Taking Mexico to full potential

February 2016
In collaboration with Bain & Company

This publication is the addendum to the World Economic Forum report “The Future of Electricity in Fast-Growing Economies”

Mexico’s economic growth over the past decade has been held back in some cases by the regulatory structure of some key sectors, including telecommunications, financial services and energy. To address these barriers and encourage the country’s economic development, Mexico has launched a series of reforms. In electricity, the reforms are guiding a transition from a state-owned electricity system to a new model that opens the door for private investment and multiple players in power generation selling into an efficient wholesale market. The reform will also ensure security of supply, improve competitiveness leading to affordable electricity prices for end-consumers, and contribute to achieve decarbonization goals. To ensure the viability of investment, Mexico is pursuing an integrated approach that supports development across the entire value chain and improves the flow of funds through the power value chain. Mexico will also need to ensure that the new market functions smoothly, enables appropriately attractive returns to investors and attracts the required scale of investment in conventional and renewable power.

In Mexico, power consumption has followed GDP growth at about 4% annually and both figures are expected to grow at about 3%-4% annually over the next 15 years (Figure 1). However, to encourage industrial and economic growth, Mexico wants to reduce its high electricity prices, which have typically run about 73% higher than industrial electricity prices in the US industrial electricity price – although Mexico has recently begun to close that gap.

Reducing electricity costs for industry, which consumes about 60% of Mexico’s electricity, is particularly important because it will help make the country more competitive in global markets. Mexico exports about 2.2% of the global total of goods but only 1.4% of energy-intensive goods because the high cost of electricity limits the competitiveness of those industries. Decreasing the cost of electricity for industry will increase Mexico’s competitiveness in domestic and international markets (Figure 2).

Figure 1: Mexico’s real GDP and power-consumption projections

![Figure 1: Mexico’s real GDP and power-consumption projections](image)

Note: Power consumption includes consumption across industries in Mexico (public sector), self-generation, losses and exports
Source: Economist Intelligence Unit; SENER; Bain analysis

Figure 2: Industry power price, composition of power-consumption composition and global competitiveness of Mexico’s energy intensive exports

![Figure 2: Industry power price, composition of power-consumption composition and global competitiveness of Mexico’s energy intensive exports](image)

Note: Energy intensive goods as defined by EU and US statistics units, and include goods according to HS classification system codes: 25-40, 47, 72-83; Analysis of energy intensive goods for top-10 global economies and Mexico
Source: IEA database; SENER; UN Comtrade; Bain analysis
Mexico’s state utility, CFE (Comisión Federal de Electricidad), directly owns 63% of the country’s power-generating capacity and coordinates much of the rest by dispatching the independent power producers that own another 20%. The rest of the country’s capacity comes from various industrial users and privately owned co-generation plants (Figure 3). The reforms aim to open the power sector for greater private participation, guarantee open access to transmission lines and gas pipelines, create an independent system operator, introduce more clean energy generation and ensure universal access to affordable electricity. While the reforms will not privatize CFE, they will allow it to leverage private support to enhance the entire power system, while also improving its efficiency and productivity. A key challenge of the reforms will be to ensure a market design that supports the development of competition with clear and transparent rules for all.

Figure 3: Mexico’s CFE owns 63% of the country’s power-generating capacity

<table>
<thead>
<tr>
<th>CAPACITY</th>
<th>PRIVATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective installed capacity (GW, 2014)</td>
<td>Capacity (MW)</td>
</tr>
<tr>
<td>Self-generation</td>
<td>65</td>
</tr>
<tr>
<td>Other generation</td>
<td>6</td>
</tr>
<tr>
<td>CFE</td>
<td>6,516</td>
</tr>
<tr>
<td>IPP</td>
<td>12,851</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PUBLIC SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (MW)</td>
</tr>
<tr>
<td>CFE</td>
</tr>
<tr>
<td>IPP</td>
</tr>
</tbody>
</table>

Note: “Other” series include Continuous self-use, Small producers and Exports; includes former Luz y Fuerza
Source: Prospectiva del Sector Eléctrico 2013-2027; CFE

The reforms, launched in 2013, have already begun to show positive effects. From January to May 2014, Mexico’s industrial electricity rate was 77% higher than the industrial rate in the United States. A year later, Mexico’s rates were 33% lower, only 18% higher than in the US. The reduction can be attributed largely to CFE’s ongoing initiative to convert power plants from oil to natural gas (Figure 4), a cost-saving move that also substantially reduces carbon emissions. CFE plans a large expansion of the national network of gas pipelines and conversion of seven plants by the end of 2016 and also plans nine new combined cycle power plants that will bring another 6 GW online. Since the energy reforms reposition the old state monopoly as a state productive enterprise (Empresas Productivas del Estado), it will have budgetary and management autonomy.

The price of fuel determines about 80% of the cost of electricity in Mexico, and some of the savings can be attributed to the country’s ability to tap into the abundant gas resources coming from US shale fields. As part of its reforms, Mexico intends to create an independent market for natural gas and invest $11 billion in gas pipelines between 2011 and 2018, to secure a reliable supply of low-cost fuel. In 2013, Mexico produced about 3.6 billion cubic feet per day (bcfd) of dry natural gas, a modest decline from the previous year as the state oil company, Pemex, focused on oil production. Mexico had about 11,342 kilometres of gas pipeline in 2012, about 100 kilometres for every million people. The US, by comparison, has about 1,600 kilometres for every million.

Figura 4: Power-generation in Mexico by fuel source

Mexico public service power generation by technology, TWh

Source: SENER
A key feature of the energy reform is the introduction of a wholesale market with new participants (generators, suppliers, traders, users of basic supply, qualified users and an independent state operator. The market is designed to create a competitive environment with clear and transparent rules to sell electricity without barriers (Figure 5). To make sure the market functions as designed, and that generators compete in an open and fair manner, the independent system operator, CENACE (Centro Nacional de Control de Energía), will operate the electricity spot market and the national electricity system by dispatching power and overseeing the operation of the transmission grid and general distribution networks.

Mexico aims to generate 35% of its electricity from clean sources (which include all renewables energies, nuclear, efficient cogeneration and CCS) by 2024 – up from 14% in 2013 – most of which came from hydroelectric sources. Wind, solar and geothermal offer great potential for Mexico. To encourage development of those sources, Mexico is launching clean energy certificates, which industry power users will have to buy from clean-energy generators.

**Figure 5:** Structure for Mexico’s new power market, with the independent system operator coordinating the market

Mexico is already approaching universal access, with 98.4% of the population able to access basic electricity, thanks largely to CFE’s mandate to ensure access. However, the reliability of electricity varies across the country and one of the reform goals is to ensure uniform high-quality access to power as Mexico’s population continues to grow and moves from rural to urban areas.

The grid remains under state ownership and, to increase the efficiency of the system, CFE plans to invest about $15 billion in transmission and about $18 billion in distribution by 2029. Between 2012 and 2014, modernization and general improvements reduced technical and non-technical losses from 16% to 14%. This was good progress but still significantly higher than the 7% average across OECD countries and in large part achieved by reducing non-technical losses (Figure 7). CFE wants to reduce losses to 10% by 2018.

**Figure 6:** Mexico’s renewable energy resources

Mexico is launching clean energy certificates, which industry power users will have to buy from clean-energy generators.
Figure 7: Transmission and distribution losses in largest fast-growing economies

Transmission and distribution losses share of generation, % (2012)

Note: Transmission and distribution losses stand for amount of energy lost during transmission and distribution, chart gives share of T&D losses of total power generated in the country; India losses for 2013-2014 fiscal year which ended on March 31 2014
Source: US EIA; India Central Statistics office; CFE
Key recommendations for Mexico

Mexico’s energy reforms promote key structural changes that open up new opportunities in the power sector. However, the degree of change will present considerable challenges for policy-makers, regulators and the business and investment communities who will all need to work together to transform the country’s electrical ecosystem. The country aims to invest $146 billion by 2029, with most of that going towards generation with natural gas and renewables, gas pipeline infrastructure and strengthening the distribution system (Figure 8).

Figure 8: Mexico plans to invest $146 billion in the electricity system by 2029

Source: Mexico Ministry of Energy (SENER) National Power System Development Plan (PRODESEN) 2015-2029

To attract the necessary capital, Mexico will need to finalize its plans for the power market and continue to signal policy stability to investors. There are critical roles for policy-makers, regulators and private businesses and investors across the value chain, in upstream roles (fuel, equipment and development), power generation, and transmission and distribution. Most of the eight best-practice recommendations highlighted in the global Future of Electricity report are applicable to Mexico, but in the short term power market stakeholders in Mexico should focus on three key recommendations.

1. In upstream, a viable market in natural gas is required to encourage stability and predictability that will attract the required investment to build out the infrastructure for bringing the supply of fuel to the power generators. The energy reforms allow private companies to build and own their own pipelines, and the private sector will be instrumental in meeting this infrastructure challenge under certain regulatory conditions:
   - Policy-makers will need to create incentives for new infrastructure for gas production and storage. Policies will need to create a truly transparent and competitive gas market with multiple producers and suppliers and a secondary gas transport market. The transparency and coordination of the gas and power markets will create the necessary signals for infrastructure to be built in Mexico on a long term basis.
   - Regulators will need to ensure that the new government agencies regulating and managing the gas market are aligned. In accord with the spirit of energy reform, they should continue to identify and remove redundancies in regulation, promoting simplification and homogenization in regulation. Creating an index of gas prices across Mexico will help create a domestic market in gas and decouple the country’s gas prices from the Henry Hub price in the US. Regulators also have a role to play in lining up anchor tenants for new and proposed pipelines, so investors and operators can estimate a predictable cash flow.
   - Policy-makers should encourage the creation of diverse financial instruments to increase the depth, robustness and liquidity of wholesale markets. The private sector should explore long-term contracts to tackle gas price volatility and market liquidity.

2. In power generation, Mexico should continue working on implementation of energy reform, in particular focusing on the following:
   - Policy-makers need to define clear targets for the generation mix and demand-side management.
   - Regulators should also finalize the outline of a clean energy market, detailing the criteria for clean technologies and specifying detailed bidding criteria.

Source: Mexico Ministry of Energy (SENER) National Power System Development Plan (PRODESEN) 2015-2029
before the launch of clean energy certificates that will be issued to renewable energy generators for the power they generate, and which many industry participants will be obliged to buy to support renewable generation.

- Regulators will need to structure the market and provide stability by setting minimum amounts for capacity and energy from suppliers in long-term contracts, and creating and calibrating the auctions for renewables. Regulators should create new institutions that will be responsible for monitoring the market operations and ensuring policy and regulation stability.

- Mexico’s energy regulator, Comisión Reguladora de Energía (CRE), has a large role to play also in eliminating or reducing regulatory barriers to investment in power generation and putting in place governance mechanisms that ensure independence from government and state-owned enterprises.

3. As in many other fast-growing countries, Mexico has much work to do restoring the viability of its transmission and distribution systems to make it more reliable and efficient while reducing loss:

- Mexico needs to adopt a “smart follower” strategy on new technologies, encouraging adoption of proven technologies that support its transmission and distribution (T&D) development and are within the scope of the energy system's financial capability. Policy-makers should also be seeking and creating opportunities for interconnections with neighbouring countries. They can also help coordinate the efforts of the various relevant government entities working to modernize and improve the country’s regulatory structure, which will also help the T&D network grow. Moreover, policy-makers could help manage demand by developing energy efficiency regulations that would begin to level out the growth of the country’s energy demand.

- Regulators have an important role to play in reducing the loss of electricity, both by encouraging the adoption of better technology and setting the precise mechanisms to minimize non-technical losses. They should also encourage sharing of best practices across the T&D network to improve efficiency and reduce operating costs, including higher participation of private players. Regulators can also improve the transparency and clarity of the tariff structure for the private sector.

- Businesses and investors have an important role to play in bringing in fresh capital that will deliver new technology and efficiency to the T&D system. Smart grids and other technologies that manage demand and outages, as well as customer management systems that can help reduce non-technical losses, are prime targets for investment. The private sector can be invited to contribute to Mexico’s T&D sector by engaging in public-private partnerships and other investment vehicles that tap less traditional pools of capital.

- Regulators need to simplify subsidies frameworks and ensure that they are targeted towards end-users that need them most.
References

9th five-year plan, Government of India Planning Commission
10th five-year plan, Government of India Planning Commission
11th five-year plan, Government of India Planning Commission
12th five-year plan, Government of India Planning Commission
Azzopardi, Tom. "Renewables takes 20% in Chilean power auction", Wind Power Monthly, December 17, 2014
Best practices in Public-Private Partnerships Financing in Latin America: The role of subsidy mechanisms, World Bank Institute, January 2012
Beták, Juraj et al. "Solar resource and photovoltaic electricity potential in EU-MENA region"
BNDES and Renewables, Brazilian Development Bank, 2013
Brazil Wind Report, IRENA
Coal data, BP Statistical Review of World Energy, June 2015
Codensa and Emgesa’s 1H 2014 Results
Company and market data, Bloomberg
Company and market data, Thomson Reuters
Company data, Comision Federal de Electrecidad
Comparative study on rural electrification policies in emerging economies, International Energy Agency
Corporate presentation: Financial area, The Brazilian Development Bank, June 2015
Dr. César Emiliano Hernández Ochoa, Connecting the Americas: Mexico’s Electricity Reform, North American Energy Forum Future of Electricity Workshop Roundtable, September 17, 2015
Electricity data, US Energy Information Agency
Electricity prices, International Energy Agency Data Services
Gandotra, Stuti. Peaking & Reserve Capacity in India, POWERGEN India & Central Asia 2015
Global trends in clean energy investment, Bloomberg New Energy Finance
Global Wind Report 2009, Global Wind Energy Council
Global Wind Report 2013, Global Wind Energy Council
Global Wind Report 2014, Global Wind Energy Council
IEA database, International Energy Agency Data Services
India solar irradiation maps, India Ministry of New and Renewable Energy
Informe Anual 2014, Comision Federal de Electrecidad
International trade data, UN Comtrade database
Investor presentation, The Brazilian Development Bank, 2015
Levelized Cost of Electricity data, Bloomberg New Energy Finance
Macroeconomic data, Economist Intelligence Unit
Mexico to Invest $11 Billion in Gas Pipelines, Distribution. Latin American Herald Tribune, 2011
New Masdar Institute Students Prepare to Innovate, Masdar Institute News, August 31, 2015
Population data, Euromonitor
Presentation Energy Access in Brazil, Prof. Suan’ Coelho CENBIO – Brazilian Reference Center on Biomass University of São Paulo
Programa de Desarrollo del Sistema Electrico Nacional 2015-2029 PRODESEN, Mexico Secretaria De Energia (SENER)
Programa Luz para Todos, Brazil Ministry of Energy
Projected Costs of Generating Electricity 2010, International Energy Agency
Projected Costs of Generating Electricity 2015, International Energy Agency
Prospectiva del Sector Eléctrico 2014-2028, Mexico Secretaria De Energia (SENER)
Provisional Coal statistics 2014-2015, India Ministry of Coal
Renewables 2015: global status report, REN21
Risk Briefing, Economist Intelligence Unit
Solar – India adds 453 MW in Q4 of FY 2013-14; Total addition in FY 2013-14 : 948 MW, RESolve, April 1, 2014
Stanway, David. “China installed wind power capacity hits 7 pct of total in 2014”. Reuters, February 12, 2015
The benefits of energy efficiency – why wait? Ecofys
The Brazilian Development Bank Investor presentation, 2015
The Global Competitiveness Dataset, World Economic Forum
Turkey overview, US Energy Information Agency
Turkey’s Energy Strategy, Turkey Ministry of Foreign Affairs
Wind power in Brazil-The wind potential is 250.000 MW, REVE (Wind Energy and Electric Vehicle Magazine), October 3, 2009
World Bank Open Data, World Bank
The World Economic Forum, committed to improving the state of the world, is the International Organization for Public-Private Cooperation.

The Forum engages the foremost political, business and other leaders of society to shape global, regional and industry agendas.