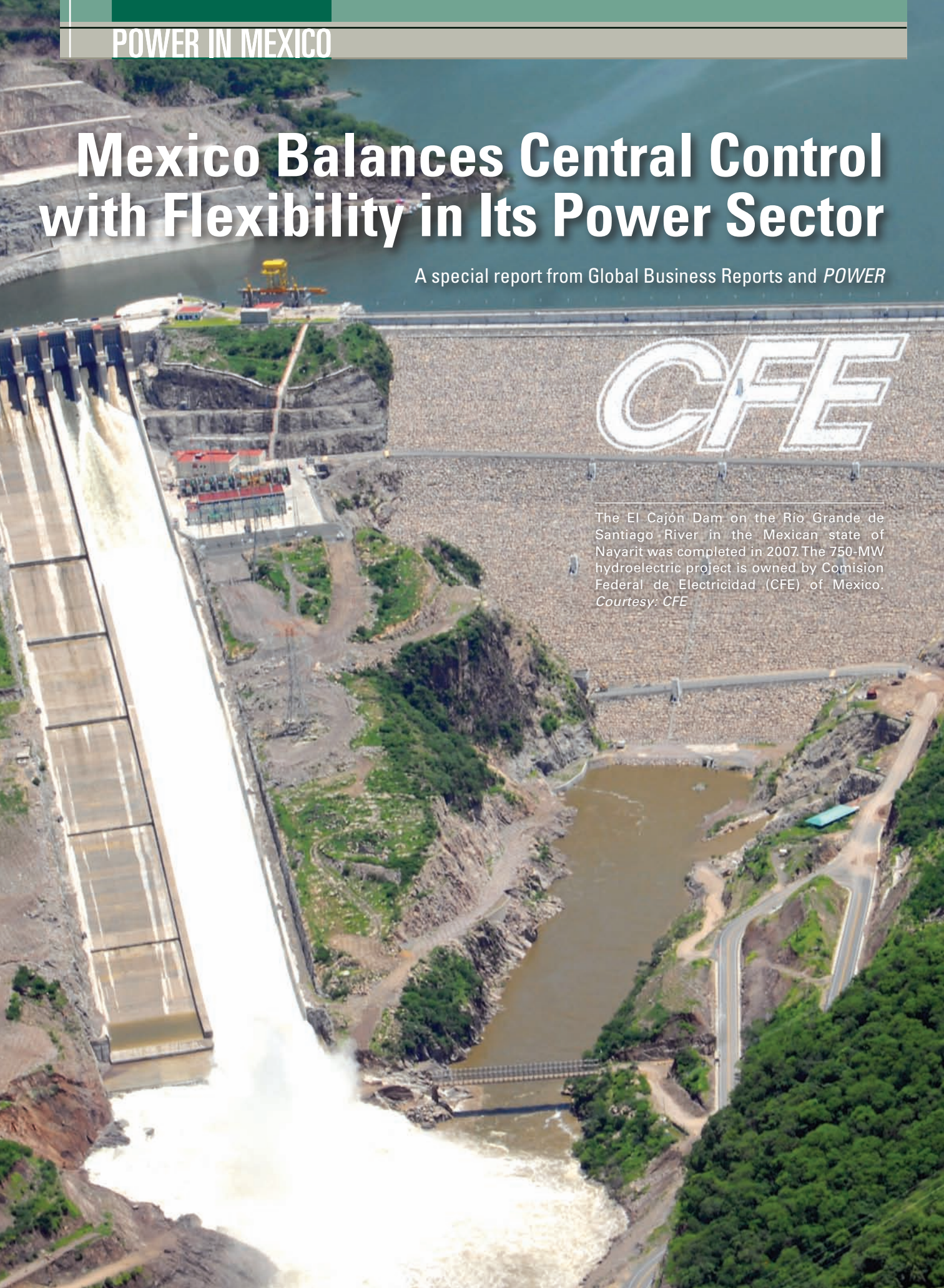
Mexico Balances Central Control with Flexibility in Its Power Sector

A special report from Global Business Reports and *POWER*



The El Cajón Dam on the Río Grande de Santiago River in the Mexican state of Nayarit was completed in 2007. The 750-MW hydroelectric project is owned by Comision Federal de Electricidad (CFE) of Mexico. *Courtesy: CFE*

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A Brief History of Mexico's Power Sector

Mexico, one of the few countries in Latin America that has resisted the tide of liberalization, retains a monopolistic state player in the electricity market. In treading its own path by maintaining the government's predominance in the sector, Mexico has an important question to answer: Is this path sustainable?

By Clotilde Bonetto and Mark Storry, Global Business Reports

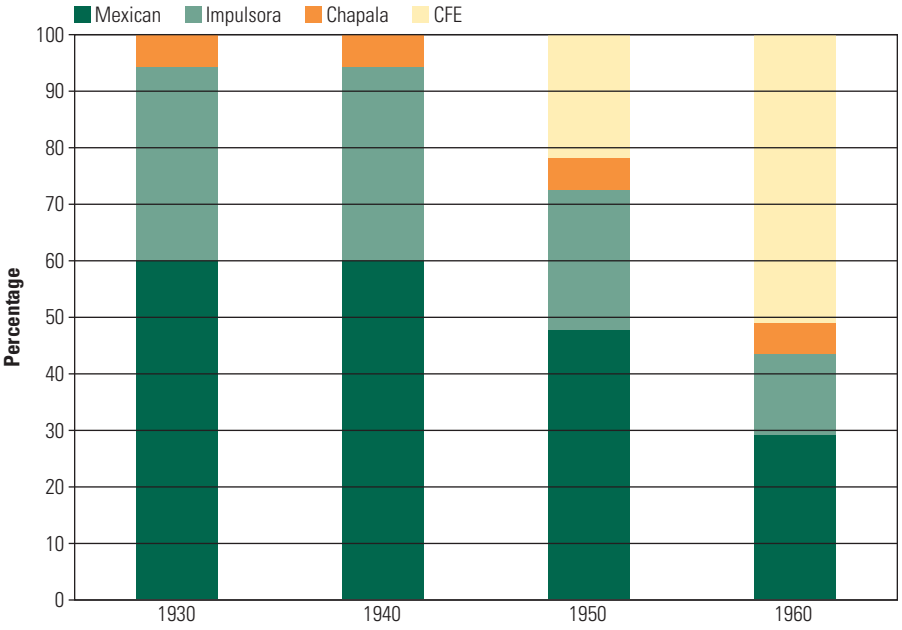
The Mexican electrical sector is federally owned, as is required by the constitution, with Comisión Federal de Electricidad (CFE) directly responsible for around 70% of all electricity produced in Mexico. Following its recent takeover of Luz y Fuerza del Centro (LyFC), the CFE controls 100% of the transmission and distribution network in the country. Few countries have maintained this level of government control over the industry. Private companies can only participate in specific tenders offered by the CFE.

The structure of Mexico's power sector reflects Mexico's radical revolutionary past and the dominance of the Partido Revolucionario Institucional (PRI), which came into existence under the guise of the Partido Nacional Revolucionario in 1929. This party was formed as an attempt to keep the various factions of the Mexican revolution together and to unite the country. The coalition comprises a wide variety of interests and political opinions, including a strong left-wing element. This left-wing influence led to the creation of the CFE in 1934 with the mandate of regulating the private vertically owned energy monopolies and also of supplying the areas that the private sector neglected due to their being perceived as unprofitable (Figure 1).

Throughout the 1940s and 1950s, the CFE slowly and steadily acquired regional concessions throughout the country. On September 27, 1960, under the administration of Adolfo López Mateos, the government fully nationalized the sector, and constitutional arrangements were enforced, making the state the sole producer, provider, and distributor of electricity in Mexico.

The concentration of the sector within state hands allowed for considerable planned expansion of energy supply during the 1970s. This expansion was fueled by the availability of fuel oil from Petróleos Mexicanos (PEMEX), which was provided at subsidized prices to the CFE. PEMEX's vast profits from high oil prices in the 1970s fueled the CFE's investments.

1. Percentage of new capacity by firm, 1930–1960. In 1960, when the constitution was changed to designate the state (CFE) the sole electricity producer, provider, and distributor, Mexican, Impulsora, and Chapala were all nationalized. *Source: SENER*



The final piece of the social puzzle involved subsidies on the price of electricity for the end user. Though these tariffs supplied relief to many lower-income families, they inadvertently subsidized higher-income households too. The thinking at the time, which continues today, is that electricity is a basic need and, as such, the state has an obligation to provide it at an affordable rate to its population. During the 1970s the CFE was very successful at expanding the reach of electricity to rural areas, and the number of households with access to electricity roughly doubled. Nevertheless, an estimated 6 million Mexicans remain unconnected to regular electricity today.

During the 1980s, Mexico, following the global trend, allowed increasing private participation in its economy; but electricity, together with hydrocarbons, remained firmly in the hands of the public sector. In 1992 the government allowed for the introduction of independent power producers (IPPs) with the reform of the Ley del Servicio Público de Energía Eléctrica as well as cogeneration and self-supply schemes. According to the Mexican energy regulatory commission, Comisión Reguladora de Energía, around 30% of the electricity currently produced in Mexico is by private sources, be that through autogeneration, cogeneration, or by IPPs.

Mexico's energy challenge is twofold. First, it must determine whether the state can continue to be the dominant energy provider or whether radical reform is needed in which the private sector takes a more prominent role. The second concerns the role of renewables

Interview with Estéfano Conde, CFE Communications Director

Q. Can you please give us a brief background of the structure and role of the Comisión Federal de Electricidad (CFE)?

A. CFE is a state-owned company headed by a chairman who is the secretary of the Board of Energy. There is a board which is headed by a director and who is appointed by the president. The current director has been serving for 10 years. CFE is a completely integrated company, and our duties include generation, transmission, and distribution.

Q. What are the challenges of having to supply electricity to everyone, regardless of profit viability?

A. This is a great challenge; it is one of the reasons why being state operated is important for us. The government is committed to supply electricity to every place. Thus the question of profitability becomes less of a priority. The government has to realize the social commitments that it makes with the people. At present our coverage of electricity is 98%, which is among the highest in the world. We have around 50,000 megawatts of installed capacity, and we are very close to 26 million users, which includes residential, commercial, agricultural, and industrial. At present, we have about 80,000 employees. Our net annual sales are close to $20 billion.

We have a pretty well diversified installed capacity, which ensures security in terms of continuous supply. Our geography and natural resources have enabled us to generate electricity from diverse sources, including hydro plants (which account for 20%), natural gas (which accounts for 30% of our total electricity generation), coal (which generates 10% of the total electricity), and nuclear (which accounts for 2%), wind, geothermal, and the rest is from fuel oil. But day by day, we are moving away from reliance on hydrocarbons because of the environmental constraints and costs.

Despite being a monopoly, we encourage competition inside the company between various divisions that leads to more efficiency.

Q. What future do you see for renewable energy in Mexico?

A. The president is completely convinced about the importance of renewable energy, and his administration plans to reach the 25% of total energy target to be produced from renewables by the end of his term. This will include large hydropower plants. Right now we are working on wind energy in the south of the country.

Q. How are you going to resolve the dilemma of your commitment to provide cheap energy and at the same time working on producing energy from renewables, which may not be able to compete on price?

A. Natural gas is cheap and clean, this is true. Certain challenges are associated with renewables. For example, if there is no wind, there is no wind energy. Renewables can work as complementary to other sources. Unfortunately, they do not have the full capacity to supply the energy on a baseload basis.

Q. How is the demand for electricity in the country evolving, and how you see it in the future?

A. Generally, you add 1.5% to the annual GDP growth rate, and that is our growth. For example, if the economy grows 3%, we need to grow 4.5%. In the last two years the growth was very slow, but before that our growth was around 6% annually. Year by year, we incorporate around one million new clients.

Q. Can you tell us about the challenges for the future in the CFE?

A. Energy security is the main challenge. We need to ensure a steady supply of the fuels that we need to generate for the future is available. Gas is going to be the main source that we will rely on. We know that the supply of gas has not been adequate from PEMEX; 50% of our gas is supplied by PEMEX, 30% we acquire from the gas pipeline from the U.S., and about 20% from our LNG [liquefied natural gas] facilities.

within the Mexican energy mix. Mexico's unique structure means that the CFE has an obligation to obtain energy from the cheapest source, and as renewables are in an incipient state of development and therefore expensive, this obligation makes it difficult for the IPPs to develop such projects and leaves the CFE itself little reason to encourage them. ■

*—Written and researched by **Clotilde Bonetto** (clotilde@gbreports.com) and **Mark Storry** (mark@gbreports.com) of Global Business Reports.*

Mexico's Generation Mix

Mexico enjoys considerable fuel diversity for powering its generating plants, and its goal is to become even more diversified.

By Clotilde Bonetto and Mark Storry, Global Business Reports

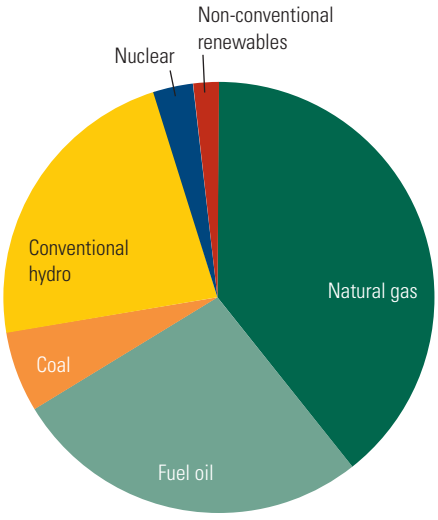
Mexico relies on combined-cycle plants, primarily running on gas, to supply its base load. As Figure 1 shows, natural gas is the most prominent energy source. The Comisión Federal de Electricidad (CFE) has invested considerable capital in converting its existing combined-cycle plants from running on fuel oil to running on natural gas.

This conversion to natural gas has encouraged investments in liquefied natural gas (LNG), resulting in the CFE becoming the largest shipper and consumer of LNG in Mexico.

To date there are three major LNG projects: in the cities of Ensenada, Altamira, and Manzanillo. The U.S. company Sempra Energy is operating a $975 million LNG receipt terminal that has the capacity to process up to 1 billion cubic feet of natural gas per day. The LNG is designed to supply the needs of Baja California, with the excess being sold to the international market. Regional Vice President, External Affairs of Sempra Mexico, Tania Ortiz Mena, argues that Sempra's role has been crucial in the regasification of Baja California: "California Baja has gone from being a gas importer to a gas exporter. We believe our inward investment, of around $2,000,000,000 just in infrastructure plays a major role in this."

Mexico is home to a 1,365-MW nuclear plant, Laguna Verde, which is currently being upgraded to increase its capacity by 20% (Figure 2). Enrique González, president and general director of Schneider Electric Mexico, is an advocate of this source: "Every year the technology gets better. It has significant benefits over fos-

1. Energy sources for Mexico's electricity generation. *Source: LVHS*



2. Laguna Verde. Located in Alto Lucero, Veracruz, this 1,365-MW nuclear generating plant is being upgraded to increase its capacity by 20%. *Courtesy: CFE*

sils fuels. I believe the country needs nuclear energy."

However, critics of nuclear expansion argue that there are still lingering doubts over safety and that the long lag time and the high upfront costs make it more difficult to justify on a financial basis. Andrés Flores Vargas, commercial director of General Cable Mexico, which supplied certain cable components to the CFE for the Laguna Verde plant, predicts further investment in nuclear generation in Mexico: "We supplied products for Laguna Verde, and one of the reasons we have massively expanded operations in Mexico is that we believe that there are growth opportunities here and not just in the nuclear area."

Unlike the U.S., Mexico neither has an abundance of coal reserves nor a large number of plants that run on coal. Coal therefore accounts for just 6% of all generation. Shigeru Watanabe, vice president of Hitachi Mexico, claims that the CFE intends to tender two 700-MW coal-fired plants in the future. He argues that after a long period of building combined-cycle plants there is a need for diversification in the type of power plants being built.

On the renewables front, large-scale hydro provides about 20% of all generation, but nonconventional renewables amount for a very small percentage—around 2.2%.

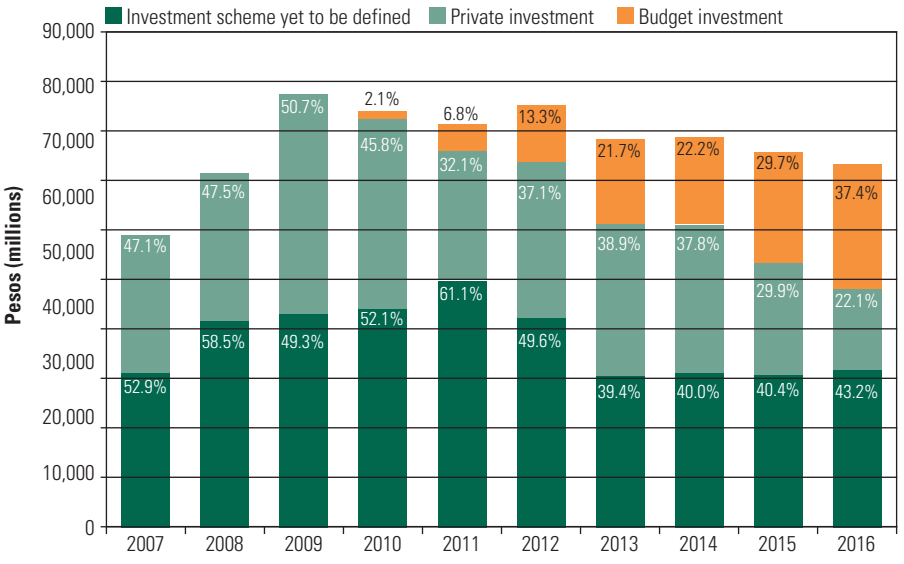
The Government's Role in Generation Development

The Comisión Federal de Electricidad is a special case. On one hand it considers itself a world-class organization and claims to work as if it were private. However, at the same time it has to fight off criticisms that it doesn't do enough to fulfill its social responsibilities. Local manufacturers demand more assistance, and approximately 6 million Mexicans lack access to reliable electricity.

Most market participants agree that CFE Director General Alfredo Elías Ayub's tenure has improved the CFE by increasing efficiencies and winning more independence for the state-owned company from the federal government. One of the changes that Ayub has introduced was opening up the bidding process for new generating plants to independent power producers (IPPs) in order to attract the participation of top international companies, although this move has arguably hurt local companies.

Ing. René Lechevalier, director general of Sepac, an industrial automation company serving both the CFE and Petróleos Mexicanos (PEMEX), says: "In the past,

3. Private vs. public investment in Mexico. *Source: CFE & LyFC*



CFE used to show more preference for domestic companies. However, in the last 10 to 15 years it has been partially open to other participants. True, there has been some degree of patronage towards national manufacture, but we have seen the disappearance of a lot of companies in the industry."

Independent Power Producers

Although the amendment to allow IPPs was passed in 1992, the first IPP permit was not awarded until 1997, when the U.S. energy company AES won a contract to build, own, and operate the 532-MW Merida III plant.

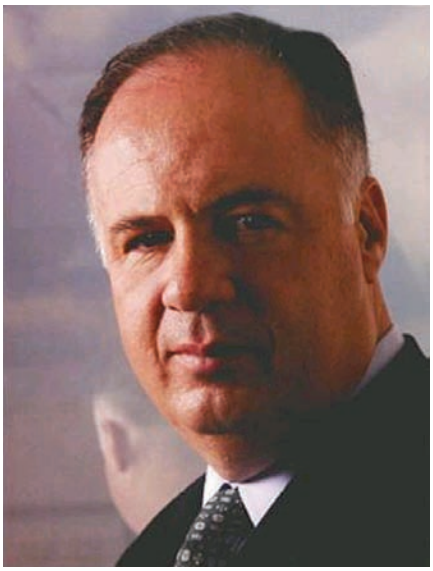
The IPP model was provided a fresh impetus in 2001 when President Vicente Fox of the pro-business Partido Acción Nacional ended 70 years of Partido Revolucionario Institucional (PRI) government. As of December 2009, IPPs operated around 11,450 MW of capacity at 22 plants, and 2009 was the first year in which private investment in energy exceeded public investment (Figure 3).

Mexico was able to attract world-class companies to bid in an extremely competitive process. Eduardo Andrade, corporate director for Latin America of the Spanish energy company Iberdrola, comments on the IPP process: "I believe that it has been successful as the bidding process is very competitive and open. IPPs have a clear set of rules to comply with and companies bid aggressively in order to win these contracts. The CFE benefits greatly because of this competition and they achieve efficiencies in terms of the end prices. The fact that contracts are for the long term allows us to be certain of the future. It helps us in financing the project and enables us ultimately to give the CFE a more competitive price."

Carlos Álvarez, vice president for Mexico of Intergen adds: "We accept it is a competitive market and we firmly believe that from a neutral perspective it has been a successful process."

Leading energy attorney and former head of the international legal department for PEMEX, Rogelio Lopez-Velarde, of law

Eduardo Andrade, general director Latin America, Iberdrola



Jaime de la Rosa notes that the entry of IPPs has been vital for the market and resulted in more than $25 billion of domestic investment in the sector.

Jaime de la Rosa, president of AME and president of Gas Natural Unión Fenosa México

firm LVHS, mentions that when Électricité de France (EDF) sold its Mexican assets, there were 55 bidders for the projects.

The IPP model has proved itself by bringing world-class energy companies to Mexico. Jaime de la Rosa, president of the Mexican Energy Association AME (Asociación Mexicana de Energía) as well as president of Gas Natural following its takeover of Union Fenosa, observes that the entry of IPPs has been vital for the market and resulted in more than $25 billion of domestic investment in the sector. The joining of forces between these two Spanish giants has worldwide implications and in Mexico pushes them into second place in the market behind Iberdrola.

Jaime de la Rosa, when speaking in his capacity as president of Gas Natural, claims that the purchase of Union Fenosa puts them in a very strong position in the market. It added more than 2,000 MW to their portfolio, which, when combined with the purchase of EDF assets previously, demonstrates Gas Natural's interest in the Mexican market. De La Rosa adds that the extremely competitive nature of the IPP bids and the relatively low internal rate of return means that only long-term committed players come to the market, rather than short-term speculators.

Intergen Mexico is the third-largest IPP player in the market, following its acquisition of Canada's Transalta's Mexican assets. Intergen now operates 2,211 MW of assets in Mexico. One of its largest facilities is the 600-MW gas-fired plant located in San Luis de la Paz, 500 MW of which are contracted under a 25-year power purchase agreement (PPA) with the CFE. The remainder is used by local partners under the cogeneration scheme.

Intergen also operates a 1,100-MW gas-fired plant located close to Mexicali in Baja California. About half of this energy is supplied under a PPA to the CFE, while the rest is supplied to the U.S. market. Carlos Álvarez explains that Intergen's critical mass along the border makes it possible for his company to export to the U.S.: "We own a transmission line which runs across the border and connects the power which we produce to the [U.S.] national grid. The main difficulty is for us is to access this very complicated but potentially vast market." The difficulty that he is referring to relates to the extremely convoluted energy tariffs, together with the need to extend transmission lines. He also believes that "There is potential to develop renewable projects here which will be exported to the Californian market."

In addition to these three large players, Mexico has two Japanese companies running IPPs: Mitsui and Mitsubishi. Though the Mexican market has seen considerable consolidation over the past few years, these Japanese companies have proven to be resistant. Tetsu Nagame, vice president of Mitsubishi Mexico, explains that Mexico is an important market for his company but that it has seen a reduction in projects over the past few years.

Japanese influence can be explained by the power of JBIC, the Japanese development bank, which encourages operations overseas. Shigeru Watanabe of Hitachi Mexico, believes that access to funding provided by JBIC gives them an important advantage over their rivals during the bidding process.

The presence of eminent global power companies is testament to the successful evolution of the sector.

International Players Optimistic

Daniel Galicia—president and general director of ABB for Mexico, Central America, and the Caribbean—is a veteran of the energy industry. He points to three main growth areas: nuclear, renewables, and the transmission network. ABB has a large presence in Mexico, employing more than 800 people, and is one of the major suppliers to the CFE. Galicia is firmly optimistic about operations in Mexico: "We at ABB have invested heavily in Mexico. The system might be different to other countries, but we have made money here and we will continue to make money here."

The presence of eminent global power companies is testament to the successful evolution of the sector and proof that, despite heavy state involvement, there are real possibilities for private ventures. As Mexico's energy sector evolves, it will offer more opportunities in a wide variety of areas, and the government will be looking to the private sector to help it realize its ambitions. ■

*—Written and researched by **Clotilde Bonetto** (clotilde@gbreports.com) and **Mark Storry** (mark@gbreports.com) of Global Business Reports.*

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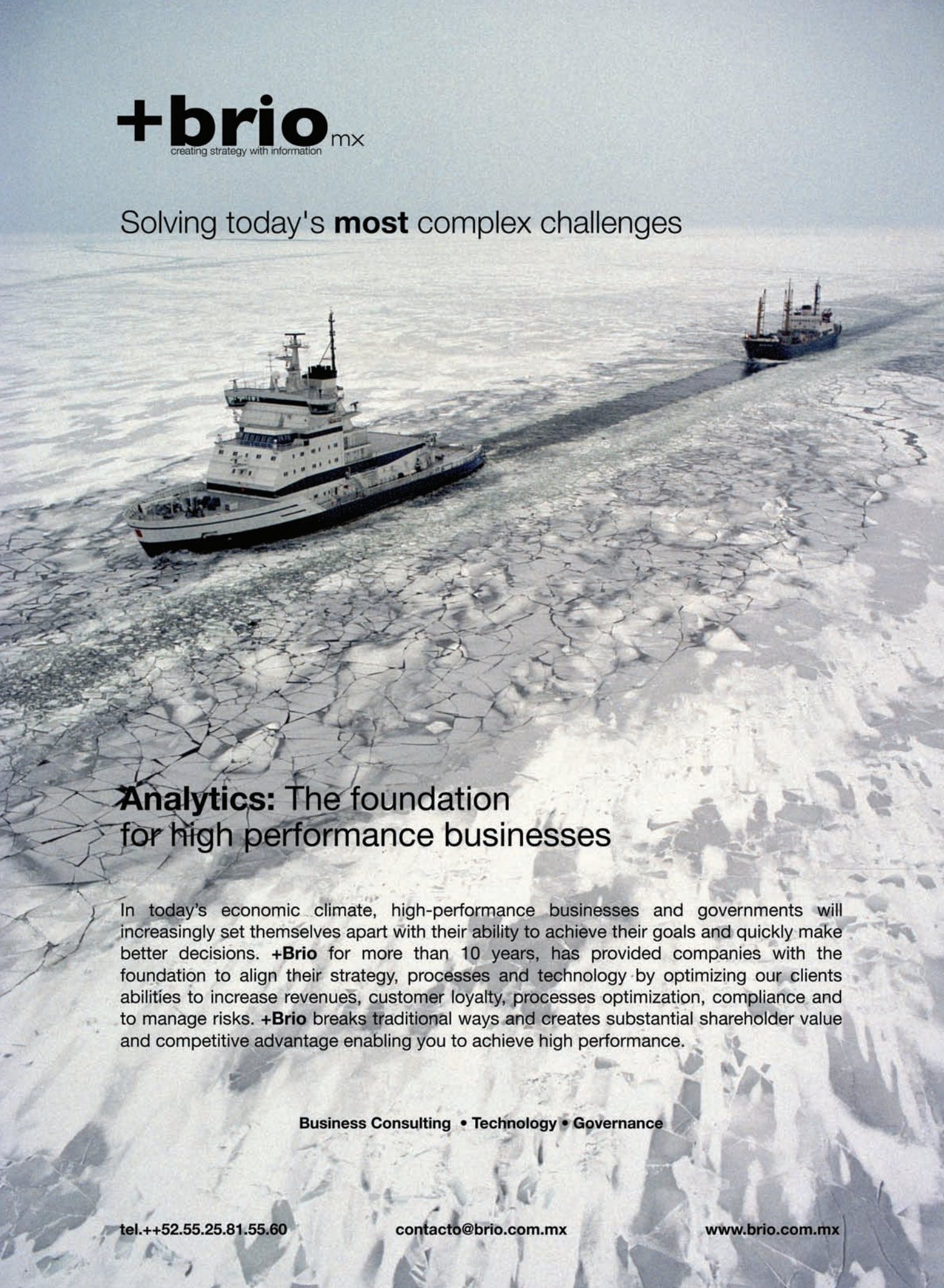

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Renewables Remain More Desired than Real

Mexico has already developed substantial large hydro and geothermal resources. However, without policy changes and government-sponsored financial incentives, unconventional renewable sources are taking the equivalent of baby steps.

By Clotilde Bonetto and Mark Storry, Global Business Reports

"Renewables" is on the tongue of every Mexican politician and business leader; however, talk hasn't yet transformed into action. The energy mix remains dominated by natural gas and petrol (gasoline), and there has been no dramatic increase in the use of renewables. Alberto Escofet, formerly director general at the Comisión Federal de Electricidad (CFE), argues that renewables are very important but that it is difficult to expect countries such as Mexico to spend excess resources on what many still consider to be a luxury. While the U.S. and Europe may have the wealth to do this, Mexico cannot afford the penalty that more expensive energy would have on its industry.

Having said this, many in the sector do see renewables as the future. Giovanni Aloi, director general of GE Energy Mexico, argues that renewables are an area that his company can profit from and a key strategic aim for GE Energy: "GE Energy Mexico intends to invest considerably in building a Class 1 turbine factory in Mexico, aimed at serving both Mexico and exporting the wind turbines overseas. We are also working on wind turbine technology and trying to increase the efficiency."

However, apart from this investment by GE Energy, Mexico has many projects in development but few actually operational. There is certainly potential in Mexico, especially for wind energy, but various factors—most noticeably the lack of specific subsidies for renewables and the important obligation of the CFE to supply energy at the cheapest price, which prices out the majority of renewable energy options—hinder development.

Luis D'Acosta is director general of SEL Mexico (Schweitzer Engineering Laboratories), a multinational company that has developed complete product lines for the protection, control, automation, measurement, and monitoring of electrical power systems. He says: "Renewables aren't necessarily quite there yet. At the moment we are focusing our energy on our expansion to the U.S. and the services we offer to the CFE, but we expect [renewables] to be a growth area."

1. Independent wind. The CFE is initiating wind projects Oaxaca II, III, and IV in La Venta park, which will have a combined generating capacity of 304.2 MW, generating average annual net electricity of 1,129.29 GWh. They are operated under the independent power producer model. The Spanish company Acciona was awarded the three new projects, for presenting the lowest cost per kilowatt-hour compared with its competitors. *Courtesy: CFE*

Alejandro Ramirez, director general of Geo-Productos Mexicanos, a construction and engineering company, argues that there are three main drivers for the growth of renewables: the public, the government, and the opinion makers. The increasing interest of the public in the renewables sector will drive the two other factors and lead to a growth in renewables, he believes.

Government Aid for Renewables and Energy Efficiency

So far, there is no price subsidy, feed-in tariff, or other such interventionist help from the Mexican government to encourage renewable energy generation. Some elements of the government are, however, active in promoting renewable projects.

Francisco Xavier Salazar Diez de Sollano, president of the Comisión Reguladora de Energía (CRE), a regulator of the private electricity and gas industry, mentions that the CRE has changed certain price signals for renewable projects so that they can compete better with conventional fuels: "So what this new legislation did is to take into account the externalities of different technologies. By taking into account that fossil fuels have an impact on the environment (they produce greenhouse gases), they should cost more than the mere accounting cost which is currently attached to them. Renewable energies on the other hand, offer price stability, which is a positive externality. The idea is then to take into account the real economic cost of generating electricity from these sources, not only the accounting cost, but the social cost. If you take into account these factors, of course renewable energy is very competitive. These kinds of assessments are to be performed by the ministry. Based on the planning of the sector this will enable more renewable projects."

In addition to the CRE, Fideicomiso para el Ahorro de Energía Electrica (FIDE), an

innovative trusteeship for energy saving and efficiency, is very active in bringing together the private and the public sector. Its purview extends to helping small and mid-size enterprises increase energy efficiency by developing an energy efficiency culture in an oil-rich country.

Yolanda Valladares Valle, general director of FIDE and formerly social development manager for Petróleos Mexicanos (PEMEX), explains: "With current financial conditions our message of energy efficiency is even more relevant. Energy efficiency can save companies money, save resources, as well as [have] beneficial effects on the environment." She also highlights that reducing carbon emissions means more than just working on renewable energy. It also includes using other resources more efficiently.

Arturo Echeverria, president of Rolan Aislantes Minerales, a mineral fiber producer working both with the CFE and with PEMEX, concurs. He argues that sustainability and reduction in consumption could work hand in hand with investment in alternative generation sources, but he fears that the government is more focused on media-friendly wind farms (Figure 1) than insulation and other efforts that could reduce demand.

He also points out that the tariffs (rates) are working directly against government policy by encouraging higher usage: "The CFE is promoting energy consumption, whereas other countries, and even our own current administration, is talking about savings in consumption." He argues that this spending on subsidies for electricity is bankrupting the government and working directly against government sustainability policies.

Rodolfo Flores, marketing and product manager for Lumisistemas (owned by Philips) also compliments the work of FIDE as important for the country but points out that the minimum wage in Mexico is 56 pesos ($4) per day, and Mexico has considerable problems with poverty. It is very difficult to persuade such workers to invest even a day's wages on an efficient light bulb when they need to sleep, eat, and live off that money.

Wonderful Wind Resources

Wind is seen as having the greatest potential of all the nonconventional renewables in Mexico. Eduardo Zenteno, president of Asociación Mexicana de Energía Eólica (AMDEE), the Mexican wind association, argues that the potential in Mexico is more than substantial. He predicts that if plans go ahead, by 2013 the State of Oaxaca, located in the south of Mexico, will have the largest cluster of wind generation in the world. He mentions that wind energy potential in Oaxaca is around 30% higher than average elsewhere; thus, unlike other areas, it can compete on price without a government subsidy.

Jorge Fernandez Wilburn, director general of Sectrol DPH, an engineering company aiming to specialize in renewable energy, which is working with Iberdrola Ingeniería y Construcción at La Venta II wind farm, states: "I cannot imagine another place in the world where there is such a concentration of generated power in such a small single space."

Dana Younger of the International Finance Corp. (IFC), when speaking at the Platts 13th annual Mexican Energy conference last November, predicted that 3,800 MW could be developed between 2009 and 2014. He went on to argue that the growth in wind in the Oaxaca region has largely been driven by the self-generation projects of the private sector.

The largest of those is the EURUS project consisting of a 250-MW wind farm using 167 1.5-MW wind-turbines operated by Acciona Energia, the Spanish energy giant, which is designed to meet the needs of CEMEX, a Mexican multinational focused on cement

production. The energy is sold to CEMEX through a 20-year self-supply agreement, and the total project is estimated to cost $560 million. Long-term financing for this was partially arranged by the International Monetary Fund, which has taken a strong interest in renewables in Mexico.

Miguel Angel Alonso, the general director of Acciona Energia Mexico, believes that the advantage for the client is that, "Once it is financed, wind energy is a powerful hedge against fossil fuel costs."

However, despite the wind strength in Oaxaca, wind energy in Mexico will never be a baseload energy source, and despite all of this potential, until 2008 only 88 MW of wind energy had been developed in Mexico.

Perhaps the biggest challenge for anyone wanting to develop wind energy projects in Mexico is the need to maintain relations with local communities. Jaime Martínez, general director for ERM Mexico, a provider of environmental and social consultancy, states that the Mexican market still has some way to go in terms of dealing with the environmental and social impacts of wind power. Certain international companies have had to learn this the hard way.

Jorge Fernandez Wilburn worries about the difficulties of developing projects in Oaxaca: "Projects have been developed in the state of Oaxaca, which is not industrialized at all, thus making it hard for companies which come from very developed countries or even cities within Mexico such as Mexico City."

Oaxaca is one of the poorest regions of Mexico and in the past energy companies have had problems in trying to bring on board the "ejidatarios," the communal land owners in the Mexican system of the "ejidos" (communal farmlands assigned in small portions to the villagers to be farmed under a federally supported system of communal land tenure). The creation of wind farms can certainly bring increased development during the construction phase and through ongoing maintenance of the wind farm. The IFC estimated that a 100-MW wind farm would bring in an income of $300,000 per year for an "ejido" of 300 families. However, this $1,000 per family is a tiny percentage of wind farm's potential profits, and thus locals worry that they are simply being taken advantage of.

In addition, the skills needed to construct and maintain a wind farm are not the skills in which Oaxaca is traditionally strong. Another worry is that the energy produced will largely, although not totally, be transmitted to the center and the north of the country, where private demand is higher, rather than providing for local needs.

Mexico is lucky enough to have renewable resources all over the country, as well as the exceptional resources located in Oaxaca. However, in these alternative areas wind power faces the worldwide question of competitiveness. Mexican firms face a low internal rate of return on wind projects due to the obligation to sell to the CFE. A lack of appropriate financing resources and an unsuitable transmission grid add to their troubles. To begin with, as mentioned previously, demand for wind projects is largely private sector–driven and located in the center and north of the county. Oaxaca's existing transmission grid is inadequate for the load, and the CFE, having a monopoly on the transmission network, has had little incentive to invest in private projects.

Transmission Trials

Due to the nature of the Mexican constitution, it was extremely difficult and expensive for

Energy Reform: Fostering Renewable Energy

By Rogelio Lopez-Velarde and Amanda Valdez

Attorneys Rogelio Lopez-Velarde and Amanda Valdez, Lopez Velarde Heftye y Soria

Following a long and thorough debate in October 2008, the Mexican Congress approved a series of reforms to the legal framework of its oil and gas industry and renewable energy sources. Although most comments and reports have focused on the changes to the statutes regulating PEMEX and the oil and gas industry, we should also pay attention to the new challenges and opportunities that this reform has brought to the renewable energy field.

Renewable energy projects are still incipient in Mexico. Mexico is a Non-Annex 1 country in the Kyoto Protocol and, as such, it has benefited from investments in Carbon Development Mechanism (CDM) projects. Investments are regulated by a series of administrative rules adopted over the last few years and implemented by the Inter-ministerial Commission for Climate Change (Mexico's national designated authority), responsible for the approval procedures concerning CDM projects, including those involving renewable energy sources. However, it wasn't until October 2008 that a statute specifically regulating renewable energy was enacted: the Law for the Use of Renewable Energies and the Financing of the Energy Transition (the "Renewable Energies Law").

The Renewable Energies Law is intended to foster renewable energy projects, provide financing tools, and promote the progressive substitution of fossil fuel generation. It will be initially applicable to the following sources of renewable energy: wind power, solar power, hydropower, seawater power in its different forms, geothermal heat, and biofuels. Other sources may be added to the list as determined by the Ministry of Energy.

Throughout 2009, the executive branch issued and implemented a number of regulations, administrative fiats, and energy policy instruments, primarily aimed at promoting the efficient use of energy and increasing the participation of renewable energy projects in the country's installed generation capacity. These include the publication of the *National Strategy for the Energy Transition and the Sustainable Use of Energy* and the *Program for the Use of Renewable Energies,* whereby the following goals have been set for 2012: increasing the participation of renewable energy sources in the country's total generation capacity to 7.6% and increasing the participation of renewable energy sources in the country's total power generation to a range of 4.5% to 6.6%.

Moreover, the Mexican Energy Regulatory Commission is now working on a new model Interconnection Agreement for the interconnection of renewable energy projects to the national grid and a new "postage stamp" methodology to determine the charges payable to the Comisión Federal de Electricidad (Mexico's electric power utility) for the wheeling of power generated by renewable energy facilities.

It is yet to be seen if the tools that this new legal framework provides will be sufficient to substantially increase the participation of renewable energy sources in the overall Mexican electricity sector, but there is no doubt that these are important steps toward that goal.

private companies to invest in their own transmission grid. So Mexico has the problem of exceptional renewable energy resources but no ability to exploit them. Eventually, helped by the hard work of AMDEE, the wind association headed by Eduardo Zenteno, a deal was reached between the public and private sectors. The cost was shared between the two, largely picked up by the private sector, with ownership remaining in public sector hands. This agreement on transmission has opened the doors for investment in Oaxaca, and it is rapidly gaining momentum. Dana Younger of the International Monetary Fund predicts an explosion of international interest in Oaxaca once a core capacity of 500 MW is reached.

Arturo Benavides, general manager of Zetrak, a transformer producer, sees the growth spurt as partially attributable to the expansion in the transmission sector. He also believes that there could be even more growth opportunities in the future if certain changes are made: "We see considerable demand for our transformers in the transmission sector; however, the lack of regulations is slowing the country down." Benavides' company began in his backyard but has opened a consolidated new facility and is expanding its three existing factories.

Financing Equipment Means Currency Challenges

Like most emerging markets, Mexico also has to face the problem of currency risk when purchasing equipment. The major wind turbine manufacturers are based in Europe or the U.S., thus liabilities would be in dollars or euros, while local income would be in Mexican pesos. Although the peso has been relatively stable, especially in comparison to the early 1990s tequila crisis period, any potential currency fluctuation adds risk to a wind energy investment.

The nature of the technologies involved means that a large down payment is needed to purchase the equipment, later to be followed by small interest payments for the energy. This situation may be resolved with GE Energy's plans to build a Class 1 turbine factory, which would produce the necessary products for the Oaxaca region.

Zenteno argues that two things are needed to make wind energy outside of Oaxaca consistently profitable: higher oil prices that remain high and the government introduction of strong measures to subsidize renewables.

Solar Struggles to Gain Traction

Solar energy is very much an emerging technology in Mexico. Solar companies haven't developed at the same rate as their wind equivalents, but the industry remains bullish. Mexico does have potential, especially in the south of the country, but to date only 18.5 MW of photovoltaic energy has been installed, with a growth rate of around 1 MW per year.

Dr. Ernestina Torres, president of Asociación Nacional de Energía Solar (ANES), the national solar association, is optimistic. She believes that Mexico still has more than 6 million people without reliable access to energy, many of them in remote rural locations off the grid. Solar energy can't compete economically with a combined-cycle plant, but it can compete in terms of its ability to be sited close to loads. Additionally, due to the relatively small size of the sector today, Dr. Torres sees potential high growth rates for entrants in the future.

Peter Eschenbach, business development manager of ERDM Solar, says that since the Spanish government reduced its subsidies in the solar sector, global demand for solar panels has dropped dramatically, and his company is able to purchase products for considerably cheaper than previously, helping the profitability of solar in Mexico.

Dr. Torres' optimistic view of the sector is warranted at least by the success of solar water heater companies such as Frantor, located in Arandas, just outside of Guadalajara. Frantor is headed up by Hector Franco, who explains that solar water heaters have been widespread in Mexico for more than 30 years. They directly convert solar energy into heat, rather than into electricity, thus maximizing efficiency. Victor Hernández, project manager at Frantor, claims that the payback on solar water heaters for domestic users is 17 months. "People think that solar is just for the rich, the privileged, those who have the resources and want to give something back. What we are doing in Frantor is showing that people can save money using solar. We want to prove that solar is for everyone," says Franco, who intends to target the U.S. market next.

Well-Established Geothermal and Conventional Hydro

In terms of installed capacity, conventional hydro is Mexico's largest source of renewable energy, contributing around 22% of Mexico's installed capacity, the vast majority of which is operated by the CFE. The largest plant is a 2,400-MW facility located in the State of Chiapas on the Grijalva River. This facility ranks among the top five largest plants in the world.

Mexico's hydro capacity was largely developed during the 1970s, and the CFE has already developed those sites with the highest potential, leaving private players little area to operate anything except mini-hydro projects, with around 83 MW under development.

One company intending to change this is Grupo Carrión, headed by entrepreneur Fransisco Carrión. Grupo Carrión imports top-of-the-line offshore hydro generators. Then it signs 10-year long-term contracts with its clients, principally hotels and heavy manufacturing companies, promising them the advantages of being associated with both clean energy and lower electricity bills. Grupo Carrión currently has 10 MW of signed contracts, but it has an ambitious target of installing 3,000 MW within Mexico and Central America.

In regard to geothermal sources, Mexico currently has an installed capacity of 964.5 MW, which ranks it among the top five worldwide. This large installed capacity has been made possible by the fact that Mexico's boundries encompass the edges of tectonic plates. The majority of this is sourced from the 720-MW Cerro Prieto plant located in Baja California (Figure 2). The CFE also plans to tender out another plant in Baja California in 2010.

In terms of geothermal and large hydro, the CFE has been able to exploit the natural resources Mexico has relatively early, so that in geothermal and hydro the CFE has already exploited the best regions, meaning the two technologies are strong and mature in Mexico with less potential for development than other areas.

Biogas Potential

Mexico is relatively new to using biogas sources, but there have been discussions about projects in Mexico City, and there is one relatively advanced project in Monterrey. Jaime Luis Saldaña, director general of Seisa, one of Mexico's most successful energy service companies specializing in providing self-generation solutions to clients both in Mexico and abroad, says: "We are working on a 17-MW biogas plant which will provide electricity to important public services such as the metro and street lighting. This project is very exciting as it is a joint venture with the public sector, which could be used as a model for the rest of Mexico."

Last Call of Kyoto

As mentioned above, Mexico is a non-Annex 1 country in the Kyoto Protocol and thus can

2. Geothermal field. According to *Industrial News,* the 720-MW Cerro Prieto Geothermal Power Station in Baja California, Mexico, will be expanded to 820 MW by 2012. The plant currently operates 13 generating units equipped with turbines ranging from 25 to 110 MW that were manufactured by Toshiba and Mitsubishi. *Courtesy: CFE*

benefit from CDM programs and the sale of carbon credits. The CDM market in Mexico and worldwide has suffered from the credit crisis. As financial conditions have tightened, it has been extremely difficult to finance CDM projects in Mexico. The Copenhagen round also cast a shadow over the future, but market participants remain bullish.

Mexico's Ministry of the Environment (SEMARNAT) launched the Program GEI Mexico (Gases Efecto Invernadero), a national program on greenhouse gases emissions with roots in the private sector. This program aims to help participant companies position themselves to take advantage of environmental technologies designed to reduce greenhouse gases (GHG) as well as provide training courses on emissions, and aims to raise awareness of GHG's ecological impacts. With this heightened awareness and the change in administration in the U.S., certain market players see the advantages of developing renewable products in Mexico, with potential to sell carbon credits into an eager U.S. market.

Eduardo Piquero, country manager for MGM International, a project development, investment, and commercialization firm, argues that a major market movement has been the development of a cap-and-trade precompliance market in California, which is open to projects developed in Mexico.

Francisco Carrión of Grupo Carrión, told us that a potentially profitable section of his business will come from using the CDM mechanism: "We believe that the added advantage of selling carbon credits will add to our profitability. It is a difficult mechanism to get involved in; we will have to invest time and money, but it can provides us with another revenue source."

Francisco Salazar, president of the CRE, mentions that many developers of renewable projects in Mexico will take advantage of the CDM mechanism: "The users are those that also apply for carbon credits, which will enable them further to benefit from the use of renewables."

However, having taken this into account, Mexico is behind where it should be in the CDM mechanism. Mexican energy companies have been slow to benefit from the opportunities it offers. ■

—Written and researched by ***Clotilde Bonetto*** *(clotilde@gbreports.com) and* ***Mark Storry*** *(mark@gbreports.com) of Global Business Reports.*

A Regulatory Framework with Little Flexibility

Mexico's federal government retains almost total control over who builds and owns what electricity infrastructure. But if you know how to work within the strict constraints, it is possible to engage in profitable projects.

By Clotilde Bonetto and Mark Storry, Global Business Reports

Article 27 of the Mexican constitution states that the electricity sector is of strategic importance for national sovereignty and that therefore the state, via the vertically integrated Comisión Federal de Electricidad (CFE), should hold a monopoly over the public service of electricity. Originally, this meant that only the CFE could generate electricity, own transmission lines, and distribute electricity to the general population. During the 1980s, when oil prices fell, Mexico looked at reforming the sector to increase the role of the private sector; however, reform didn't arrive until the 1990s.

Reforms in the early 1990s allowed the private sector to participate in the power generation industry in four ways:

- Via the independent power producer (IPP) process, whereby bids are tendered out by the CFE.
- By cogeneration or self-supply, whereby a company needs to own a stake in the production company or be co-owner of the power production facility to furnish its own electricity needs.
- Private producers can produce power for export, as do Sempra Energy and Intergen in Baja, California.
- A rarely used exception for projects less than 20 MW.

The IPP and cogeneration approaches are by far the most important.

Beyond power generation, companies can participate in other aspects of the electricity sector via the Obras Publica Financiada (OPF), which allows private companies to become involved in public works.

Pros and Cons of IPP Projects

In 1992 the Mexican government, then under President Carlos Salinas, amended the Electricity Public Service Law (Ley del Servicio Público de Energía Eléctrica) to allow for further participation of the private sector. The IPP program that he initiated allows private companies to both build and operate power plants in Mexico, on the condition that the resulting electricity must be sold to the CFE.

In Mexico there is no open market; private companies cannot simply come in and build a plant. Instead, they need to wait for a tender by the CFE, bid, and then, if successful, the plants normally sign a 25-year power purchase agreement (PPA). Then, depending on the exact nature of the contract, ownership will normally shift to the CFE. The CFE also retains a call option on the development.

One of the advantages of the IPP program is the CFE's good reputation in the financial markets—together with the long-term build, operate, and transfer nature—means that the project financing can be spread over 25 years and that companies can be sure that they will be paid on time and in full.

Estefano Conde, communications manager in the CFE, explains that the CFE is rated BBB by Standard & Poor's. The bidding process normally lasts about six months before the winning bid is declared, and the entire process is generally considered to be extremely competitive. Potential entrants to the sector need to be sure of their financing before submitting a bid and, due to financial conditions and financial institutions' desire to spread their risk, it is unlikely that a single bank will underwrite the risk; a syndication is more likely. Due to the difficulties of financing in the current climate and the high number of bidders, those who have access to international financial markets will be at an advantage.

Shaving Peaks with Cogeneration and Self-Supply

The cogeneration (co-ownership) and self-supply system allows an enterprise to "opt out" of being supplied by the CFE and instead generate its own electricity. This can be as simple as buying a generator or involve more complicated structures whereby the customers are required to hold a nominal share of a generation company.

The way that the tariffs are structured in Mexico means that peak hour industrial usage is expensive, which encourages many large consumers to move toward generating their own electricity.

Juan Carlos Quintero, country head of Wärtsilä Mexico, a specialized power plant developer, observes that his company has seen an increase in interest in their cogeneration plants specifically for peak hour use.

Francisco Haro, director general of Ottomotores, a subsidiary company of TT Electronics PLC, specialized in manufacturing and distributing generating sets and commercializing uninterruptible energy systems, argues that, rather then being a backup in the case of blackout or brownout, his product can out-compete the CFE on price: "What we have seen is that with the peak cost of energy, many people are using a genset as a way of 'self consumption' [sic]. Due to the high cost of this peak energy, we worked out that a genset can actually pay itself back over a period of two to three years." Haro believes that this lack of competitiveness is due to a lack of investment in infrastructure by the CFE.

Fernando Calvillo is CEO of Fermaca, a company with more than 40 years' experience in the development and construction of infrastructure in Mexico's key sectors, focusing on natural gas transformation systems, oil product terminals, and power generation plants. He maintains that the CFE has some good intentions in terms of investments—for example, its planned move toward natural gas—however, it needs more resources for investments in pipelines, which would make CFE's electricity more competitive. For the time being though, cogeneration is an attractive option.

A major barrier to the profitability of cogeneration is, however, the unique nature of the Mexican constitution that decrees that cogeneration schemes cannot sell excess energy to the grid; they must use it or lose it.

High Hurdles for OPF Projects

The OPF is a part of the Proyectos de Impacto Diferido en el Registro del Gasto (PIDIREGAS) scheme, which has been the main mechanism for private sector entry into the energy industry in all tenders except for IPPs. OPF schemes are fixed price construc-

CFE A World Class Company

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Interview with Alfredo Elias Ayub, Director General of the CFE

Q. The Comisión Federal de Electricidad (CFE) is widely complimented as a world-class organization. What measures have you taken during your 10-year tenure to better the CFE?

A. We have taken a number of measures. Firstly, to modernize and improve our infrastructure. About one-third of our infrastructure is new and one-third has been recently refurbished. Thus around 70% of the infrastructure incorporates the latest technologies. Secondly, all of our operations are now under SAP [Systems, Applications and Products in Data Processing] control. Thirdly, and most importantly, we have reached agreements with our union on training. We have increased our number of training days from 6 to 11 per year, which is above the national average. We have even opened our own university, situated across 14 campuses, where we train our staff to be better engineers and better managers. The universities started some time ago; they are mainly distance courses on technical subjects. We have around 1,500 people training for engineering degrees as well as 1,000 studying for master's courses. So better infrastructure, better management, and better people have been three key reasons for our success.

Q. Over the course of our research we have seen the difficulties of local companies participating in CFE projects via both the OPF [Obras Publica Financiada] and IPP [independent power producer] schemes. What steps is the CFE taking to promote the participation of local companies?

A. We talk a lot with Mexican companies. We certainly want them to play a role in the sector, but we see that it is difficult for them in terms of financing. We are encouraging them to go to the stock market to raise equity. For transmission lines under OPF we do have a requirement to source 40% of final output with Mexican participation.

Q. The CFE was created to provide energy to the whole population regardless of the profit motive. What steps is the CFE taking to provide service to the 6,000,000 Mexicans currently without access to electricity?

A. I don't believe that it is 6,000,000 people; here in Mexico 97.5% of the population have access to electricity. Once you reach that number it gets very difficult to increase the percentage, as there are constantly new people starting new homesteads in very remote areas. It is very difficult in any country, even in Europe or the U.S., to reach that 100% figure. In the last 10 years we have undertaken a lot of electrification for rural and ethnic minority communities. We have gone into more than 3,000 small towns in this period.

Q. Renewables are seen as a great growth area, especially wind resources in Oaxaca; however the CFE's mandate demands that it supply energy at the cheapest price. What have been the CFE's main activities in renewables?

A. We are increasing our installed capacity in renewables; for example, we are working on a large hydroelectric project as we speak. Just today we will announce a 100-MW wind project in Oaxaca. We fully intend to continue on this front. We will continue looking for good projects and continue developing them. We will even support some private projects within the renewables sector.

Q. What are the main new projects the CFE are constructing and what effect will they have on the generation matrix [mix]?

A. We have several projects which could potentially be constructed, principally combined-cycle coal plants and thermoelectric projects. We are also deciding whether we should develop another nuclear plant, a decision which will be taken soon. We have noticed in the U.S. a choice has been made to develop some nuclear plants, so it is certainly something which we have to consider.

Q. The liquidation of Luz y Fuerza del Centro had a great effect on the Mexican electricity sector. What does this move imply?

A. Operations are working well within this area. We have started to rehire certain people, including ex-LyFC workers. In the central region we have connected more than 110,000 users, and we expect that to increase in the future. We will start making the investments this year to bring the central region up the level of the rest of the country. In my opinion, it is going well, and I remain optimistic about the future. We intend to introduce new concepts in the central region, which we hope will bring our service up to the next level.

tion projects whereby the project developer receives a payment upon completion when ownership is passed to the CFE. Due to the high cost of such projects, most companies cannot manage this off their balance sheets, meaning that they need access to financing to bid for an OPF.

Unlike some contracts issued by Petróleos Mexicanos (PEMEX), the CFE generally issues contracts in U.S. dollars. One of the main criticisms of the PIDIREGAS process is that the CFE sets very high tender conditions for entry, so although it has been successful at attracting world-class companies, it has been considerably less successful at attracting local companies to bid or even in encouraging joint ventures. Critics also argue that the same problem emerges with general contracts with the CFE, which is that there is a selection of "preferred bidders" who remain close to the CFE, and it is difficult for outsiders to join them.

The OPF only generates assets for the bidder once construction of a specific asset is complete, so a very strong balance sheet or access to credit are required. Ygor Guilarte, managing director of Yokogawa Mexico, argues that "The CFE is extremely strong financially speaking. Its strength allows it to execute its own projects without resorting to external funding from suppliers." The CFE's financial strength allows the company to dictate very tough terms to its would-be suppliers.

Subsidies: A Sacred Cow

The Mexican federal government provides considerable subsidies on the final consumer cost of energy. This strategy was designed to share Mexico's oil wealth among the population. Traditionally, the resulting CFE deficit on the federal budget has been financed by the huge profits of PEMEX, the state monopoly in the hydrocarbons and petrochemicals sectors.

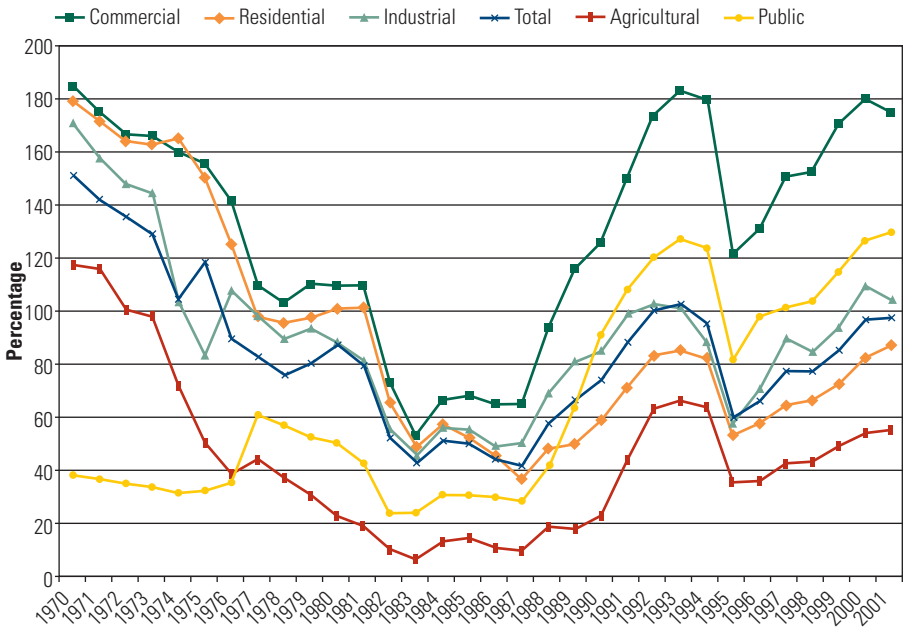
Electricity tariffs are set by the Secretaría de Hacienda (Treasury Department). As the tariff is set so close to the government, it is also very difficult to lower or cancel this tariff due to the political cost associated with doing so. As Figure 1 shows, these tariffs have fluctuated with the price of oil anticyclically. The prices for household and for agricultural use, both of which directly affect voters, are the lowest.

Potential Reform

While investment opportunities in the energy sector may be limited by the role of the large state monopolies (CFE and PEMEX), there remain opportunities to invest—providing that the investor understands the Mexican market.

Diana Sasse and Alberto Silva, lawyers at Goodrich, Riquelme y Asociados, a full-service legal firm with more than 75 years of

1. Mexican electricity rates as a percentage of U.S. rates. *Source: CFE-SENER*



experience, argue that although Mexico may have a more closed environment in both electricity generation and oil and gas, the multinational companies that come to Mexico understand this and also see that there nevertheless is money to be made in Mexico.

Guilarte, one of the leading authorities on the Mexican energy sector, as noted above, concurs: "There are still opportunities in Mexico. Sometimes the press overlooks the positive projections and great potential of Mexico in the near future, especially in business, which can be quite profitable. Mexico is a modern nation and one of the best choices to invest in Latin America." He then goes on to specify that the CFE is consistently changing and improving facilities, so despite the regulatory restraints and the absence of a solid reform plan on the table, he remains firmly optimistic.

Despite arguments that the state-owned CFE would struggle to compete in terms of efficiencies with world-leading energy companies and deters private investment, the reality is that, as is the case with PEMEX, there is very little chance of changes being made to the constitution to enable much more private competition in the near future. This is a topic that is considered too dangerous for an administration even to discuss due to the political fallout that such moves would undoubtedly entail. The last major attempt was made in 1999 by President Ernesto Zedillo, who backed a radical bill attempting to privatize the majority of plants and unbundle the sector. Both this and the later attempt by President Vicente Fox to introduce legisla-

tion specifying that electricity was a commodity and not a public good, failed and caused considerable political damage to their instigators' political careers.

There are, of course, voices calling for reform. Juan Carlos Machorro, partner at Santamarina y Steta, speaking in a personal capacity, argues, "Ideally reform of the electricity sector should be part of a deeper structural reform in Mexico. This package should include reform to both the electricity and the oil and gas sectors. Mexico should allow for more direct and free access for the private sector. If we can't have direct involvement of the private sector within the market, we should at least have increased internal competition, such as splitting up the CFE into regional bodies. This would still be nationally owned, but would add elements of competition and certain elements which it currently lacks such as efficiency and transparency."

Adrián Escofet, consultant at Alesco Consultores, which offers strategic advice to both national and international players wishing to enter the energy market, advises that the CFE will continue to be the dominant force in electricity generation in Mexico in the near future and that anyone who wishes to come into the Mexican market must understand this. Any reform that allows the private sector further market access will not result in the CFE simply disappearing; it is too strong and entrenched for this to take place. It will remain the largest player in the generation market. An addition of private sector players could reduce the necessity of the state to invest in energy generation; however, it is unlikely that it would result in a lower cost for the end consumer.

Escofet's father, Alberto Escofet, a former director general at the CFE as well as a government minister, argues for the creation of merchant plants. These merchant plants would be privately owned and operated and, rather than have long-term PPAs, they could compete on a free market, only operating when they could compete on price.

Alternatively, Eduardo Andrade, corporate director for Latin America of Iberdrola, one of the largest players in the IPP market, argues, "I wouldn't agree with the need for radical reform to this system. It provides a cheap way of financing projects for Mexico while providing the private sector with a role."

At the time of writing, there is no plan for serious reform of the electricity sector. President Felipe Calderón's loss of a majority in parliament means that it relies on the Partido Revolucionario Institucional (PRI) to pass legislation, and the PRI remains close to the CFE (and SUTERM, the union of the CFE) and is unlikely to back radical changes to the status quo. ■

Alberto Escofet, CEO, Alesco Consultores; former undersecretary of energy and CEO of Luz y Fuerza del Centro and the CFE

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Three Keys to Success for the Service and Manufacturing Sector

NAFTA was both good and bad for Mexico. In both cases, it required a different approach to doing business, and the effects of that shift are still playing out.

By Clotilde Bonetto and Mark Storry, Global Business Reports

Mexico is home to both very strong local players and a full array of multinational service providers from around the world. Since the North American Free Trade Agreement (NAFTA) was signed under President Carlos Salinas, Mexico has been forced to open up its economy and integrate with international markets. This treaty influenced greatly, for better or for worse, the Mexican economy.

Carlos Gottfried, president of Potencia Industrial, an electrical motor producer, details the background of Mexican economic policy: "The government was pursuing an import substitution policy, together with an active policy of building up Mexican expertise throughout all sectors, but especially in core industries such as electricity and the oil and gas field. It is my belief that these policies were very successful. The country grew extensively. It did present some problems, such as high outlay for imports, and there was a cost to the end consumer, but this was balanced out by the huge advantages to Mexican companies. If you were producing quality goods at a reasonable price, you could grow. This situation was radically changed in the late 1980s by the growing influence of the Chicago School economists within the Mexican administration. These U.S.-educated bureaucrats came back [to Mexico] with ideas of laissez-faire capitalism and the free market. When Carlos Salinas came to power in 1988, he told us that he would introduce these free-market ideas slowly over his six-year term. In fact, within six months the border was open and Mexican firms began to suffer. They closed down 200,000 Mexican companies, four and a half million Mexicans lost their jobs, and industry suffered. Many of these skilled workers moved permanently to the U.S., seriously damaging the Mexican economy."

Others would argue that it became easier to invest in Mexico, and while NAFTA opened up Mexican companies to compete with the best and most experienced global companies, it also opened the international market to Mexican companies.

Rogelio Lopez-Velarde, lawyer at LVHS, argues: "My opinion is that the NAFTA agreement forced the liberalization of the electricity sector, and the fact that it came from an external rather than an internal driver is something overseas investors need to consider."

Felipe Ochoa, chairman of Ochoa y Asociados, explains the impact of NAFTA on energy projects: "Until 1994, when we signed the NAFTA agreement, there was a strong participation of local firms, both in construction and the engineering and design of energy projects. Previously, most of the engineering and design took place within the ministries; they had very strong teams for these activities. After NAFTA many of these teams were dismantled, so we lost a lot of this capacity."

This transformation is what makes the Mexican environment unique. The movement from a national, inward-looking economy where Mexican companies were protected from international competitors and enjoyed the active support of the

government, to an environment in which Mexican service companies were left to sink or swim, was radical and painful. Although the advent of NAFTA meant that the cheaper manufacturing costs in Mexico proved advantageous in certain circumstances, Mexican labor is not cheap when compared with that in Vietnam or China. Mexican entrepreneurs are well aware of the dangers of relying on price to remain competitive. This puts Mexico in a difficult situation: How can it compete in the global economy when it can't compete with East Asia on costs or the U.S. on technology?

As Fernando Calvillo, CEO of Fermaca, a gas pipeline company, explains, "There is a lot of potential in Mexico. We have 5,000 kilometers of land bordering the U.S. and an internal market of 114 million people. We are an integral part of NAFTA, and we have free trade agreements with many European and Asian countries. Mexico is a land of opportunities." The proof of this statement is demonstrated by a large number of Mexican service companies that have learned how to grown and prosper under the new conditions.

Innovation

Some Mexican firms have been able to adapt or enter into partnerships with international firms to help them meet the new market realities. Indigenous technologies are quite limited, and a foreign partner can supply the innovative edge. Rolmex, an example of a successful Mexican company now operating in Brazil, Columbia, and Venezuala as well as domestically, provides additives-based solutions to the CFE and PEMEX. Rolmex General Manager José Luis Chávez says, "If you want to work in Mexico, you need a local partner—not just a local supplier or consultant, but someone who will share the risks and rewards with you."

According to Santiago Barcón, director, Power Quality and North America for Arteche, "Mexico hasn't been at the forefront of innovation in the past. If you look at the statistics you can see that Mexico has to do better in terms of innovation, in terms of research, and in terms of investment in knowledge. I'm very clear in my view that the best way to combat the current recession is to promote innovation." He insists that investment in innovation has been key to the growth of the local company Inelap, which Barcón cofounded and nurtured before teaming up with multinational Arteche.

Mexican companies don't have the resources that U.S., Japanese, or European companies have to produce groundbreaking products, but they can advance specific niche markets. By focusing their

innovation capacities on these areas, certain Mexican companies are thriving.

Raul Reyes is general manager of PESS (Power Engineering Services and Solutions), a startup company using proprietary developed high-tech equipment to repair turbines and other electrical equipment. PESS is located adjacent to the Tecnológico de Monterrey (a leading university) within a technological cluster. Reyes believes that the clustering effect has helped his business: "Every company offers service, quality, and price. We need to offer something more. We have an R&D department to specifically look at clients' problems and our location close to so much concentrated knowledge is certainly a great advantage."

Carlos Mortera, general manager of Grupo Omni, a company specialized in the design and manufacture of cooling towers with last-generation technology materials, is also located close to the Tecnológico de Monterrey. He proudly states: "One of the key strengths of Grupo Omni is our commitment to investment in research and design. We have three international patents. Not many of our rivals can match us on this, and it is a fundamental reason for our success." Mortera adds that his company is focusing on high-tech towers and compliments Reyes' insistence on R&D by pointing out that Monterrey has seven world-class universities, meaning that it is both easy for him to find staff and to find synergies with nearby companies.

Exports

Another significant challenge facing the manufacturing sector in Mexico is the need to take advantage of the freedoms NAFTA offers—together with the change in policies introduced by President Vincente Fox and President Felipe Calderon designed to liberalize and increase competition in the economy. Mexico's huge domestic market, protectionism, together with the massive purchasing power of the CFE meant that many manufacturers traditionally looked inward.

Francisco Haro, managing director of Ottomotores, believes that one of the biggest challenges for firms like his is to cultivate an export-oriented culture: "Until around 10 years ago, Mexico wasn't an export-oriented country; it didn't have the appropriate infrastructure to help companies like us who want to export overseas. For example, should I wish to ship a product overseas, it would cost me considerably more and take considerably longer than a company based in the U.S. or Europe. This makes it more difficult for companies like us to compete in the global economy." He goes on to say that while the country is improving, "Mexico still doesn't have an export-focused culture; we still have a lot to learn."

Jorge Lozano, president of Prolec GE, a world-class transformer producer, believes, however, that the climate is changing: "In Monterrey we are forming mentoring groups whereby large companies can advise smaller companies on all ways of running the business, including the export market." Lozano points out that NAFTA offered opportunities for Mexico, as is demonstrated by the fact that GE closed three transformer factories in the U.S. while expanding capacity in Mexico. He goes on to argue that Mexico needs to realize it faces competition from low-cost manufacturing locations and it needs to focus on tailor-made products, rather than commodities.

Venezuelan Ygor Guilarte—president and director for Mexico, Central Ameri-

ca, and Venezuela of Yokogawa—concurs with Lozanos' view and sees Mexico as a potential Latin American leader. He highlights how Mexico has benefited Yokogawa: "Mexico is the core of the region due to NAFTA's advantages, such as the *maquila* model, which will allow us to manufacture cabinet automation equipment in partnership with our global suppliers, which have their factories near us. Hopefully, by next year we will export to South America from here, creating more jobs and following the Mexican model of consistent high-quality standards and added value."

Value

Mauricio García, general manager of CMS International, a Mexican company that manufactures and markets valves and regulators for gas-related solutions, notes that some Mexican companies are focused on price, concentrating on being the low-cost supplier to U.S. companies. Garcia says that before he became general manager, CMS International used to offer its key product, the LOBO, on discount to boost sales. "What we needed to do, and what we are doing now, is to invest and build up a product so that we are able to compete on quality, not just on price," he says. He also reiterated his intention to reopen his company's research department to further these aims.

Ygor Guilarte, director of Yokogawa Mexico, and **Arturo Carrillo,** managing director of Cimaltec

This attention to looking at long-term value is a challenge that the Mexican service sector needs to rise to. Manuel Gomez, general manager at SYSCE argues: "Mexican companies focus on buying and selling, not on investing in the product. Mexican companies need to think more how they can make money in the long term, rather than making a quick profit."

Gerardo Maltos and Manuel Gomez, cofounders and CEOs of SYSCE

Times have changed since the sector was nationally dominated and relatively static. Now successful companies need to be fast-moving. The CFE has a world of potential suppliers, and it is those who offer best value that are most likely to succeed.

Ricardo Arratia, director of Brio Mexico, one of the key advisers to the CFE top management, says, "The CFE went through some considerable changes in order to try to become a world-class company. Since these changes you need to offer them quality as well as value."

Felipe Martin, director general at Kobrex, a specialist cable manufacturer and part of LM holding company, concurs: "All products which are supplied to the CFE need to be evaluated by their internal testing lab to be approved. There is no point trying to cut corners or the like." Flanked by his son and daughter in the family-operated company, he goes on to argue that in his business a large percentage of the product is determined by the price of the underlying commodity (most of their products are copper-derived), thus it is difficult, but very necessary in Mexico, to differentiate yourself from your rivals.

The Mexican service and manufacturing sector has gone through significant challenges, including regular financial crises. At the time of writing, the sector has safely hurdled the current economic crisis and is home to some excellent domestic companies and host to the regional headquarters of various multinationals. The Mexican service sector is in a position to look toward the future with more confidence than before. ■

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Risks and Rewards

State control of the electricity sector may mean fewer customers, but it also can mean clearer expectations.

By Clotilde Bonetto and Mark Storry, Global Business Reports

Working with the Comisión Federal de Electricidad (CFE) can be a difficult, yet financially rewarding activity. In the past 15 years the Mexican electrical sector has gradually attracted an increasing number of international players, often to the detriment of local companies.

Becoming the CFE's Preferred Partner

Felipe Ochoa, founder and president of Felipe Ochoa y Asociados, a consulting company specializing in strategic planning for national and international clients, believes that the influx of foreign companies has been a major challenge for local firms, many of whom now have difficulties in winning bids with the CFE. He says, "We need the international participation of these companies for their investment and expertise; however, we also need to promote our domestic industry. Our country needs to have a strong engineering base complemented by the presence of these international firms. At this point in time most of the [independent power producer] contracts have gone to international firms. I believe that we need a stronger local content on these projects. So far there haven't been many joint ventures or extensive collaborations."

The problem for small companies is that they do not have adequate access to finance, unlike many multinationals. This hinders their ability to scale up and bid for large-scale projects that the CFE and Petróleos Mexicanos (PEMEX) normally tender out. They can tender to be a subcontractor for a specific part of the original contract, but that is considerably less profitable.

Santiago Barcón is director, Power Quality and North America for Arteche, a Spanish multinational designing and manufacturing quality instrument transformers, relays, and substation-integrated protection and control devices. The company is also known as Inelap in the local market. Barcón argues that there are two main drivers behind the lack of local participation. First is the difficulty of accessing competitive financing for local companies. Second, the evolving nature of the Mexican legal framework makes it difficult for the CFE or PEMEX to take legal action against their suppliers. As a result, they require very detailed, complicated contracts to ensure that they are appropriately protected, but that can put off potential entrants to the sector.

According to Arturo Carillo, general manager of Cimaltec, a Mexican engineering company, "The main challenge to serve global markets is the lack of financing. The Mexican industry has the capabilities, talent, and knowledge, but there is no funding, and that is a big problem." He goes on to argue, "In order to get the necessary resources, we need the international banks to strengthen their confidence in Mexico, and this is a problem."

Winning the Deal

This problem of bidding is elaborated on by Thomas Riedel, partner at ASM Mexico, who distributes C.C. Jensen's filters for the conditioning of oil and other fluids for the CFE's plants. He argues that while the CFE is a valued customer, it took a great deal of time and effort to win the CFE over. He has had to go to the plant managers to explain his product and then to the zone chief, who had the purchasing authorization, as well as numerous other departments. "The CFE is an important client for us, but we feel that there needs to be a quicker way of introducing new products and services to them. We may manage to convince one plant manager to introduce our products, but then we have to repeat that process more than 100 times to cover the whole CFE."

Other leading voices in the Mexican energy sector, such as Enrique González, country head of Schneider Electric Mexico, argue that the fact that the CFE is big and unified actually makes it easier to do business. He considers the CFE to be a genuinely world-class organization and a key pillar of his growth strategy. Unlike other countries, such as the U.S. or the UK, where there are many utilities, Mexico has just one: "In many of the other markets we are involved in there are a plethora of different authorities, different buyers with different needs, and different demands. Here we only have one person to deal with, which certainly makes it easier for us," he enthuses.

Jorge Lozano, president of Prolec GE, a joint venture between GE and the Mexican company Xignus, producing a complete line

Interview with Hon. Georgina Kessel, Secretary of Energy

Q. Mexico is at a defining moment in terms of the direction of its electricity market. What are the main highlights and initiatives under your mandate?

A. From the beginning of President Calderon's administration, we have been committed to ensuring a reliable energy supply, at competitive prices to meet the consumers' demands, as stated in the National Development Plan.

In regards to competition, we have designed a very flexible program allowing medium-and high-voltage [large industrial] users to define energy and power consumption, which can vary from month to month. This allows them to structure their energy needs taking into account factors such as the exchange rate, fuel prices, and manufacturer's price indexes. This way the charges are set in nominal prices for a year, which gives businesses certainty, and makes planning easier.

Another initiative was the closure of Luz y Fuerza del Centro, whose operations inhibited the economic growth in the central region of Mexico. Everybody knew that the decentralized agency (LyFC) was in an unsustainable financial situation.

We have developed two specific priorities within the sector. The first is using energy in a more efficient way, making more from less, thanks to technological advances and best user practices. To achieve this we have implemented measures to integrate these practices into the public sector and to regulate and promote the private generators. We have also started programs to renovate electrical appliances and lighting in Mexican households, specifically focusing on the poorest of households.

The second is the diversification of our energy portfolio, generating electricity from renewable sources, such as wind power and water, as well as biomass, solar energy, and agribusinesses. We have begun a series of public projects, but also fostered private involvement.

Q. What vision does the administration have for the future of the CFE?

A. As we have mentioned, President Calderon has been committed from the start of his administration to the National Development Plan, ensuring a reliable, quality supply and competitive prices to the energy supplies that consumers need.

Thus, the Ministry of Energy and the Comisión Federal de Electricidad share the vision of a continuous offer of excellent services, now for the whole of the country. Therefore, we will invest in the infrastructure of LyFC to ensure that the entire area continues receiving electrical services with the highest quality standards of CFE.

Q. Mexico has a distinctive structure whereby the majority of the generation capacity is in the hands of the state. What do you believe are the advantages of this system over a market-based approach?

A. The applicable legal framework in Mexico hasn't significantly changed since its inception. It was meant to unify and expand several electric systems, which were unconnected and scattered throughout the country.

Due to this, Mexico has had a high national electrification rate—96.68% in 2008. The large unified system that we have in Mexico speeds up the operation of the transmission network and the coordination of all the power plants fueling the network.

Q. What role can IPP's [independent power producers] play in the Mexican energy matrix [mix]?

A. In terms of importance for the power matrix, the IPPs account for roughly 22% of the effective generation capability of the national electric industry, generating 32% of the country's power.

The IPPs' relevance has increased in recent years, with a yearly average increase of 5.7% in their share of the national generation, between 2003 and 2008.

Q. Mexico is generally considered to contain high market potential in energy generation and has one of the highest GDP per capita levels in Latin America. What are the major advantages that Mexico has over its neighbors in terms of a premium destination for investment within the energy sector?

A. Last year we implemented a reform in the energy sector, introducing a new legal framework with new advantages and opportunities that have turned México into a better destination for investment in different sources of energy.

In terms of hydrocarbons, we set Petróleos Mexicanos (PEMEX) on the right path to become a better, more efficient, transparent company, with better reporting systems. Also, PEMEX has a new hiring system, a more flexible system, which allows it to provide compensation according to industry standards, as well as additional cash bonuses, when the state-owned company earns greater revenues due to better results from a project or service.

Regarding electricity, our main achievement is that we have been able to enhance the cogeneration and electricity generation schemes from renewable sources. The new legislation and our great supply of natural resources will turn Mexico into an important destination for investment.

Q. Where do you see the best opportunities for foreign companies looking to invest in the Mexico energy sector, and what advice would you give them?

A. The greatest potential is where I have already mentioned: hydrocarbons and private generation, including cogeneration and renewable sources.

I would recommend investors to be aware of the opportunities Mexico has to offer, thanks to its natural resources and to the hard work of all Mexican people in order to upgrade its energy sector.

Q. In many countries renewables benefit from market mechanisms, for example a price guarantee or subsidy in order to promote their use. Do you believe that a measure such as this is necessary in Mexico?

A. The new legal framework on renewable sources provides the tools to procure favorable conditions to promote investment to benefit from these energy sources.

For instance, we planned the development of a methodology to gauge the negative externalities in the generation of electricity, which we published in recent months. Through this we intend to integrate in the cost of electricity the different hazards its generation causes to society. Therefore, these data would reduce the relative price of electricity generated from renewable sources, compared to that produced from traditional sources.

Also, the decision to specifically adopt these instruments from public policies was made by the Congress. So far these initiatives have not been contemplated in the approved expense budget for 2010.

of transformers, seconds this view: "One of the big advantages to working with the CFE is that you only need to supply one variety of product, and due to the integrated planning, you know what to expect and when to expect it."

Of course, neither Schneider Electric Mexico, with 7,500 employees and 11 factories in Mexico, nor Prolec GE, with the largest integrated transformer manufacturing facility in the Americas, suffers from the problems of access to financing that may hinder smaller companies. Ricardo Arratia, director of Brio Mexico, a business intelligence company that works extensively with the CFE top management, and part of SCAP holding group, argues that the secret to working with the CFE is winning their trust and properly understanding their aims and needs: "The CFE are looking for partners who can help them improve themselves, not just a supplier. The way we sell is by creating solutions together. We do not have a typical client-supplier relationship. People, tools, and the knowledge of the client are key."

As well as larger companies, there are many subject matter experts that work for the CFE. Geraldo Maltos and Manuel Gomez, who head up SYSCE, a Monterrey-based engineering company focused on the transmission sector say, "We are both former CFE employees, and in many ways that is an advantage. However, we have been much more successful in selling our products outside of Nuevo Leon (the state encompassing Monterrey) than here. When we sell something to our former colleagues we have to try twice as hard!" Maltos and Gomez, who won an international innovation prize in 2006 with SYSCE, do, however, add that although the CFE is an important client, to become a top-tier company, Mexican leaders need to expand their reach to beyond the public sector.

Marcelo de Zamacona is founder and general director of Grupo Dielec, a dis-

1. The credit default swap spread on Mexican bonds. *Source: Standard & Poor's Mexico*

The Pervasive Influence of Hydrocarbons

Mexico's hydrocarbon sector is all-pervasive and permanently intrudes on all areas of the Mexican economy, electricity being no exception. PEMEX, the state-owned monopoly, is one of the largest electricity users in the country and, following reforms in PEMEX's structure in 2008, now has the ability to cogenerate electricity (that is, be a partner in owning power generation infrastructure) rather than being tied to the CFE. PEMEX recently tendered a 300-MW cogeneration plant, a bid won by Spanish giant Abengoa.

Both electricity generation and the oil and gas sector are seen as key strategic areas by the state. The oil and gas sector has traditionally provided the finances, while the electricity sector was key to the development of the country. The hydrocarbons sector has usually been extremely profitable, and these resources were reinvested in electricity generation, which was a net drain on PEMEX's resources.

David Shields, editor of *Energia y Debate,* a local energy-focused publication, explains that oil production in Mexico, specifically at the Cantarell field, is currently going though a period of decline. Cantarell production has fallen from 2.1 million barrels per day at the start of the decade to 772,000 in 2009.

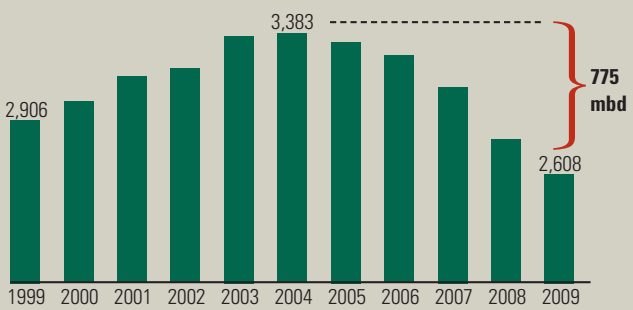
Giovanni Aloi, director general of GE Energy Mexico predicts: "My own belief is that oil and gas will rise in price in the near future. The days of cheap petrol and gas are over. We have to look to heavy deep sea oil, which is considerably more expensive to extract."

Thus, despite a potential rise in oil and gas prices, Mexico's revenue will fall due to the lack of new fields coming online (Figure 2). This drop in revenue will have profound effects on the Mexican budget.

Juan Carlos Machorro of Santamarina y Steta, a law firm, says: "It seems clear that from 2010 the government will suffer from a lack of revenues due to a decline in oil exports. There will be a big black hole in the Mexican budget of 2010."

What remains to be seen is how the government will be able to commit the same level of investment to the electricity sector in the future. Allowing more opportunities for private sector involvement might be forced upon the Mexico's future administrations.

2. Crude oil production (million barrels per day).
Source: PEMEX



tributor for the electricity sector supplying equipment to the CFE that has recently started sales to South America. He argues that the CFE's bidding process is helpful: "Bids are published online, but we do have the opportunity to interact with the CFE—we can ask questions, we can give them feedback on the bids. In the past the CFE asked for a lot of paperwork, but we feel that has decreased over the past few years. In fact, we find it easier to work for the CFE than the private sector. With the CFE you have certainty, there are no surprises, and you will be paid."

Financing Challenges

Mexico's exposure to the most recent financial crisis was late and deep. At the time of writing, Mexico is just beginning to emerge from one of the deepest recessions of its recent history. In December 2009, Mexico's credit default swap levels were wavering around the 200 basis point mark, compared to the double digits of European countries, but way down from the 600 that it reached just after the Lehman Brothers collapse in October 2008. Figure 1 (p. 91) shows that international markets have become more relaxed about Mexico's debt, despite the recent downgrading of Mexico's sovereign debt by Finch to BBB, two grades above junk rating.

Mexico's gross domestic product is expected to have fallen by 7.5% in 2009, before recovering to record a predicted 3% growth in 2010. In the first three quarters of 2009 industrial production fell by 5.7%. Consumer inflation reached a high of 6.5% in 2008 before dropping to a predicted 4% in 2009, according to Standard & Poor's. In addition to this drop in activity, liquidity on the Mexican market remains elusive. Despite this, the mood remains optimistic within the energy sector.

Mauricio García, director general at CMS International, a 40-year-old Mexican company manufacturing and distributing products within the gas and electric sector, specializing in valve production, notes that Mexico emerged strongly from crises in 1982, 1994, and 1997. That history makes him optimistic about a quick recovery from the latest financial crisis. Mexicans are used to dealing with unstable circumstances and fluctuating financial conditions, and this crisis is perceived as being no different from the previous ones.

Despite these turbulent financial conditions, Carlos Álvarez, VP Mexico of Intergen, insists that working with the CFE gives credibility on international markets. Alvarez explains the financing of his company's Campeche and Chihuahua acqui-

sitions: "The project financing deal for the acquisition of these new plants was a tricky one. It was certainly challenging to go to the international market at a very difficult time and put this deal together. In fact, these deals were put together in 2008, just after the collapse of Lehman Brothers. This willingness to push through the deal shows the commitment we had to the expansion as well as the credibility our company has on the markets. I believe that the fact that we are dealing with the CFE also helps financing these deals, as the CFE has considerable credibility with the international markets."

Luis D'Acosta, general manager of SEL Mexico, known in the U.S. as Schweitzer Engineering Laboratories, argues that while Mexico has suffered from a downturn, the effect of stimulus money on the energy sector played a part in cushioning the fall. He points to the record high margin factor, arguing that the coming few years will be vital once the stimulus money dries up. Nevertheless, Eduardo Zenteno, president of AMDEE (the Mexican Wind Association), argues that financing wind energy projects in Mexico is difficult and that there is little deal history to date.

This claim is backed up by Abel Clemente, director general at Equipamentos y Suministros Industriales, a water treatment company moving into biogas operations. Clemente maintains that "Lack of access to financing is preventing the growth of [small and midsize enterprises] in Mexico."

Another curious fact about financing in Mexico concerns the opening of the Mexican market in the mid-1990s. This resulted in vast swathes of the Mexican economy being purchased by foreign companies, especially in the banking sector. Santander, Banamex, and HSBC are three of the most prevalent names in Mexican project financing. However, as the independent power producer (IPP) market and the Mexican electricity sector in general has a prevalence of multinational firms, the regional office may find difficulties in raising finances, and banks would normally only permit limited credit exposure to a certain company. Normally, energy companies can get around this via local banks with local credit lines to compliment the money they raise on the international markets. In Mexico, however, some international energy companies are having problems doing this due to the lack of local Mexican banks.

The CFE's Position Seems Safe

Mexico is in a unique position. So far the CFE has ensured adequate investment in the electricity sector, ensured rural electrification, and attracted private investment through IPPs. It has attracted the best companies from all over the world to work with, but perhaps it needs to do more to help local companies.

However, all of gains to date were made possible by the large profits derived from the state oil company, PEMEX. Mexico was able to afford investments in electricity without seeking substantial private investment.

The next few years, together with the change in government, will be key for the future of the Mexican electricity sector. Should either the left or the centre win, as expected, the CFE can expect to retain its comfortable position, limiting further private investment. Should the pro-business Partido Acción Nacional (PAN) retain the presidency and gain control of Congress, we can expect significant changes. ■

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