform process.

Why Power Sector Reform Matters

Energy reform debates and analyses typically focus on the opening of Mexico's oil and gas industry – and for good reason. Historically, hydrocarbon policy has been far more contentious and politically charged than electricity policy. This focus, however, obscures the importance, scope, and potential impact of Mexico's power sector reform which will have vast repercussions throughout the economy, in large part because of the potential for lower electricity rates.

In light of this, Mexico's Energy Minister has referred to the power sector reform as the "economic competitiveness reform". Access to reliable and affordable power can give businesses a competitive edge over their rivals, stimulate job creation, and spur economic growth. This is particularly true of energy-intensive industries such as steel, aluminum, concrete, chemicals, glass, paper, petrochemicals, and oil refining. Studies suggest that cheaper electricity can substantially boost Mexico's manufacturing base, which currently accounts for 79% of Mexico's exports and 18% of its GDP.[2]

Mexico's power sector reform has the potential to cut electricity rates for other consumers too. By lowering residential electricity bills, the reform can put money in consumers' pockets and increase their purchasing power. This could stimulate domestic demand and may legitimize the domestically controversial energy reform itself. (Moving forward, public support will be essential to consolidating a more competitive power sector and ensuring that there is no policy backsliding.)

Timely and robust implementation of the power sector reform can strengthen Mexico's energy security over the next decade, especially in light of the country's increasing appetite for energy. This report argues that the reform can deliver a) a diversified and redundant energy matrix, b) a robust and competitive power market, and c) a resilient and smarter power grid. With these achievements in place, Mexico will be able to supply reliable, affordable and clean electricity to consumers nationwide, which will contribute to broad economic growth.

The power sector reform can also reduce Mexico's carbon footprint. The country has committed to reduce its greenhouse gas (GHG) emissions 22-36% relative to a "business as usual" scenario, with emissions peaking in 2026.[3] The reform encourages long-term investments in renewable energy projects and enhances the country's chances of meeting its climate change mitigation commitments. Specifically, the newly created clean energy certificate mechanism will require that large power consumers and suppliers obtain a certain percentage of their electricity from clean sources. Through this mechanism, Mexico seeks to generate at least 35% of its electricity from non-fossil sources by 2024, a significant but attainable target.

POWER SECTOR REFORM

2013 ENERGY REFORM

Allows **PRIVATE INVESTMENT** throughout the energy value chain.

Power Generation will become a fully **COMPETITIVE** activity.

Transition of the power sector from a vertically integrated industry with a dominant state-owned utility to a **DESCENTRALIZED MARKET** open to both public & private investment.

An independent sector will run a **WHOLESALE ELECTRICITY MARKET**

OPEN ACCESS to the power grid will be guaranteed to all market participants.

ROLE OF THE MEXICAN GOVERNMENT

- **Oversee the industry's transformation.**
- **Promote competition.**
- **Enforce transparency measures.**

COMISIÓN FEDERAL DE ELECTRICIDAD

CFE

- **Will unbundle and compete on equal terms with incoming private companies.**
- **Will be able to partner with the private sector through joint ventures and bilateral agreements.**

II. Power Sector Reform: Drivers

Before enacting its comprehensive reform in 2013, Mexico's power sector faced three major challenges: 1) uncompetitive generation costs, 2) lagging renewable capacity, and 3) steep transmission and distribution losses. This section examines these problems, all of which hindered the country's economic performance for decades.

Uncompetitive Generation Costs

Prior to the reform, the Mexican power sector was effectively a state monopoly. While certain private generation projects were allowed under Mexican law, overall capacity additions and access to the grid favored CFE's plants and power purchase agreements for which CFE was the supplier. Not only was there a lack of competition in generation activities, CFE was also in charge of dispatching power and operating the transmission and distribution networks. The industry's vertically integrated structure drove business decisions based on criteria other than market forces and resulted in higher than necessary generation costs.

CFE routinely used Pemex's fuel oil (a byproduct of crude oil refining) to generate electricity, regardless of opportunity cost or environmental impact. By 1999, one-third of the country's installed generating capacity ran on fuel oil which is not only four times as expensive as natural gas –its most abundant substitute– but also results in 40-47% more CO_2 being released into the atmosphere.[4] Mexico's energy mix was both economically suboptimal and environmentally unfriendly.

From 2000 to 2013, Mexico reduced the share of generation capacity that used fuel oil; but, in 2014, roughly 20% of total installed capacity still used fuel oil. As a result, generation costs and electricity prices have remained uncompetitive. Compared to the United States, Mexican industrial, commercial and high-consumption residential electricity rates are 84%, 135%, and 149% higher, respectively.[5]

Mexico's onerous cost structure reflects the country's inability to produce, transport, and harness natural gas cost-effectively. Despite ranking sixth in the world in terms of technically recoverable shale gas resources, Mexico's domestic natural gas output has stagnated due to underinvestment in exploration and production projects. In order to meet its immediate energy needs, the country has dramatically increased its reliance on United States natural gas. Annual natural gas imports from the US more than doubled between 2010 and 2014, a trend that is set to continue in the foreseeable future.[6]

Further complicating the issue, the national gas pipeline system has proved insufficient to satisfy demand growth, especially in the northwest and center of the country. Between 1997 and 2012, Mexico's natural gas consumption almost doubled; however, no significant pipeline projects were built resulting in constrained transport capacity and limited system redundancy.[7] This problem reached a critical point between 2012 and 2013, when the government issued 35 shortage alerts and curtailed industrial consumption. Since then, supplementary energy supply measures have been put into place, such as liquefied natural gas (LNG) purchases, a gas pipeline system expansion plan, and liberalization of oil and gas upstream activities. As a result of these measures, no shortage alerts have been issued since June 2013.

Lagging Renewable Capacity

The power sector has also struggled to deploy renewable generating capacity despite its vast resource base. Mexico has an estimated 53 GW of hydroelectric potential; 13.4 GW of geothermal potential; favorable wind farm sites in the south averaging capacity factors between 35% and 40%; and a respectable mean solar radiation of 5.5 kWh/m^2/day in the northwest of the country.[8] Renewables have

grown at a slower pace than conventional technologies, resulting in a decreasing percentage of installed capacity. They were down to 25% in 2014 from 29% in 1999.[9]

In 2008 the Mexican Congress passed the *Ley para el Aprovechamiento de Energías Renovables y el Financiamiento de la Transición Energética* (LAERFTE), which established binding clean energy generation targets of 35% by 2024, 40% by 2035 and 50% by 2050. Clean energy was defined as non-fossil generation.[10] At the time, the most visible incentives for renewables in the country were guaranteed compensation for excess generation (also known as an "energy bank"), a fixed grid usage tariff, and accelerated depreciation of specific assets, though none of these instruments had a substantial impact. Interconnection agreements and permitting for renewable projects remained difficult and were not streamlined.[11]

Mexico has not fully harnessed its renewable potential for multiple reasons. The previous industry model favored the construction of large-scale centralized power plants and an energy grid designed to deliver electricity produced by large-scale plants. Renewables were regarded as costly and unreliable alternatives to hydrocarbons. Moreover, as the monopoly grew complacent, system improvements to take advantage of renewables such as distributed generation, net metering, and energy storage were not given serious attention.

Steep Transmission and Distribution Losses

Mexico's power grid consists of almost 550,000 miles of transmission and distribution lines. CFE operates the grid and delivers electricity to over 38 million industrial, commercial and residential clients who comprise 98.4% of the Mexican population. Investing cost-effectively in grid expansions and maintenance has become a top priority for industry decision-makers. However, such investment and maintenance was difficult to achieve under the previous industry model.

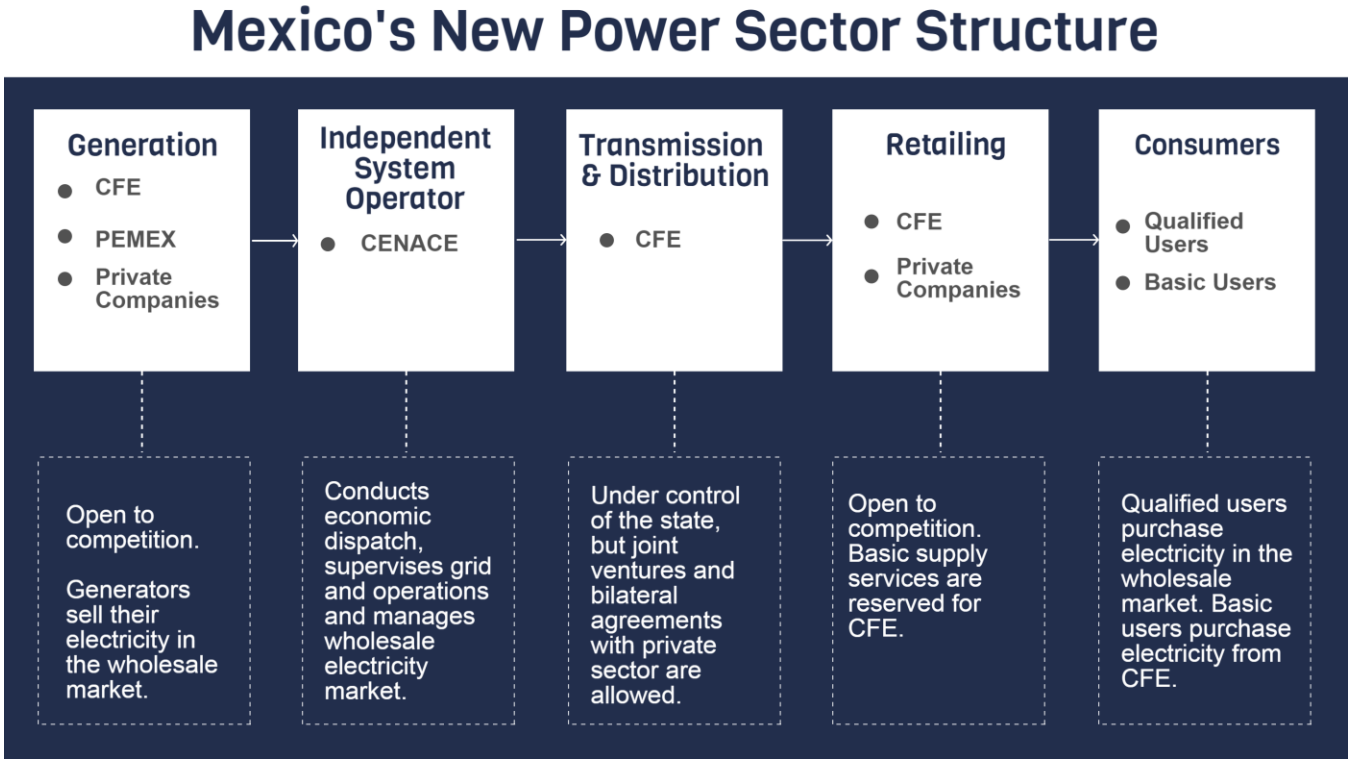
By 2013, roughly half of Mexico's transmission lines had been in operation for at least 20 years, and infrastructure investment was trailing both economic and population growth. The country was heading towards an undersized and obsolete power grid. Many industry observers were worried that Mexico would lose its manufacturing edge when an aging grid infrastructure and high electricity costs began to offset its competitive labor costs.

All of these issues contributed to the great challenge of reducing the grid's significant energy losses. While transmission losses are modest and mostly relate to technical inefficiencies, distribution losses are substantial and are typically caused by theft, metering inaccuracies, and data handling errors. In 2012, CFE reported that annual distribution losses accounted for 16% of transported volumes, representing more than $3 billion in lost revenue. OECD member countries average 6% energy losses. Countries including South Korea, Iceland, and Singapore have managed to reduce losses to 3%.[12]

To minimize both energy and monetary losses moving forward, CFE will need enhanced access to financing and operating flexibility. Moreover, key investments in transmission and distribution infrastructure will ease the integration of information technologies (IT) and renewables into the grid and will lead to a more reliable and resilient network.

III. Power Sector Reform: Fundamentals and Implementation

Mexico's power sector is transitioning from a vertically integrated industry with a dominant state-owned utility to a competitive electricity market open to both public and private investment. The decentralization process is laid out in an ambitious timetable put forward by the Mexican government. This section analyzes the scope of the reform and the progress of the different transformations taking place along the electricity supply chain.



Liberalizing Power Generation

The reform opens up power generation to private investors and reduces barriers to entry to enable competition.[13] Opening generation to private investors effectively ends CFE's monopoly and seeks to ensure that investments in generation are market-driven and cost-effective. Experts expect a significant increase in the number of generating companies in the market over the next five years.[14]

According to the *Programa de Desarrollo del Sistema Eléctrico Nacional* (PRODESEN), up to two-thirds of new generating capacity between now and 2029 can be provided by companies other than CFE.[15] The power sector's regulatory agency, the *Comisión Reguladora de Energía* (CRE), granted 277 generation permits to new industry players between January and August of 2015 (a six-fold increase over the same period of 2014). These permits represent $29 billion in planned investment and lay the foundation for a more competitive and efficient generation market. [16]

While in the short to medium-term new capacity will mostly replace inefficient operating plants, in the long run capacity additions will mainly satisfy increasing demand. According to the official forecast, peak demand for electricity in Mexico will grow at an average annual rate of 4% over the next 15 years, requiring 60 GW of additional capacity.[17] Through a greater reliance on natural gas and renewables, both of which will become more accessible and cheap as the energy reform unfolds, Mexico plans to create a more sustainable and low-cost energy matrix.

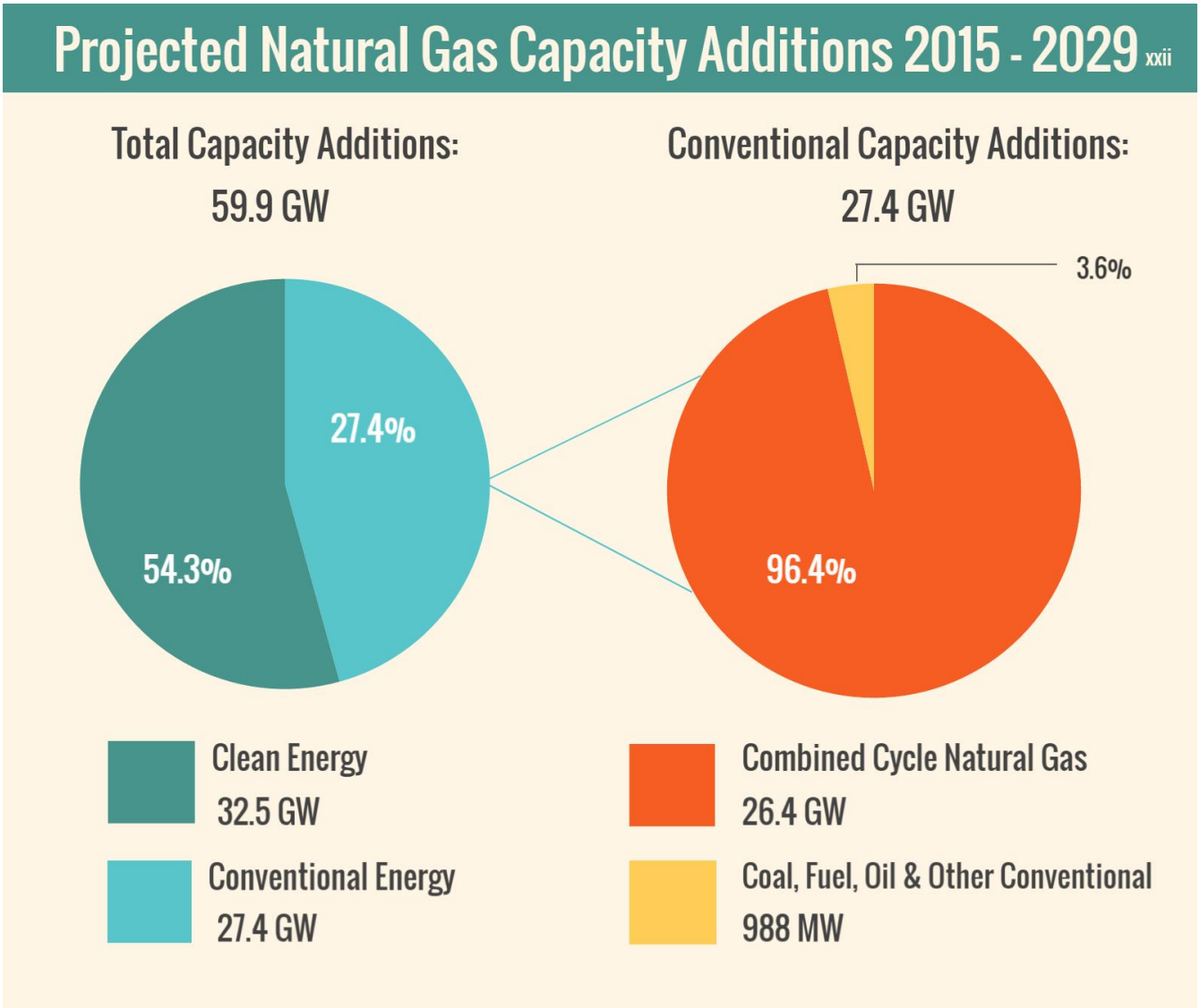
Access to Natural Gas

Inspired by the United States shale boom and the resulting decline in natural gas prices, Mexico is now experiencing its own "dash for gas." Domestic natural gas production is set to ramp up; transportation and storage infrastructure will be expanded aggressively; natural gas-fired power generation will grow significantly; fuel oil power stations will be repurposed to run on natural gas; and fuel oil will be essentially phased out of energy generation.

Mexico expects to increase its production of natural gas in the medium to long-term. The government's original reform proposal estimated that natural gas production would grow from 5.7 billion cubic feet per day (bcf/d) in 2013, to 8 bcf/d in 2018 and 10.4 bcf/d in 2025.[18] However, these targets need to be reviewed since they were estimated assuming a price of oil of approximately $100 per barrel. The 2014 oil price decline has reduced global investment in upstream activities and will negatively affect Mexico's initial oil and gas tendering rounds. Regardless, even if production falls short of 10.4 bcf/d, the country's natural gas production will almost certainly increase over the next decade.

Mexico is also investing heavily in natural gas transportation infrastructure. In October 2015, the Ministry of Energy published the *Natural Gas Transportation and Storage System Expansion Plan 2015-2019*, laying out thirteen high-priority infrastructure projects that will be developed over the next four years. Since 2012, pipeline projects that are underway or have been announced represent a total investment of over $21 billion. Mexico's natural gas pipeline system is expected to expand from 7,000 miles in 2012 to 12,500 miles in 2018, an increase of approximately 78%.[19]

Improved access to natural gas will heavily influence the power sector's performance moving forward. According to Mexico's official forecast, 44% of generation capacity additions between now and 2029 (26.4 GW) will run on natural gas.[20] CFE is currently tendering or constructing nine combined cycle power plants that will add 6.2 GW of new capacity with an estimated investment of $4.6 billion. CFE is also converting seven power plants (4.6 GW) from fuel oil to natural gas at an estimated cost of $200 million.[21]



Source: Secretaría de Energía (2015, June 30). Programa de Desarrollo del Sistema Eléctrico Nacional. Retrieved September 25, 2015, from http://sener.gob.mx/res/index/PRODESEN 2015-08.pdf

Ultimately, the opening of energy markets and Mexico's "dash for gas" will drive the phasing out of fuel oil: not only will 11 GW of fuel oil-based capacity retire over the next 15 years, but fuel oil consumption in power generation processes is expected to drop a staggering 90% between 2012 and 2018.[22] Unsurprisingly, this new reality has created tension between Pemex –the complacent fuel oil seller– and CFE –the increasingly autonomous off-taker that is transitioning to more cost-effective natural gas.

Harnessing Renewable Energy

Mexico's transition to a low carbon economy will be determined in large measure by the uptake of renewable energy and the deployment of clean technologies. As previously discussed, the country has lacked a robust framework for renewables despite having significant renewable potential throughout its territory. It was not until 2008 that a binding clean energy generation target of 35% by 2024 came into force. In order to meet this goal and diversify the national energy mix, the recent energy reform has established new mechanisms designed to promote long-term investments in renewable energy projects.

The first such mechanism was a roadmap for renewables and energy efficiency –the *Programa Nacional para el Aprovechamiento Sustentable de la Energía 2014-2018* (PRONASE)– which the Ministry of Energy was required to prepare. The final version of this document was published in April 2014 and was within the timeframe set out in the reform.[23] The PRONASE is not as comprehensive as other planning instruments developed by the Ministry. It does not address financing and funding issues; however, it does describe industry best practices, provide concrete policy guidelines, and define clear indicators to evaluate progress towards the 2018 goals.

The second change that the reform established is a new legal, administrative, and financial framework for geothermal energy. Between January and July of 2015, the Ministry of Energy conducted a geothermal "Round Zero" to determine which prospective sites and projects were to be developed by CFE and which were to be tendered to public and private investors in future rounds. Based on its technical and financial capabilities, CFE was granted four existing production concessions (874 MW), one new production concession (25 MW), and 13 exploration permits (448 MW), taken together close to 52% of its initial request.[24] Over 12.5 GW of geothermal potential remains untapped and is ready to be tendered in future rounds.

In terms of private sector participation, the Ministry of Energy has granted one production concession and is currently processing ten exploration permit requests in six different states. Nevertheless, a formal tendering process has not yet been launched. Furthermore, CFE has publicly stated it will analyze potential joint ventures with the private sector to fully develop its geothermal portfolio.

The third mechanism is the clean energy certificate (CEL) market. CELs are Mexico's most powerful tool for achieving its clean energy target of 35% by 2024. The mechanism's main objective is to internalize GHG emission costs in the power sector by requiring that large energy consumers and suppliers obtain a certain percentage of their electricity from clean sources. This will effectively level the playing field between conventional and renewable energy sources. CELs will also provide long-term price stability to the market and help diversify Mexico's energy mix.

Initially, the CRE will issue 20-year certificates to new clean energy generation projects including wind, solar, wave, geothermal, bioenergy, waste, hydro, nuclear, efficient cogeneration and carbon capture and storage thermal plants. Clean generators will receive one CEL for each megawatt-hour of electricity that they generate. Later, they will be able to sell their CELs to large power consumers and suppliers. CELs will be offered, priced, and traded in the newly created wholesale electricity market.[25]

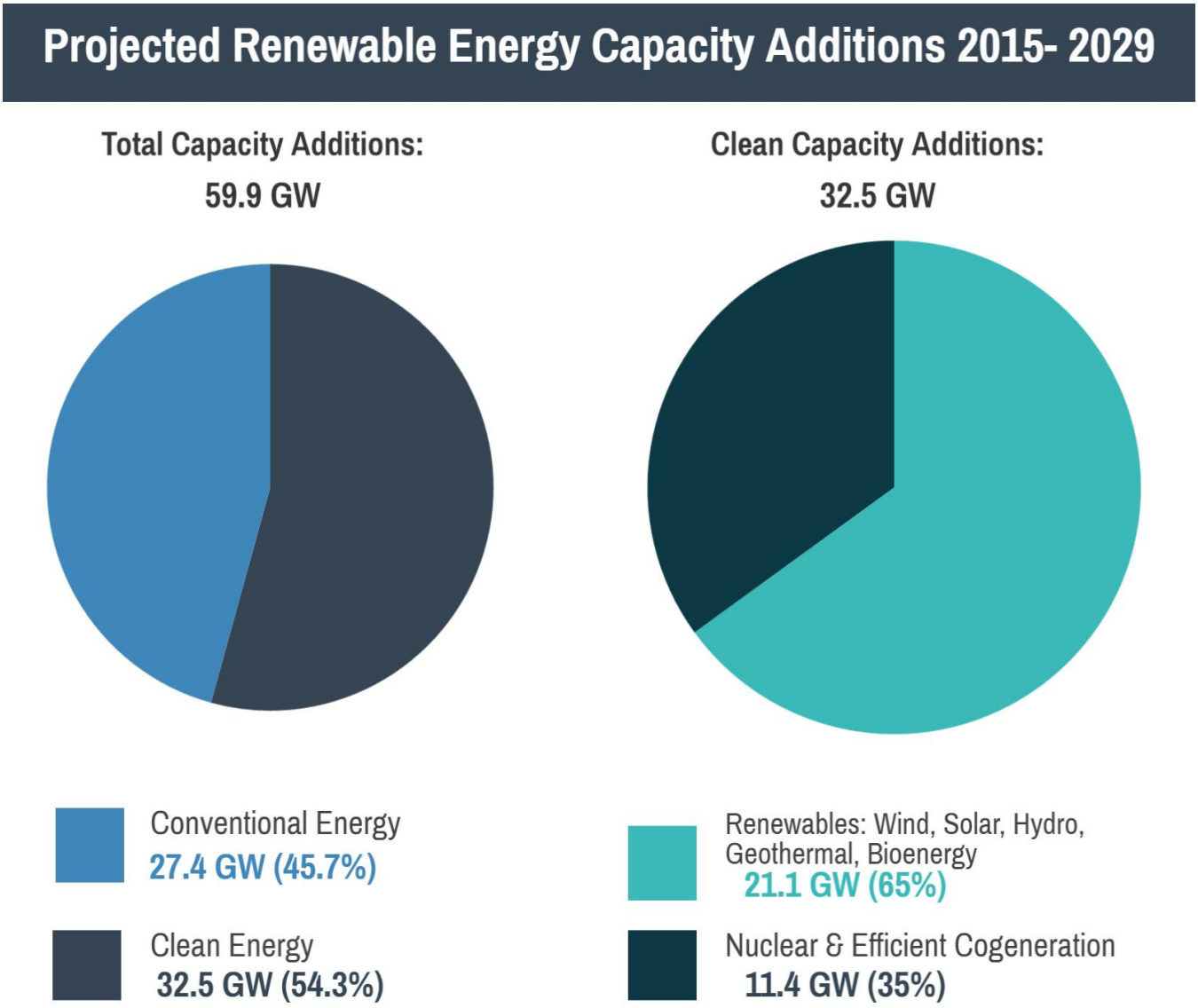
Each year, the Ministry of Energy will set the minimum percentage of clean energy in the national energy mix for the next three years. In March 2015, the Ministry established a 5% obligation by 2018, the year in which the mechanism will officially get underway. Authorities will be able to set multiyear targets if they wish to promote greater investment in renewable energy projects.

The mechanism's effectiveness depends greatly on the penalties' deterrence effect and how aggressively the penalties are enforced. Like many other well-designed policies in Mexico, their success will boil down to their transparent and robust enforcement, i.e. to the rule of law.

In addition to the PRONASE, the new framework for geothermal energy and the CELs mechanism, the energy reform has upheld accelerated depreciation benefits for specific renewable energy assets. It has also discarded the energy bank and the fixed grid usage tariff that were in place before the reform was enacted.

To what extent does the energy reform intend to accelerate the deployment of renewable energy projects in Mexico? According to the PRODESEN, 35% of incremental generation capacity between 2015 and 2029 (21.1 GW) will correspond to renewable energy technologies: onshore wind energy –

20% (12 GW), hydroelectricity – 9.2% (5.5 GW), solar and bioenergy – 3.3% (2 GW), and geothermal energy – 2.7% (1.6 GW).[26]



Source: Secretaría de Energía (2015, June 30). Programa de Desarrollo del Sistema Eléctrico Nacional. Retrieved September 25, 2015, from http://sener.gob.mx/res/index/PRODESEN 2015-08.pdf

However, not all industry assessments agree with the PRODESEN. Bloomberg New Energy Finance has a more bullish outlook for renewables in Mexico. Between 2015 and 2040, it projects over 60 GW of renewable energy capacity additions, with both wind (22 GW) and solar (35 GW) playing a major role in the mix.[27] Solar power uptake is expected to surge from 2020 onwards due to two critical drivers: a) an increasingly competitive levelized cost of energy (LCOE) for utility-scale photovoltaic (PV) projects, and b) declining costs and payback periods for small-scale PV installations in commercial and residential rooftops. Several energy companies, including CFE, have announced their plans to market and sell small-scale PV systems in the coming year.

In the foreseeable future, CFE plans to install fifteen utility-scale renewable energy projects (2.8 GW) worth an estimated $4.8 billion.[28] The scale of the company's projected renewable portfolio is a clear indication of the role the private sector is expected to play in developing renewable energy capacity.

Whereas natural gas infrastructure has been –and will continue to be– spearheaded by the state, most of Mexico's renewable energy projects will be privately financed and operated.[29] On the one hand this will translate into sizeable business opportunities for incoming energy companies; but, on the other hand, it may limit CFE's ambition to become a more decentralized and flexible organization. The key to averting this scenario is the consolidation of a dynamic subsidiary focused exclusively on renewables.

The energy reform has provided the power sector with better and more powerful tools to encourage renewable energy uptake in Mexico. However, the government and private sector must maintain an open dialogue in order to prevent potential setbacks. Consider the current debate around solar energy. In 2014, Mexico's tax authority levied a 15% tariff on solar panel imports. As expected, solar investors and developers objected to the policy, arguing that this measure contradicts national clean energy targets and will result in delayed investments greater than $4 billion. Meanwhile, Mexican solar panel manufacturers have celebrated the tariff, claiming that they will now be able to compete on equal terms with Chinese subsidized low-quality imports.

The solution to the current solar energy controversy is not straightforward. Countries like the United States have imposed similar tariffs on Chinese panels on the grounds of anti-dumping. At the same time, it is not the government's job to pick winners and losers when it comes to renewable energy. The Mexican government –in coordination with the private sector– should foster and prepare nascent industries for heightened competition, while not losing sight of the country's long-term clean energy goals.

Establishing an Independent System Operator

Another central component of Mexico's power sector reform is the creation of an Independent System Operator (ISO). The *Centro Nacional de Control de Energía* (CENACE) was designed to fulfill that role, and is now operating as an autonomous public entity responsible for electricity dispatch and guaranteeing open access to the transmission and distribution networks. Even though CENACE is in charge of coordinating and monitoring the energy grid, it does not own the infrastructure. CFE will continue to own the transmission and distribution infrastructure.

CENACE is tasked with ensuring economic dispatch; in other words, determining power output levels in increasing order of cost to meet demand regardless of which company generates the electricity. CENACE must also guarantee the safety and reliability of the electric system at all times. These mandates provide certainty and level the playing field for all market participants.

The establishment of an ISO is essential for maximizing the efficiency of any power sector, let alone a recently liberalized one like Mexico's, where for decades the dominant utility was in charge of both generating and dispatching energy. In order to avoid potential conflicts of interest in a competitive generation market, CENACE officially separated from CFE in August 2014.

Three months later, in November 2014, CFE transferred human and material resources to CENACE so CENACE could fulfill its duties. The list of transferred resources included two national control centers, eight regional control areas, IT infrastructure, real estate, vehicles, service contracts, insurance policies, and over 1,000 employees. Moving forward, the government should be mindful of CENACE's financial and material needs. Many industry analysts have argued that CENACE's independence and healthy operation are the cornerstone of Mexico's power sector reform.

Launching a Wholesale Electricity Market

As previously noted, CENACE will be in charge of dispatching electricity and supervising grid operations. However, setting up and managing a national wholesale electricity market (MEM, for its acronym in Spanish) will be its greatest challenge over the coming decade. The energy reform

mandates the creation of the MEM to promote transparent transactions, enhance competition and efficiently drive down electricity costs.

CENACE will be the centerpiece of the MEM. Incoming companies –also known as market participants– will have to enter into an agreement with CENACE before conducting transactions. Each market participant will register under one of four categories: power generator, qualified user, supplier, or non-supplying trader.[30]

Market participants will notify CENACE of every power plant or load center that they plan to use when tapping into the power grid. Market transactions will cover a range of products and services: electricity, ancillary services, power capacity, financial transmission rights to reduce exposure to grid congestion, and clean energy certificates.[31]

Basic Structure of Mexico's Wholesale Electricity Market (MEM)

Major Players	Products & Services (Sub-Markets)	Transaction Classification
1. CRE (Regulation) 2. CENACE (Operation) 3. Market Participants a) Power Generator b) Qualified User (Demand Equal or Greater than 2 MW) c) Supplier ● Basic ● Qualified ● Last Resort d) Non-Supplying Trader	1. Electricity 2. Ancillary Services 3. Capacity 4. Clean Energy Certificates (CELs) 5. Financial Transmission Rights	1. Short-Term Transactions a. Day-Ahead Electricity & Ancillary Services b. Real-Time Electricity & Ancillery Services c. Capacity Market (Annual) d. Clean Energy Certificate (CELs) Market 2. Medium & Long-Term Contracts: a. Medium-Term Electricity & Capacity Auctions (3-year contracts) b. Long-Term Capacity & Clean Energy Auctions (15-year contracts); CELs (20-year contracts) c. Financial Transmission Rights Auctions

The MEM will host short-term transactions as well as medium to long-term contracts to ensure the power supply chain's reliability. Short-term transactions refer to electricity and ancillary services sales both on a day-ahead and real-time (spot market) basis. In both cases, power generators bid their available capacity to access the grid while suppliers and qualified users submit their energy requests. Next, CENACE economically dispatches electricity from the generators into the grid in light of transmission availability, then clears the market at the marginal bid which determines the price.

Long-term contracts promote sustained price stability in the MEM. They can either be bilateral agreements negotiated freely between market participants or they can be awarded through auctions carried out by CENACE. Medium-term electricity, along with long-term capacity, renewable energy and financial transmission rights will be regularly auctioned to reduce uncertainty in the market and increase price predictability.[32]

CRE will regulate the MEM and issue permits to market participants. Meanwhile, CENACE will coordinate all market operations based on system-wide information regarding generating costs, economic dispatch, inflow and outflow nodes, energy imports and exports, as well as demand-side management activities.

Qualified users will be able to purchase their energy directly in the MEM through bilateral agreements with generators or through qualified suppliers. Qualified users are mostly industrial consumers with a demand equal or greater than 2 MW.[33] Basic users (residential and commercial consumers) on the

other hand, will have their energy provided by basic suppliers under a regulated tariff set by the CRE. This does not mean, however, they will not benefit from the MEM, since basic suppliers will acquire their energy through competitive auctions carried out by CENACE. Initially, CFE will be the sector's basic supplier, but this will change over time as more providers come into the market.[34]

In September 2015 –after a thorough public consultation– the Ministry of Energy published the guidelines for the MEM which contained the market's design and operating principles. The next industry milestone was the inauguration of day-ahead and spot market operations in January 2016, which marked the start of an era of open and non-discriminatory access to Mexico's power grid.

CENACE held its first long-term auction in March 2016. Renewable energy was the undeniable winner of the auction, as 11 companies were awarded contracts to develop 18 renewable energy projects (12 solar and 6 wind-based projects). The 18 winning proposals represent over 2,000 MW of additional generating capacity, 85% of the energy initially requested by CFE, as well as the allocation of 5.4 million CELs. Despite having to repeat the tendering process - due to technical difficulties and participants submitting invalid offers – CENACE's first long-term auction was successful in terms of lowering expected electricity prices and promoting renewable energy in Mexico. Industry analysts were greatly surprised by the low prices offered during the auction with CFE and Mexican electricity consumers starting to benefit from cheaper electricity. A medium-term auction will follow in October 2016.

Financial transmission rights will be auctioned starting November 2016, while the capacity market will formally get underway in February 2017. The market for CELs is expected to kick off in 2018. The MEM will unfold in several phases over the next two years, with increasingly complex operations and transactions. This approach will allow for improved pricing methods and greater system resilience by 2018.[35]

A healthy and fully operational wholesale electricity market will take several years to take hold.[36] It is unrealistic to expect substantial cost reductions in the short-term. Nevertheless, the first two years of operation will be crucial, since success will send a strong signal to potential investors and financial markets. The key to guaranteeing the MEM's long-term success is enforcing true competition and transparent transactions. To this end, CENACE needs to be held accountable from day one of market operations; and, more importantly, the sector must avoid high levels of market concentration after CFE's restructuring (this issue is more broadly discussed in section IV).

Enhancing Power Transmission and Distribution

The reform dictates that power transmission and distribution will remain under control of the Mexican State. However, CFE will be able to partner with the private sector through joint ventures and bilateral agreements to finance, install, operate, maintain, expand, and modernize the grid infrastructure. This provision will help address some of the industry's most pressing challenges such as reducing energy losses, deploying smart grid technologies, and integrating renewable energy into the grid. CENACE will coordinate all power plants and load centers in the system, acting as the interface between generators and the transmission network. Grid usage tariffs will be regulated by the CRE and will promote open access to the grid while assuring an efficient cost recovery for CFE.

Whereas the generation capacity growth outlined in the PRODESEN is not mandatory (it will ultimately be determined by market forces), strategic transmission and distribution network expansions are compulsory. The Ministry of Energy will require a connection between the Baja California Peninsula's isolated network and the national grid as well as improved connections with both the US and Central America.

By publishing the PRODESEN, the Ministry of Energy has effectively replaced CFE as the power grid's planning entity. In addition to using established criteria to plan the grid's expansion such as economic growth and energy demand forecasts, the Ministry will now evaluate additional factors such as renewable energy growth, opportunities to deploy smart grid technologies, and expansion proposals from multiple stakeholders (CENACE, CRE, market participants). This decentralized planning process would have been unthinkable under a vertically integrated and state-centric model.

All the efficiency gains achieved through competitive generation in the wholesale market are at risk if energy is transported through low quality transmission lines. Strategic investments can prevent system congestion, increase redundancy, minimize dependence on specific power generators, and extend the asset life of key transmission infrastructure. In terms of power distribution, investments are needed to accelerate the rollout of theft detection systems, smart meters, and retrofit programs. In the aggregate, these measures can reduce energy losses significantly. CFE expects to cut distribution losses from 16% in 2012 to 10% by 2018.[37]

An additional tool to enhance Mexico's distribution network is the Universal Electricity Service Fund (FSUE, for its acronym in Spanish). This newly created fund will extend electricity coverage to rural and marginalized urban areas throughout the country. Under the previous industry model, CFE was responsible for every electrification project regardless of cost. Now, the energy reform enables CFE to allocate its resources freely while the FSUE finances social electrification projects. The fund will pool resources from the wholesale market's efficiency and energy loss reduction program. The government has set the goal of increasing Mexico's electricity coverage from 98.4% of the population in 2014 to 99.8% by 2024.[38]

Restructuring CFE into a State-Owned Productive Company

CFE's new role in the power sector will be critical to ensuring the energy reform's success. The reform seeks to boost CFE's productivity and long-term growth while restructuring the company to enable greater competition industry-wide. This is a difficult balancing act to perform but it is by no means impossible.

As provided by the energy reform, CFE has become a "State-Owned Productive Company" (SPC). As an SPC, the utility has greater technical, operating, and budgetary autonomy. Put simply, CFE can now freely determine its project portfolio, basing its investment decisions solely on value creation, and only having to stay below a debt ceiling annually set by the Mexican Congress. In February 2015, the Ministry of Energy officially recognized CFE as an SPC, after the company finalized its new procurement, acquisitions, financing, debt, budgetary, transparency and audit regimes. The energy reform has also simplified CFE's fiscal regime by redefining its income tax obligations to bring them in line with those of competitors'.

The government committed to partially absorb CFE's pension liability, provided that by May 2016, the company's management and union jointly and voluntarily adjust the collective bargaining agreement and implement an austerity program. In May 2016, the CFE leadership came to an agreement with the electricity union and with the government to reduce the labor liability by 50%, with Hacienda agreeing to take on a substantial amount of the remaining debt. As of January 2015, CFE's pension liability totaled 34 billion dollars. The utility's annual pension obligations will peak in 2030 ($1.8 billion), year after which they will begin to decline until they eventually reach zero by 2090.[39]

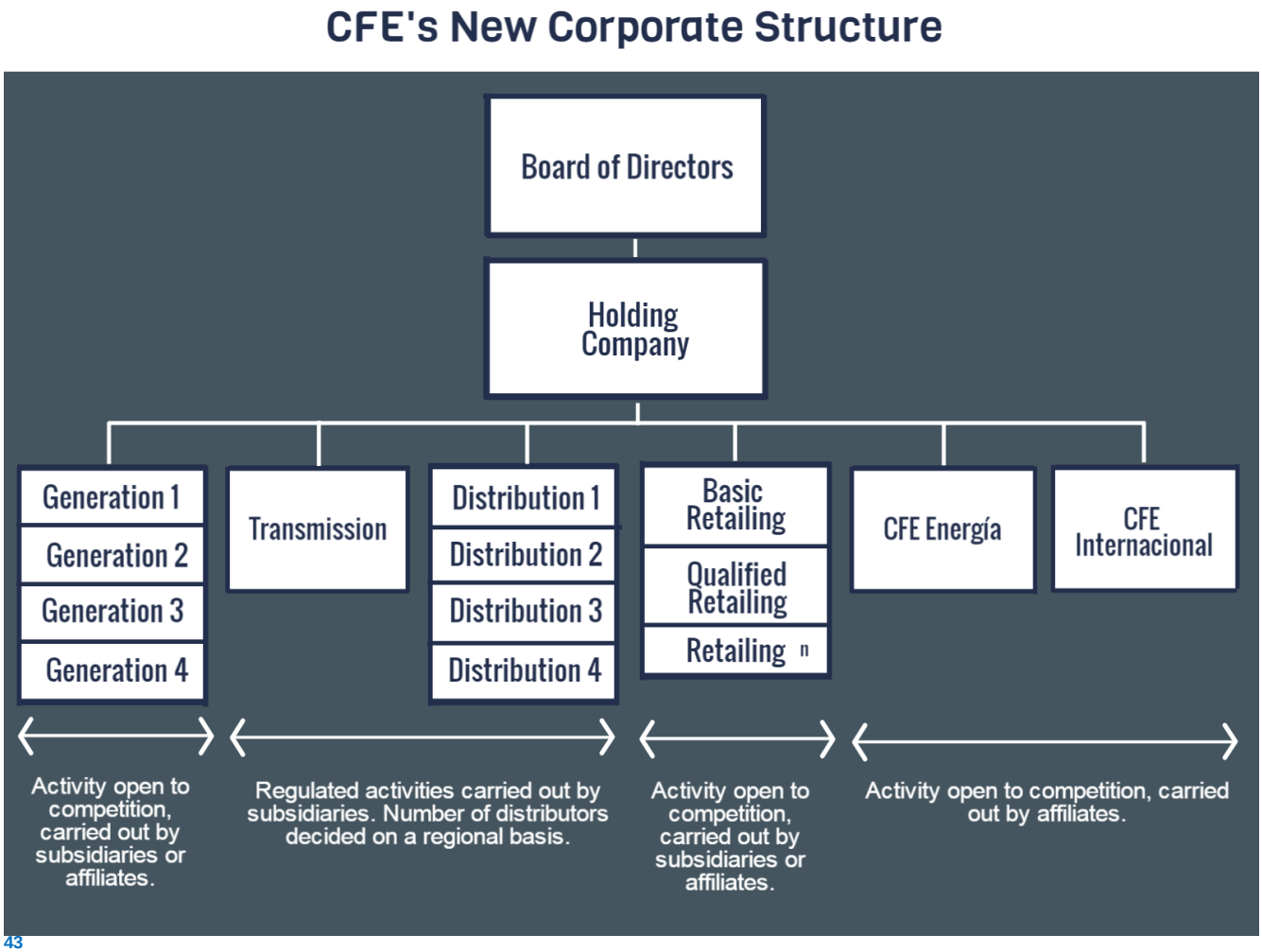
CFE's considerable pension liability is not the only factor weakening its financial position. The company posted a net loss of $4 billion for the first three quarters of 2015 (a 189% year-on-year increase spurred by lower revenues and higher financial expenses). Moreover, in January 2015, the Ministry of Finance announced an austerity plan, including a $600 million cut for CFE. Austerity measures and lower annual revenues are expected to continue through 2016.[40]

Despite its current financial woes, CFE's long-term outlook remains moderately positive. The reform has provided the utility with the necessary tools to compete on equal terms with incoming energy firms. In addition to its SPC regime, the utility will be able to partner with the private sector to carry out generation, transmission, distribution, and retail projects.[41] However, if CFE is to reap the benefits of public-private partnerships, it must also demonstrate willingness to reorganize and compete on a leveled playing field.

The first step in CFE's corporate restructuring process was the installation of a new board of directors in October 2014. The composition of the current board is more balanced than that of the previous one, as it includes independent board members (without any ties to the government) who are proposed by the President and then ratified (or not) by the Senate.

The energy reform also lays the groundwork for the unbundling of CFE. This measure seeks to promote competition in the power sector by preventing high levels of market concentration; it also intends to make CFE's operations more flexible and nimble. While the company is still allowed to invest throughout the electricity value chain, the reform mandates an operating and legal separation among its generation, transmission, distribution and retailing divisions, now termed "subsidiaries" (vertical separation). Moreover, the law requires CFE to separate its generation and distribution divisions into several independent subsidiaries to enhance competition (horizontal separation).[42]

In January 2016, the Ministry of Energy unveiled CFE's new corporate structure. The new structure includes a holding company overseeing at least six generation subsidiaries, one transmission subsidiary, sixteen regional distribution subsidiaries and two retailing subsidiaries. CFE is tasked with setting up these individual companies throughout 2016. The operating and legal restructuring process needs to be agile in order for wholesale electricity market participation to pick up.



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In February 2015, CFE's board of directors created the first two affiliates under the SPC regime: CFEnergía –for energy imports, exports and midstream activities– and CFE Internacional –the company's international energy trading arm. CFE's new decentralized structure will streamline decision-making and boost efficiency. This will be particularly relevant as CFE develops new business lines, such as small-scale PV installations and electric vehicle charging infrastructure.

The Power Sector's New Business Ecosystem

The changes currently taking place throughout Mexico's power supply chain are reconfiguring the industry landscape. The energy reform has not only strengthened government agencies and regulators, but has also created business opportunities for power generators, grid companies, suppliers, and traders. While many global and domestic energy firms are considering their options for entering the power market, others have already announced their long-term investment plans in the country. In the medium to long-term, the industry's new business ecosystem will result in increased efficiencies and lower costs across the board.

Pemex –Mexico's oil and gas State-Owned Productive Company– will become a steadily more important player in Mexico's power sector. Through its newly created subsidiary, Pemex Cogeneration, Pemex will integrate combined heat and power (CHP) projects to its refineries and petrochemical plants. The company plans to sell its surplus electricity to the grid and become the country's second-largest power generator. Pemex has already initiated project appraisals and has signed several memorandums of understanding with companies interested in establishing joint ventures.

According to the PRODESEN, up to 7.5 GW of efficient cogeneration capacity can be added to the energy matrix towards 2029. These projects –undertaken not only by Pemex, but also by private companies– would represent an estimated investment of $7 billion.[44] It is noteworthy that Pemex is growing its electricity business, as CFE is increasing its natural gas investments. Heightened competition in both arenas is expected to reduce the energy industry's carbon footprint over the next decade (this issue is discussed in greater depth in section V).

Raising Capital through Fibra Es

In order to attract greater capital flows to the energy sector, the Mexican government unveiled a new investment vehicle called *Fideicomiso de Inversión en Energía e Infraestructura* (Fibra E). Fibra Es are comparable to the energy-focused Master Limited Partnerships (MLPs) that have existed in the United States since the early 1980's; both vehicles are publicly traded, cover specific business activities, and ultimately facilitate financing in the energy industry.

Fibra Es are energy and infrastructure trusts operated by authorized banking institutions or licensed brokers. The trusts invest in a set of "promoted companies", which must be incorporated and pay taxes under Mexican law. Subsequently, Fibra Es issue trust bonds registered in the National Securities Registry and listed in the Mexican Stock Exchange. Both equity holders of the "promoted companies" and Fibra E bond investors will then benefit from the revenue generated by the "promoted companies". They will also receive a favorable fiscal treatment in comparison to conventional investment vehicles.[45]

"Promoted companies" are required to obtain at least 90% of their annual taxable income from a list of "exclusive business activities", which includes the generation, transmission and distribution of electricity.[46] The asset base in which the Fibra E invests must be mature enough to provide stable and predictable revenue flows to the bondholders. Existing gas pipelines along with transmission and distribution assets are ideal for Fibra E monetization due to their low-risk operation and long-term contracts.

Energy companies will be able to monetize their assets and raise capital through Fibra Es. This is particularly relevant in light of the decreasing capital expenditures in the Mexican energy sector. The Mexican Securities Industry Association estimates Fibra Es alone can generate additional investments worth 70 billion dollars by approximately 2020. CFE has already set the goal of raising 600 million dollars on existing transmission infrastructure during the first semester of 2016.[47] However, CFE will not be the only company monetizing electricity assets through Fibra Es. Private energy firms are also expected to benefit from this new financing mechanism.

IV. Power Sector Reform: Next Steps

In addition to the energy reform's current implementation status, policymakers, investors and the general public should not lose sight of the industry's medium and long-term trajectory. This section analyzes pending steps and actions that will shape Mexico's power sector for decades to come. Five major issues need to be addressed: preventing high levels of market concentration, financing and investing, addressing subsidies and decreasing electricity rates, diversifying the power sector, and implementing the Energy Transition Law.

Preventing High Levels of Market Concentration

Prior to the energy reform, CFE did not behave like a profit-maximizing enterprise: it routinely purchased Pemex's fuel oil regardless of cost, undertook electrification projects that were not market-driven, and had lenient hiring policies in some divisions of the company. As a vertically integrated utility,

CFE had no real incentive to alter its business model. This, however, will change as CFE unbundles and starts competing in a crowded market.

CFE's unbundling needs to be carried out in a rigorous and transparent manner. The international experience shows unbundling processes require proactive authorities.[48] In this regard, the Ministry of Energy and the *Comisión Federal de Competencia Económica* –Mexico's anti-trust commission– will oversee the process. Their objective will be to ensure low levels of market concentration by promoting competition within CFE's generation, distribution and retail divisions. Additionally, regulators must prevent the creation of market entry barriers by making sure the incumbent utility respects the Chinese walls between its different subsidiaries. Meanwhile, CENACE and the CRE will enforce and monitor cost-based pricing mechanisms in the wholesale electricity market. Their job will be to detect and penalize anticompetitive practices.

While the energy reform's short-term goal was to liberalize the Mexican electricity market, its medium-term objective should be to attract significant investments. However, CFE's unbundling alone will not attract sufficient capital, nor will it consolidate a competitive market. In order to do so, regulators must credibly guarantee a level playing field for all market participants, enforcing transparent rules and establishing effective incentives on an ongoing basis.

CFE must understand its unbundling process as an opportunity to focus on its most profitable projects. CFE's subsidiaries and affiliates will have to design and execute their business plans independently – increased flexibility will be essential to success moving forward.

As deregulation and competition push down prices, CFE will have to devise a strategy for its stranded asset base. The company will need to quantify its cost obligations and expected revenues in order to negotiate a strategy to recover unmitigated stranded costs from the government. Such a strategy might include deferred taxation, government credit, or asset securitization. This policy can provide stability and certainty to both CFE and market participants during the unbundling process.

Mexico has a poor track record in terms of market liberalization. Traditionally, the opening of specific industries has not resulted in lower market concentrations or tangible benefits for consumers, due to partial unbundling and economic barriers to entry. A win in the energy space would be a boon to Mexico but also a different result from previous efforts.

Financing Investments in Mexico's Power Sector

Another driver for investment in the power sector will be the number and quality of financing mechanisms available to energy firms. Mexico has not yet developed robust financing frameworks for small, medium and large companies. Domestic credit to the private sector as a percentage of GDP is currently at around 31%, a ratio that does not reflect the fundamentals of the Mexican economy and is low compared to the US (195%), OECD member countries (average: 157%) and emerging economies like Brazil (69%), Russia (59%), India (51%), China (142%) and South Africa (152%).[49] In order to boost credit in the Mexican economy, the government enacted a financial sector reform in January 2014.[50]

Power sector financing has become a top priority for Mexican policymakers, especially in the midst of government austerity programs and lukewarm economic growth. This concern drove authorities to unveil the Fibra E investment vehicle (discussed above) with much fanfare in September 2015.

Fibra E "promoted companies" cover most of the hydrocarbons and electricity value chains. However, the downside is that the mechanism favors mature assets built decades ago such as pipelines and transmission lines; this creates an indirect barrier to monetizing new renewable energy projects. Fibra E guidelines could be modified to level the playing field among all energy projects. Furthermore, the list of

"exclusive business activities for promoted companies" could include additional technologies like electricity storage, smart grid infrastructure, carbon capture and storage pilots and energy efficiency projects. This issue is not exclusive to Mexico's power sector. It is also currently being debated in the US Congress.[51]

Development banks also have an important role to play in Mexico's power sector, especially when it comes to renewable energy finance. International banks and financial institutions such as the Inter-American Development Bank (IDB) and the International Finance Corporation (IFC), and domestic development banks like the *Banco Nacional de Obras y Servicios Públicos* (BANOBRAS) and *Nacional Financiera* (NAFIN), have already bridged the financing gap for hydro, geothermal and wind projects in Mexican territory. Nevertheless, the demand for renewable energy financing has exceeded the supply of financial products currently available in the market.[52]

Mexico could decide to take CFE public in the next five to ten years, depending on the strength of its balance sheet, the company's growth strategy, and the will of the government. Many of its future competitors have far greater access to capital markets which could give them a competitive advantage. By becoming publicly traded, CFE could raise significant amounts of capital as other power utilities have done in the United States, Europe and Latin America. Moreover, the Mexican government could remain the majority shareholder of CFE. This is a politically sensitive issue, and if it were to pursue an IPO the government would have to clearly explain the benefits to the general public.

Addressing Subsidies and Decreasing Electricity Rates

From January 2015 to March 2016, monthly electricity rates in Mexico have decreased on a year-on-year basis. In March 2016, industrial rates plunged 15-23%, commercial rates dropped 4-13% and high-consumption residential rates fell 4%.[53] These rate decreases are the result of reduced fuel oil consumption, as well as increased hydro- and natural gas-based power generation. Once the wholesale electricity market starts operating, the power supply chain will become more competitive, spurring further efficiency gains and cost reductions. The question then arises: should cost reductions aim to lower electricity rates, reduce Mexico's subsidy burden, or partially tackle both goals?

The Mexican government has stated it does not intend to adjust the current subsidy structure –a stance that is politically safe but economically inefficient. Broad electricity subsidies are regressive and fiscally costly. When electricity rates are kept deliberately low, the market emits distorted price signals that artificially raise electricity demand and GHG emissions. [54] On the margin, electricity subsidies also deter potential investors from entering Mexico's power sector.

However, subsidies are unlikely to disappear in the short to medium-term. The energy reform's main selling point was the promise of lower electricity rates; therefore, the government will not allow rates to "float" in the foreseeable future. Nevertheless, authorities should design a long-term transition strategy. Once lower electricity rates are tangible and widely accepted throughout society, cost reductions can periodically and gradually offset subsidy outlays over time.

In order to benefit marginalized segments of society, the government could eventually replace broad electricity subsidies with focused transfers. A targeted approach would be much more effective than the current subsidy structure and could be implemented through tax rebates or via *Prospera*, Mexico's conditional cash transfer program. Furthermore, a leaner government could empower disenfranchised communities by financing a distributed generation program (small-scale PV) under clear net metering regulations. Communities would not only generate electricity to fulfill their needs they could also sell their surplus electricity to the grid. Such communities would become what are known as "energy prosumers".

Diversifying Mexico's Power Sector

A diversified power sector a) generates its power with multiple fuels and technologies; b) efficiently balances domestic and foreign sources of energy; and c) supplies its power through reliable assets in a redundant system. The implementation of Mexico's energy reform poses diversification challenges which will have to be addressed jointly by government authorities and the private sector.

Some industry analysts have expressed their concerns regarding Mexico's evolving fuel portfolio, specifically warning about the country's increasing reliance on natural gas. They recognize the current benefits of using cheap natural gas in generation processes; however, they argue fossil fuel prices are volatile and will not remain low in the medium to long-term. Natural gas skeptics criticize Mexico's "dash for gas" and infrastructure program for being shortsighted. Additionally, they underscore Mexico's growing dependence on US natural gas imports, which in 2014 accounted for 69% of total imports and 24% of national consumption.[55]

Mexico's energy matrix can –and should– benefit from affordable natural gas, as it will continue to push more polluting fuel oil-based generation out of the national market. Natural gas should be considered a "transition" or "bridge" fuel between carbon-intensive hydrocarbons and renewable energy. By mid-century, natural gas and renewables will compete for market share as the costs of the latter continue to decline. Since 2009, the levelized cost of solar PV and onshore wind generation has fallen by 60% and 15%, respectively.[56] The key to consolidating a balanced fuel portfolio is leveling the playing field for all technologies and establishing diversification parameters and backup protocols.

Another diversification challenge in the coming years will be enhancing the power grid's redundancy and resiliency. The Ministry of Energy has already identified thirteen congestion points in the national transmission network, and has also projected the interconnection of the Baja California Peninsula's isolated network to the national grid. This will be particularly relevant when recovering from natural disasters such as Hurricane Odile in September 2014 (due to redundancy issues, it took over two weeks to fully restore power services in the Peninsula).

Finally, the United States and Mexico can seize cross-border energy opportunities to strengthen and diversify their respective power systems, while also taking advantage of differences in in peak electricity demand in each country. From a North American perspective, both countries can plan and roll out integrated infrastructure (natural gas pipelines, transmission lines, and renewable energy systems), protect critical assets, create joint emergency protocols, and standardize human capital development programs.[57] This can boost the region's competitiveness and energy security, while guaranteeing that both countries benefit from the US's energy revolution and Mexico's energy reform.

Implementing Mexico's Energy Transition Law

The Energy Transition Law (LTE, for its acronym in Spanish), enacted in December 2015, was the energy reform's missing pillar. The LTE's main objective is to provide legal certainty for future renewable energy investments. By enacting this law, Mexico will not only strengthen its CELs mechanism, but also demonstrate it's committed to achieving its GHG emissions goals.

The LTE establishes binding non–fossil generation targets of 25% by 2018, 30% by 2021 and 35% by 2024. With respect to previous clean energy goals, the law ratified the preexisting 2024 target, but also established new short-term milestones. Additionally, the LTE sets an agenda for distributed generation, smart grid technologies, and energy efficiency measures.

However, the law has met strong opposition from certain energy-intensive industries (e.g., iron and steel). They claim the law's clean energy obligations are too stringent and costly for the private sector. Opponents of the law have advocated for deferred clean energy targets, reduced penalties for non-

compliance and the reclassification of natural gas as a clean energy source. In response, supporters of the LTE have argued that the targets are achievable, that penalties must deter non-compliance, and that natural gas cannot be considered clean since it is a GHG-emitting fossil fuel.

Since the enactment of the LTE, the Mexican Iron and Steel Industry Chamber (Canacero, for its acronym in Spanish) has filed an appeal challenging the constitutionality of the law. The judicialization of this issue can be regarded as both a power play and a delaying tactic. In line with international practices, authorities must uphold the energy reform's validity in court and enforce its provisions on the field. The timely implementation of the LTE is essential to harness Mexico's renewable energy potential, advance its climate goals and strengthen its credibility among fellow nations.

V. Reducing GHG Emissions in Mexico's Power Sector

In March 2015, Mexico became the first developing country to present its Intended Nationally Determined Contribution (INDC) before the international community. Mexico has committed to: a) unconditionally reduce its GHG emissions by 22% by 2030, or b) reduce its GHG emissions by 36% by 2030, contingent on a global agreement providing an international price on carbon, access to financing and technology transfer. Both pledges are relative to a "business as usual" trajectory that projects economic growth in the absence of meaningful climate change policies from 2013 onwards.[58] According to Mexico's INDC, net emissions in the country will peak in 2026 and will be halved by 2050.

For Mexico to fulfill its international climate commitments, authorities will have to effectively limit GHG emissions throughout the economy. However, special attention must be paid to the country's transitioning energy industry since energy production and use accounts for two-thirds of GHG emissions at a global level.[59] In this regard, the Mexican government must first formulate a broad sector strategy to abate economy-wide GHG emissions. Such a strategy would confirm or require reassessment of the power sector's current obligations (35% non–fossil generation by 2024). Subsequently, decision-makers would have to align, and adjust as necessary, policy objectives. Specifically, CELs requirements in the power sector must be designed to fulfill national clean energy targets. In turn, clean energy targets must make a sufficient contribution to achieving overall GHG emissions goals.

The International Energy Agency (IEA) has estimated the implications of reaching Mexico's INDC targets for the country's energy industry. By 2030, one third of total electricity generation would come from renewable sources and the share of fossil fuels in the energy mix would have declined by 10%. The IEA's forecast is roughly in line with the PRODESEN;[60] nonetheless, the former explicitly associates emission reductions to renewable energy, whereas the latter's definition of clean energy includes efficient cogeneration and nuclear energy. Furthermore, while the IEA estimates restructuring Mexico's power sector in accordance with its INDC goals would require investments for a total of $150 billion, the PRODESEN anticipates an investment of only $62 billion.[61]

Currently, there is no industry consensus about whether Mexico will reach its climate and clean energy goals.[62] The key to meeting the non–fossil generation target of 35% by 2024 will be effective enforcement of the CELs mechanism. A recent study commissioned by the *Centro de Estudios del Sector Privado para el Desarrollo Sustentable* (Cespedes) –the Mexican chapter of the World Business Council for Sustainable Development– concluded that harnessing the country's renewable resources efficiently would a) create 180,000 domestic jobs over the next decade; and it would have a greater impact on the Mexican GDP than developing the equivalent natural gas infrastructure during that same period.[63]

The Mexican power sector is already reducing its carbon footprint. The industry has cut its emissions consistently since 2012, and overall CO_2 emissions are expected to decrease by 18% from 121 million

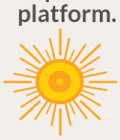
metric tons of carbon dioxide equivalent (MtCO2e) in 2014 to 99 MtCO2e by 2040.[64] Increased energy output and reduced GHG emissions will be possible thanks to the adoption of renewable energy and the phasing out of fuel oil (though this will be partially offset by natural gas-fired capacity additions).

Moreover, an integral approach to reduce energy-related GHG emissions should also focus on the hydrocarbons industry. Mexico is expected to increase its oil and gas production over the next decades, and it must do so under effective environmental regulation. To this end, the energy reform created the Agency for Safety, Energy and Environment (ASEA, for its acronym in Spanish), operating as a decentralized entity of the Ministry of the Environment. Among its responsibilities, ASEA will be in charge of regulating polluting emissions in the oil and gas sector. Furthermore, industry standards, targets and statistics should be clearly outlined and factored into Mexico's overall climate strategy.

Another key element of Mexico's climate efforts is the carbon tax introduced in 2014. This tax, which imposes a levy on fossil fuel consumption, generated approximately 540 million dollars in tax revenue for the government during its first year (the actual tax rate varies from one fuel to another based on its CO_2 content).[65] This tax has great potential, but needs restructuring. First and foremost, it needs to internalize the cost of emitting CO_2 through natural gas consumption –currently it's the only tax-exempt fossil fuel. Second, tax revenues should be directed towards clean energy projects as opposed to being funneled into the treasury's general fund. Third, the tax should form part of a broader GHG emissions reduction strategy.

VI. Recommendations and Conclusions

RECOMMENDATIONS & CONCLUSIONS

Reduce Mexico's coal, fuel oil & diesel generating capacity until it reaches a level where it is only used as backup or during emergencies. 	Implement the Energy Transition Law and comply with clean energy targets of 25% by 2018, 30% by 2021 and 35% by 2024 	Formally launch a geothermal "Round One" –a tendering process open to CFE and the private sector 
Set multiannual clean energy obligations for the CELs mechanism to foster greater investment in renewable energy projects. 	Eliminate the 15% tariff on solar panel imports. 	Evaluate developing a solar energy cluster to integrate domestic manufacturers and foreign investors; think of Mexico as a potential export platform. 
Restructure Mexico's carbon tax: a) make the tax cover natural gas, b) direct revenues towards clean energy projects c) make the tax part of a broader GHG emissions reduction strategy 	Refocus transmission and distribution investments from an "unlimited grid expansion" standpoint to an "efficient grid management" perspective 	Tap into the Universal Electricity Service Fund to install small-scale PV systems in marginalized areas; consider setting a minimum percentage for distributed generation projects 
Devise a strategy to recover CFE's unmitigated stranded costs, perhaps deferred taxation, government credit, and/or asset securitization 	Modify Fibra E guidelines to level the playing field between mature conventional energy infrastructure and new renewable energy projects 	Include the following technologies in the list of "exclusive business activities for Fibra E promoted companies": - electricity storage - smart grid infrastructure - carbon capture and storage - energy efficiency
Replace broad electricity subsidies with focused transfers, or empower communities by financing a distributed generation program (small-scale PV) under clear net metering regulations. 	Establish economy-wide binding energy efficiency goals (Mexico ranks last among the world's 16 largest economies in terms of energy efficiency).	Together with the United States, develop integrated energy infrastructure, protect critical assets, create joint emergency protocols and standardize human capital development programs 

Mexico's Power Sector Reform Timeline

Conclusion

It has been two years since the constitutional amendment of 2013 liberalized Mexico's power sector. Since then, the Ministry of Energy has published the PRODESEN and the guidelines for the wholesale electricity market, CENACE has become an efficient and independent institution, and CFE has been recognized as a State-Owned Productive Company and changed its board of directors. An unprecedented geothermal "Round Zero" was conducted smoothly and an ambitious power infrastructure program is starting to change the face of Mexico's energy matrix. In short, power sector reform implementation is on track and has so far been wholly satisfactory.

Nevertheless, economic liberalization reforms are long processes rather than single events.[66] Policymakers and the private sector must understand the on-going nature of the reform since the industry's most pressing challenges still lie ahead. Perhaps the most challenging of them all is consolidating a competitive, dynamic and transparent wholesale electricity market over the next decade. In many ways the market is the heart of the reform, as it will generate cost reductions and efficiency gains, determine long-term investment in infrastructure, and accelerate the uptake of renewable energy.

If reform implementation continues on the right path, Mexico will enhance its energy security over the next decade and beyond. The country's energy mix will become more diverse while supply chain redundancy and reliability will increase. Moreover, the power grid will evolve and become more resilient: it will be capable of incorporating distributed generation, energy storage, and electric mobility. Efficient market operations will also improve the country's energy security as industrial, commercial and residential consumers gain access to cheaper and cleaner electricity.

Mexico's power sector reform can contribute to the country's overall climate efforts. The industry has already set its sights on generating at least 35% of its electricity from clean sources by 2024. Reducing the energy industry's carbon footprint is necessary –though not sufficient– to achieving national GHG

emissions goals. In this regard, the energy reform is paving the way for Mexico to fulfill its climate commitments and reassert its leadership at the international level.

Endnotes

(Exchange rate: 16.6 Mexican pesos per 1 US dollar)

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[13] The reform grants the State exclusive rights to develop and operate nuclear power plants.

[14] Prior to the enactment of the reform, private investment in power generation was limited to five participation modes, non of which granted access to the electricity grid: 1) self-supply, 2) cogeneration, 3) independent power production, 4) importing and exporting, and 5) small-scale production.

[15] The *Programa de Desarrollo del Sistema Eléctrico Nacional* (PRODESEN) is the Ministry of Energy´s roadmap for Mexico's power sector towards 2029. By publishing this document, the Ministry has effectively replaced CFE as the industry's authorized planning entity. While this change may seem subtle, in fact it's highly relevant within the industry's new context; CFE can now focus exclusively on the company's growth strategy and the Mexican State has asserted its planning powers.

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- The treatment, refining, transportation and storage of oil; the processing, compression, liquefaction, decompression, regasification, transportation, storage and distribution of natural gas; the transportation, storage and distribution of oil products; and the transportation by pipeline and subsequent storage of petrochemicals.
- The generation, transmission and distribution of electricity, in compliance with the Electric Industry Law and its regulations.
- Infrastructure investment projects that include concessions, services or any other contractual arrangement executed between private parties and the government for performing services for the public sector or the final user, provided that such projects are currently in operation and have a remaining term of at least 7 years, in the following areas:
  a) Roads, highways, railways and bridges;
  b) Ports, maritime terminals and port facilities;
  c) Civilian airfields, excluding private ones;
  d) The expansion of the country's telecommunications network;
  e) Public safety and social reintegration;
  f) Drinking water, sewerage and wastewater treatment.
- The administration and management of the FIBRA E trusts.

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