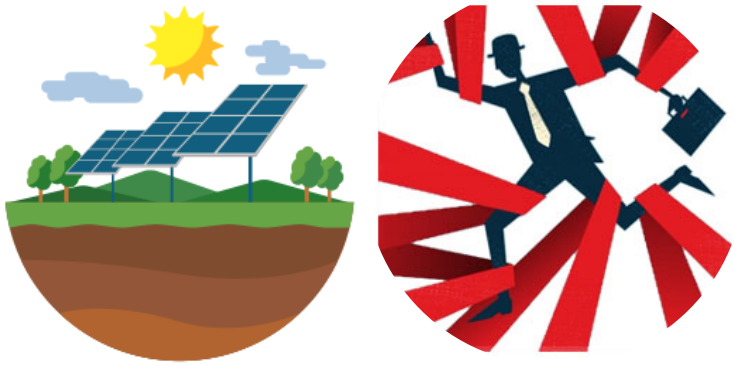
RENEWABLE ENERGY AUCTIONS IN MEXICO:
The gap between design and implementation



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EXECUTIVE SUMMARY

Energy experts around the world have their eyes on Mexico. Its renewable energy auctions have broken global low prices records. Mexico has, on paper, the cheapest solar prices on the planet. Since 2016, three auctions have awarded 36 solar projects. However, only one plant has started operations while others are delayed or looking to leave the Power Purchase Agreement (PPA) contracts. The awarded firms have been unable to obtain the necessary construction permits and without them, renewable energy projects cannot be developed. Federal construction permits represent time bottlenecks while rent seeking local governments demand outrageous permits' fees. In the end, if cheaper renewables generators fail to establish in Mexico, electricity prices will remain high, compromising the central objective of the Energy Reform of driving energy prices down.

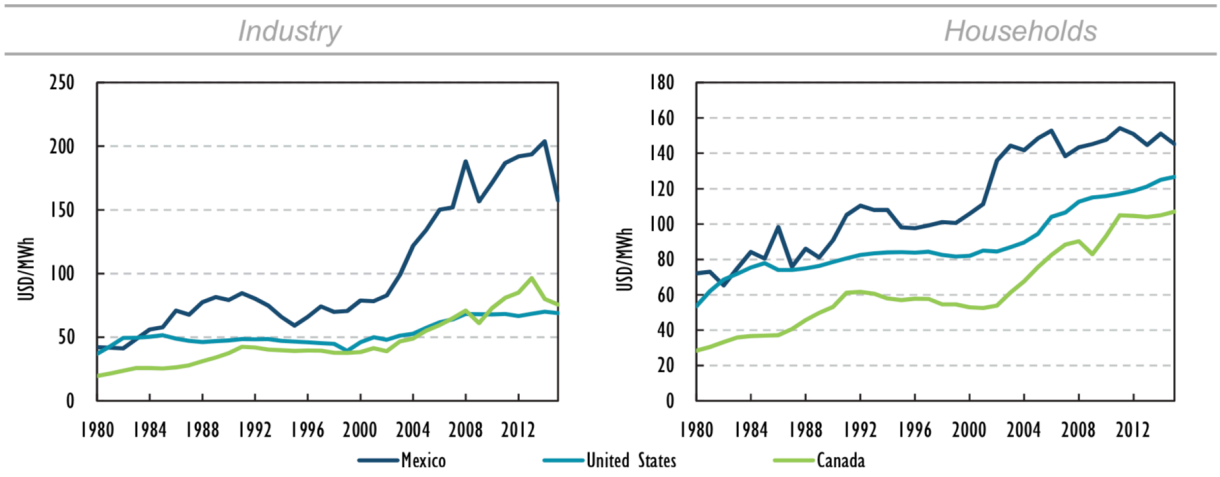
This work analyzes the challenges that three awarded firms faced in *Sonora* and *Yucatan*. Consequently, it provides three recommendations directed at COFEMER to overcome these challenges. The principal recommendation calls for the States and Municipalities Unit to be involved in auctions' permitting issues across the country. The unit has the technical expertise, administrative capacity and political relations necessary to improve local and federal regulation. However, the unit was unaware of the problems and has not been involved so far. This reveals a coordination and information sharing problem across agencies at different government levels. An alternative is for COFEMER to lead a national one-stop shop to streamline and speed up permits. Nevertheless, the time, coordination and resources needed to implement a one-stop shop will surely surpass the PPA deadlines. A different alternative is to conduct site-specific auctions, instead of technology-neutral ones. By auctioning a permits' ready site, the firms would be shielded against excessive local permits' fees and lengthy processes obtaining federal permits. This measure does not solve the problems firms are currently facing, but it complements the main recommendation. COFEMER will have to convince regulators, particularly the Independent System Operator (ISO), who is also the auctioneer, that it is worth piloting a site-specific auction.

SECTION I: INTRODUCTION AND PROBLEM DEFINITION

Introduction: The Mexican Electricity Market and the auctions

Electricity in Mexico is expensive. On average, Mexican prices are 73% higher than in the US. To compensate, the government subsidizes 95% of the households. This results in electricity subsidies representing 0.75% of the GDP. Even then, subsidized electricity prices are 25% higher in Mexico than in the US (Pavlovic, 2016). The price gap between the two countries started to widen in the late 80s; worryingly in the late 90s for industries (figure 1). Between 2012 and 2014, the state-owned utility *Comision Federal de Electricidad* (CFE) replaced expensive oil fueled generation for cheaper natural gas (Estrada, 2015). This, along with higher subsidies, narrowed the price gap between the two countries. However, lower prices for fossil fuels, such as natural gas, do not include hidden pollution costs and thus, they propel market failures (NAS, 2016).

Figure 1. Electricity prices in Mexico are the highest in North America and their recent decrease is not environmentally sustainable.



Source: extracted from IEA, 2017.

Mexico's Energy Reform's (2013) main objective is to drive electricity prices down through clean sources. Overall, the reform is consistent with global energy policies that focus on the supply side in order to decrease electricity prices (Adams, 2010). In the redesigned and unbundled electricity market –where CFE retained monopoly power over

transmission and distribution- the principal tool to achieve this objective is through the Long-Term Power Auctions (LTPA). The LTPAs are Power Purchase Agreements (PPA) between renewable energy generators and retailers –CFE being the main retailer to date.[1] Renewable energy projects have high capital costs and because energy prices do not internalize the cost of pollution, renewables are, as a rule, not cost competitive against fossil fuels. Long-term PPAs enable low-cost capital financing for renewable projects (NAS, 2016). At a simple level, the auctions work as following: retailers announce their demand for energy (Megawatt hour MWh), capacity (MW) and Clean Energy Certificates (CEC) to be auctioned by an Independent System Operator (ISO, see actors in section III) and generators bid for them separately or in packages. The contract duration for energy and capacity is 15 years and 20 years for CECs.

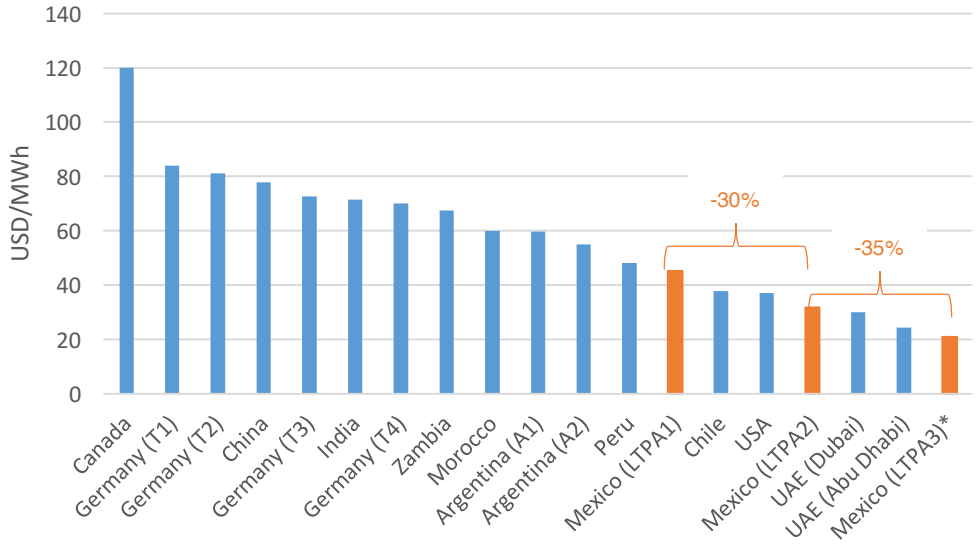
The reform stipulates at least one LTPA per year. As of March 2018, there have been three; one in each year from 2015 to 2017.[2] Compared globally, the LTPAs awarded surprisingly low prices. In particular, LTPA3's solar photovoltaic (PV) energy prices are reported to be the lowest in the world (figure 2). Solar PV constituted 81%, 46% and 58% of the auctioned products in LTPA1, LTPA2 and LTPA3, respectively (CENACE, 2017). Hence, this work will focus primarily on these outcomes. Overall, the auctions' results have strengthened the hypothesis that renewable energies can decrease electricity prices.

Besides LTPAs and a CECs market, the Wholesale Electricity Market is comprised of Medium-Term Power Auctions, Financial Transmission Auctions, a Spot Market and a Capacity Balance Market.

[1] The reform mandated CFE to separate in subsidiaries to play in each of the market's activities independently: generation, transmission, distribution and retail.

[2] LTPA1 launched its tender in November 2015 with results published in March 2016. LTPA2's tender was in May 2016 and the results were published in September 2016. LTPA3's tender was launched in May 2017 and its official results were published on November 22, 2017.

Figure 2. Mexican solar PV prices are the lowest in the world and they have decreased significantly from one auction to another.



Source: IRENA, 2017. CENACE, 2017 for LTPA3.
Note: "Calculated average prices resulting from renewable energy auctions presented in this report may differ from the data published by other sources due to the different aggregation and/or price correction methodologies used." IRENA, 2017. A = Auction, T = Tender.
** Not included in IRENA, 2017.*

The problem: Underbuilding while keeping high electricity prices

LTPAs in Mexico have been highly competitive. In LTPA2, the firm Zuma submitted three practically identical solar PV bids. Only in one project which required repairs in the sewerage system, their bid was slightly higher and ultimately, it was not awarded (Aguiar, 2017). At USD 36.2 and 36.3 MWh + CEC, Zuma's awarded bids were the third and fourth highest awarded bids in Mexico, but they were still lower than reported auctions' prices around the world in 2016, except the United Arab Emirates.[3]

CECs play a critical role in LTPAs' prices and overall in the Mexican market. The Energy Reform requires retailers to buy a minimum of 5% of their electricity from clean sources starting in 2018 and by purchasing CECs, retailers demonstrate compliance with regulation. The government intends to increase the 5% minimum every year –i.e. it will be 14% by 2022- as a move to help Mexico achieve its international pledge of reaching

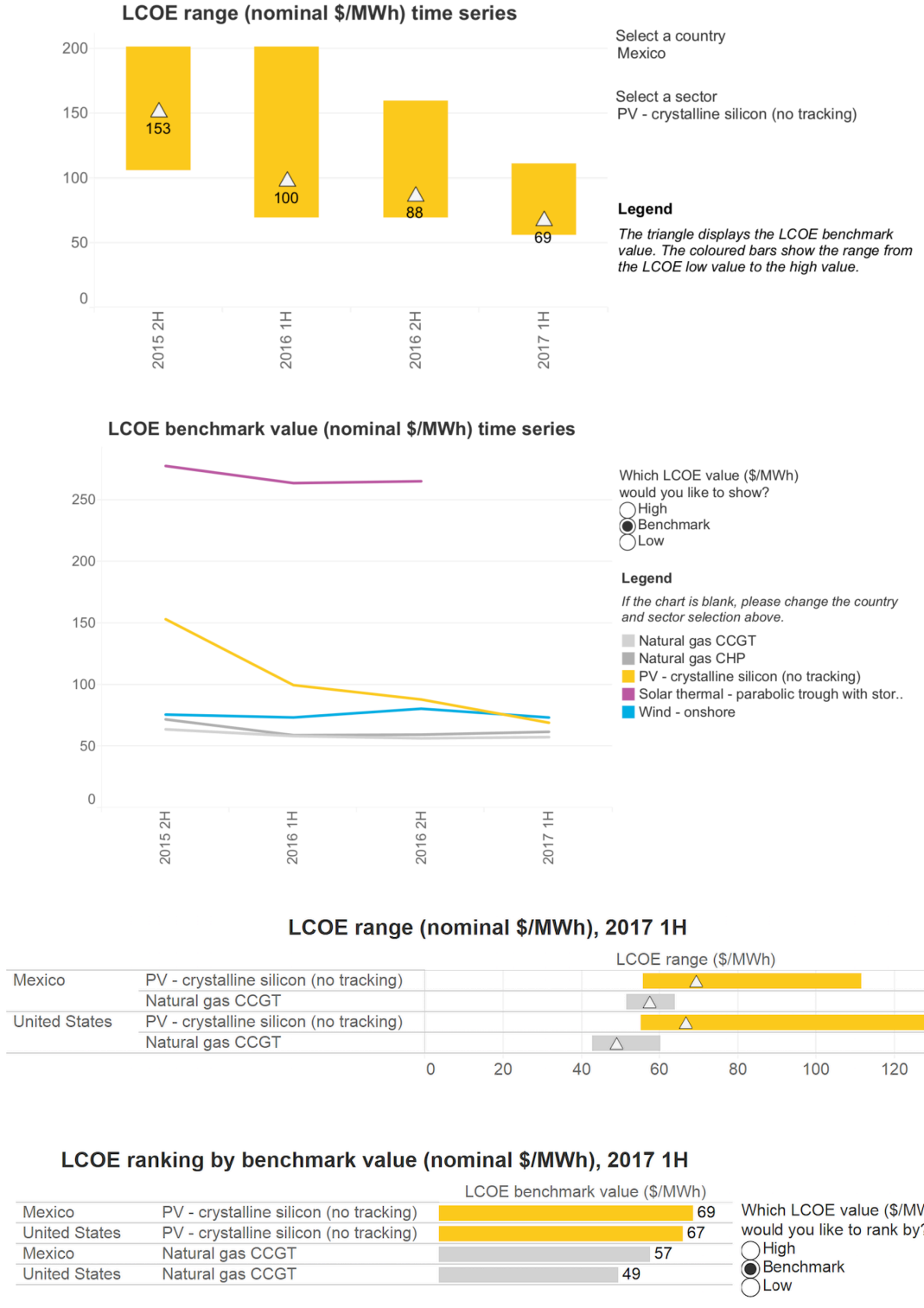
[3] LTPA2's reported solar PV price at USD 31.8 MWh + CEC is a weighted average. Its bids range from USD 25.8 to 37.8 MWh + CEC (PwC, 2016b).

35% of clean energy generation by 2024, 40% by 2035 and 50% by 2050. The requirement is a Renewable Portfolio Standard (RPS) –RPSs are second best options for more comprehensive carbon emission reduction policies (NAS, 2016). Because of the auctions' design and firms' manipulation, most of the energy bids (in MWh) were bundled, one-to-one, to CECs in the first two LTPAs. CECs allowed for more aggressive energy bids as the longer CECs contract duration lowered capital cost financing (Guadarrama, 2017).

Overaggressive bidding can result in underbidding. That is, firms bid too low to increase their chances of securing a contract, but are in the end financially incapable to realize the project at those prices (IRENA, 2015a). Underbidding has been widely documented around the world leading to high contract failure rates (Kreycik, 2011). In that sense, the LTPAs reported solar PV prices at USD 45.06, 31.37 and 20.82 MWh + CEC, respectively (CENACE, 2017), are significantly higher than different Levelized Cost of Energy (LCOE) estimates. LCOE can be interpreted as the energy price where the plant's costs and revenues break even, given an investment rate of return.[4] Replicating Lazard's (2016) methodology using a National Renewable Energy Laboratory (NREL) LCOE template,[5] the Mexican case provides a USD 109.5 MWh solar PV price (Guadarrama, 2017). That price is consistent with IRENA's (2015b) LCOE solar PV projection for 2030 at USD 70-90 MWh, attributed to the higher discount rate in Mexico and higher capital costs from a less mature market. Furthermore, Bloomberg New Energy Finance's (BNEF) estimates are also above the awarded prices. BNEF's estimates use actual constructed power plants data when available (NAS, 2016). Even after having decreased by more than a half in two years, BNEF's solar PV LCOE estimate for 2017's first semester is at USD 69 MWh. This decrease has closed the gap with respect to combined-cycle natural gas generation, but the latter still remains more competitive. Combined cycle gas plants' LCOE are lower in the US than in Mexico (figure 3).

[4] Different LCOE models make different assumptions entailing uncertainty degrees. See Guadarrama (2017) for more details on LCOE estimates from Lazard, NREL, BNEF and the Energy Information Administration (EIA).
[5] Both models have been documented to have similar estimates (NAS, 2016).

Figure 3. Despite of a sharp decrease, solar PV LCOE estimates are still above auctioned prices. Gas plants remain more competitive.



Source: extracted from BNEF, 2017.

The industry argues that LCOE models and inputs do not reflect the Mexican reality. In particular, the models account for higher capital costs and assume low capacity factors (Katzew, 2017). Resources availability, funding from multilaterals with very low capital costs and cheap labor can explain the low auctions' prices (Davis, 2017). Given the disparity between LCOE and the industry's claims, this work assumes the auctioned prices are real, but highlights a risk of some firms having underbid. Particularly, firms might have speculated future CECs' market value, as well as local and hourly price adjustments. For instance, a bid awarded at USD 38.41 MWh + CEC in *Sonora* in LTPA2, can be adjusted to USD 62.74 MWh + CEC –also to be adjusted to inflation on top- if it produces electricity in July 2033 at 6 pm (Guadarrama, 2017).

Assuming no underbidding and no speculation, this work still lays out an underbuilding issue propelled by complex and costly permitting processes. Obtaining construction permits is currently the main obstacle for renewable projects deployment in Mexico. The awarded firms dealt primarily with federal agencies during the auction's process. Federal officers were in charge of reviewing firms' estimates in order to approve the projects' financial and technical feasibility. Nevertheless, once awarded, the firms had to start dealing with municipal, state and other federal agencies to obtain permits. The number of local permits, time and costs vary significantly across the country.

Construction permits costs in Mexico can be up to eight times higher from one state to another (World Bank, 2016). On top of that, awarded firms are dealing with rent seeking municipalities. As outdated regulation is open to interpretation, municipalities are requesting up to 20 times higher fees than initially estimated by firms while placing bids. Moreover, the time to get permits can differ up to 11 times from one state to another (World Bank, 2016). Federal permits are slowing the process even more. If the awarded firms fail to start operating, electricity prices will remain high. This would not only be a political failure for the federal administration for not being able to deliver one of its most important campaign promises. High subsidies will continue hurting the country's finances and high electricity prices will continue affecting firms' competitiveness. Businessmen

have recently and publicly denounced the high electricity prices issue (El Universal, 2018).

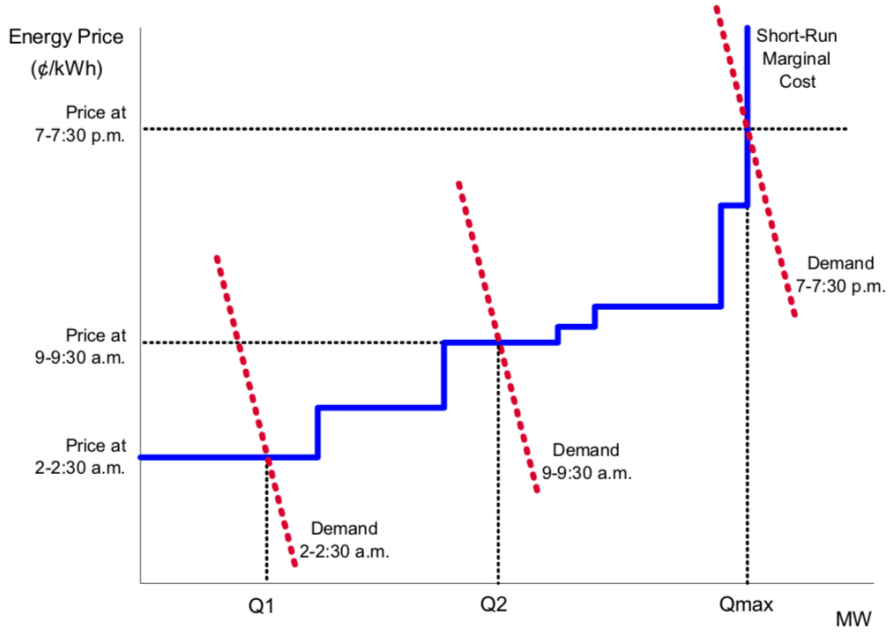
This work provides three recommendations directed at COFEMER to overcome permitting challenges: i) facilitate dialogues between government agencies and firms, and assist the former in streamlining procedures and improving regulation, ii) create a one-stop shop for awarded firms to obtain permits and iii) work together with CENACE to pilot site-specific auctions. Given the timing issue and its implementation viability, the first recommendation is prioritized over the two alternatives.

SECTION II: DIAGNOSIS

Electricity network pricing and Mexican LMPs

It is crucial to understand that the awarded bids cannot decrease electricity prices until the plants start running and certain grid conditions exist. The redesigned Mexican Electricity Market is based on a Locational Marginal Prices (LMP) model. Electricity supply and demand differ by location. *"Under appropriate assumptions, the locational prices have an interpretation as the marginal value of generation"* (Hogan, 2017a). A LMP is determined by the last plant's cost that the system had to run in order to supply demand. If electricity prices were to decrease, it is because the awarded cheaper generation firms can displace more expensive plants that steepen the supply curve (figure 4).

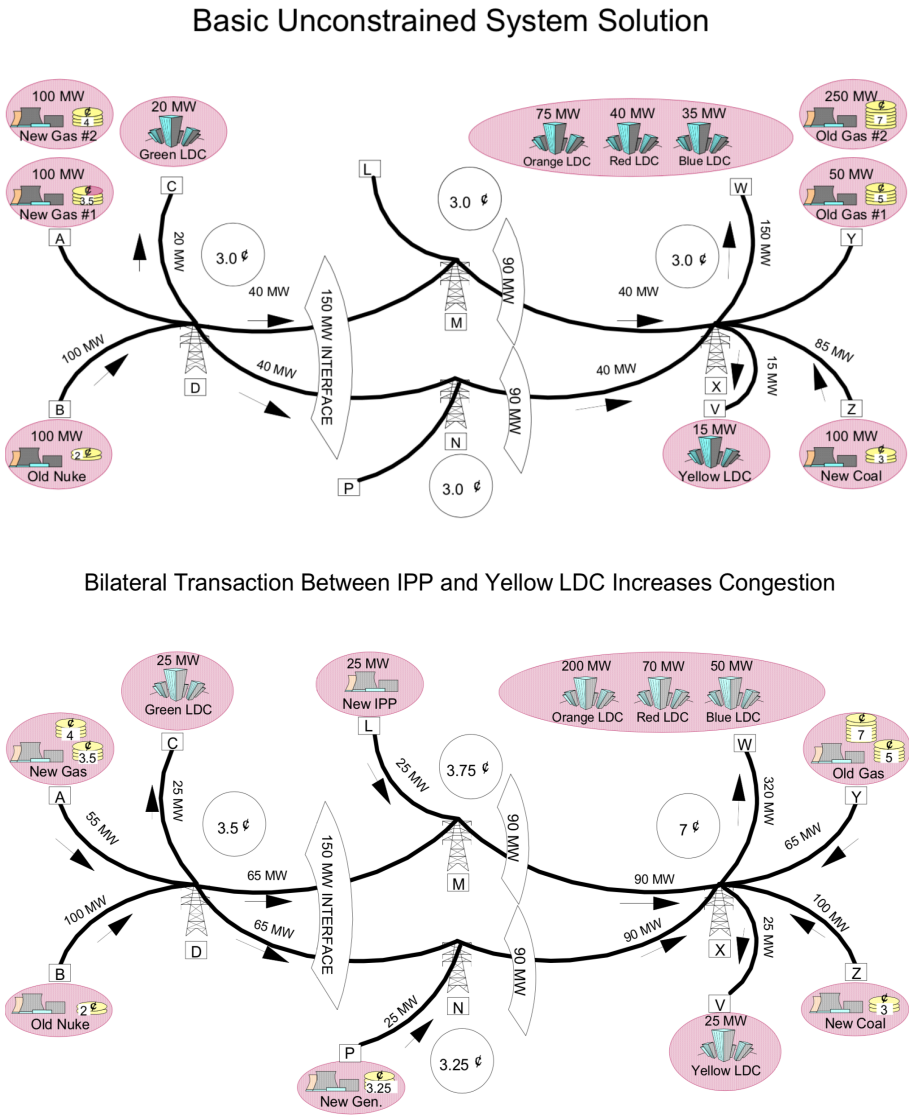
Figure 4. High market clearing prices are a consequence of high demand and a steep supply curve.



Source: extracted from Hogan, 2017a.

However, introducing cheaper generators is not sufficient to drive LMPs down. First, forcing retirement upon generating assets before 40-50 years of operation is highly unlikely (NAS, 2016). Second, electricity does not flow from generator to customer in the shortest, most direct way (contract path). It flows throughout the network. Because of loop flow effects, power flows in one region can have a significant impact in other regions (Hogan, 2017b). LMPs can be then broken down –under certain assumptions- in a price of power, a marginal cost of losses and a marginal cost of congestion. Figure 5 shows how a change in power flows, particularly a new generator –an Independent Power Producer (IPP)- at bus L together with a change in demands (loads) from Local Distribution Companies (LDC) can make prices vary significantly. If the transmission constraints were to change, further pricing changes are to be expected (Hogan, 2017a).

Figure 5. The establishment of cheap generators is not sufficient to drive electricity prices down. Congestion can increase prices.



Source: extracted from Hogan, 2017a.
Note: In the unconstrained solution, the price is determined by the New Coal plant at "Z". B was run first. In the second solution, "were it not for the IPP sale, more power could be taken from the inexpensive generators at bus "P" and at bus "A". However, because of the effects of loop flow, these plants are constrained in output, and there are different prices applicable at buses "D", "M", "N", and "X". For convenience, losses are ignored." Hogan, 2017a.

The Mexican National Electricity System (SEN) is divided in three systems, 10 regions and 53 zones. Therefore, LMPs vary across the country. In an effort to decrease high LMPs, LTPA1 favored bids in high LMPs zones, particularly in *Merida* and *La Paz*

(V. Constitucion). For evaluation purposes, the bids were discounted (or added) for the difference between the zone's LMP and the country's average LMP. For instance, in the case of *Merida,* a USD 66.86 MWh + CEC bid was discounted USD 21.98 MWh. The bid was evaluated as if it were USD 44.87 MWh + CEC against others, but once awarded, the PPA contracted price remained at USD 66.86 MWh + CEC (table 1).

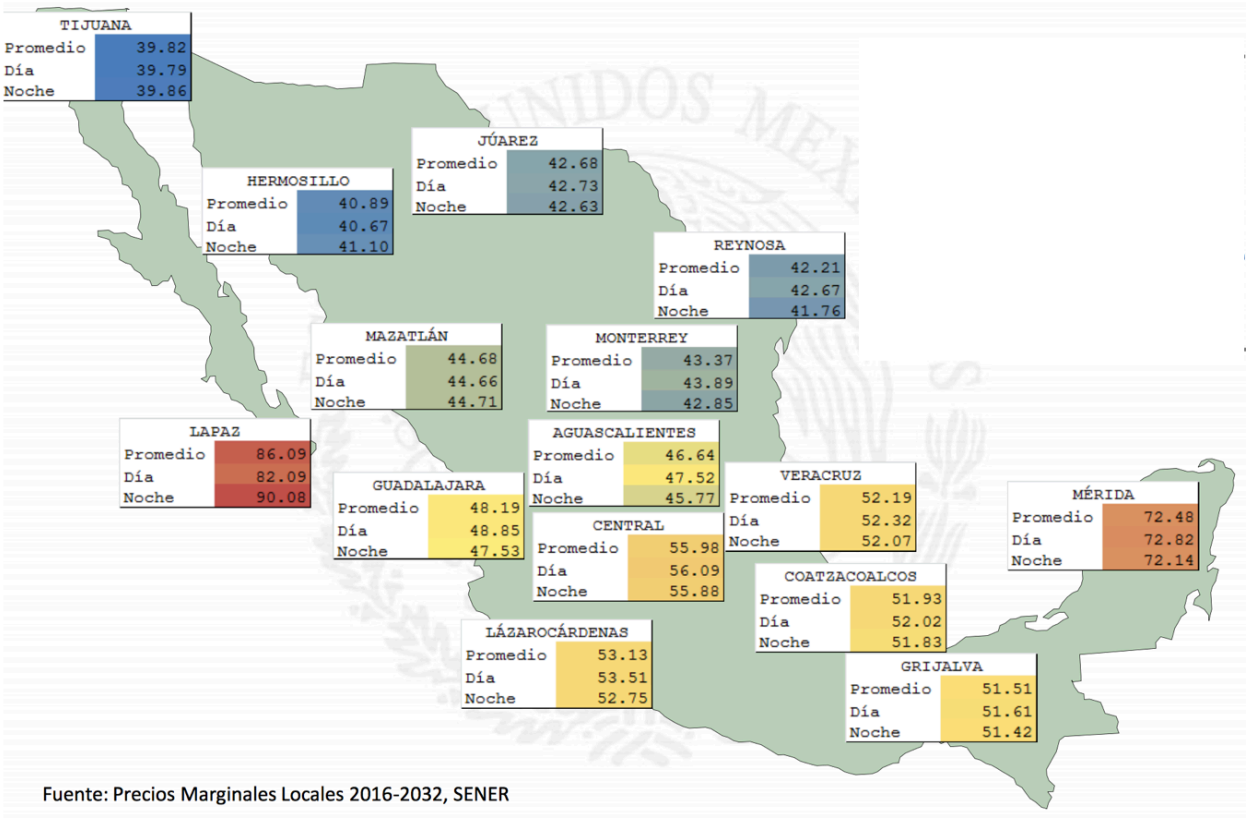
Table 1. Example of an awarded bid in Mérida

Awarded firm	Zone	Energy price bid (USD/MWh)	Package bid (USD/MWh + CEC)	Zonal adjustment (USD/MWh)	Evaluated bid (USD/MWh + CEC)	Contracted PPA price (USD/MWh + CEC)
Alarde	MER	44.57	66.86	-21.98	44.87	66.86

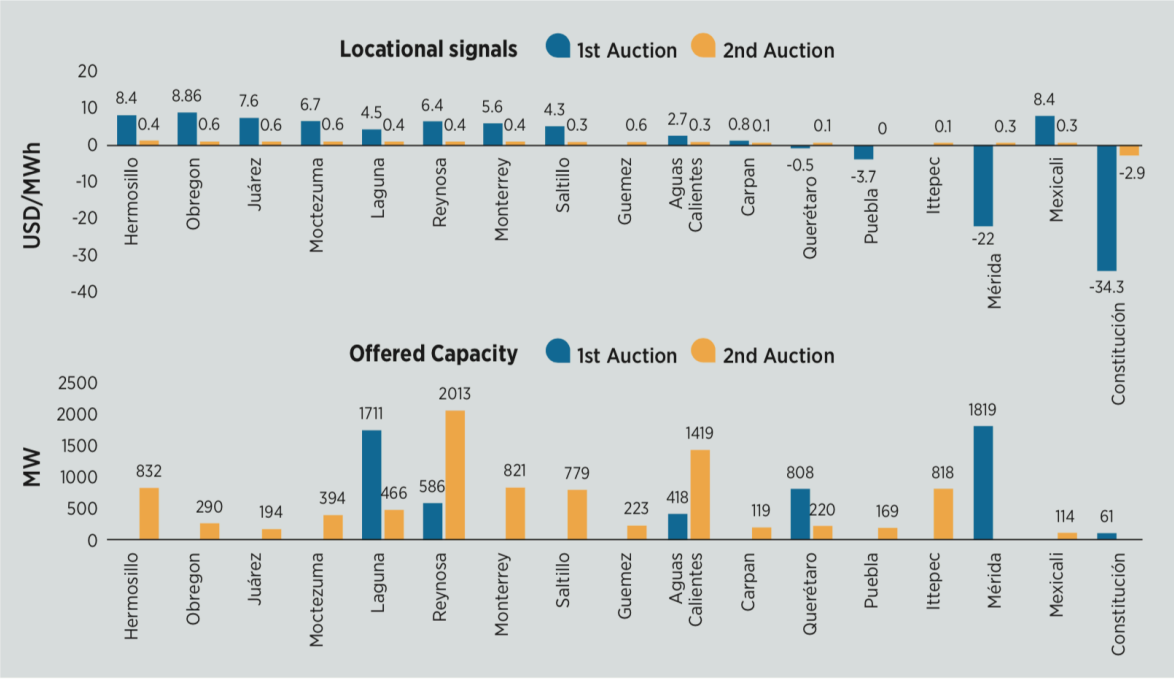
Source: CENACE, 2017.

This auction's evaluation design inflated LTPA1's clearing prices (Guadarrama, 2017). Nevertheless, LTPA1's weighted average awarded bid was still 26% below the country's average LMP (PwC, 2016a). LTPA2 and LTPA3 did not highly favor any region as the regulators change the LMPs projections for each auction. However, LTPAs' outcomes alone cannot drive electricity prices down. In the case of *Merida,* additional investments in transmission infrastructure are necessary in order to accommodate the doubling of generation capacity through LTPA1, to subsequently allow prices to go down (Guadarrama, 2017).

Figure 6. LMPs vary across the country. LTPA1 favored bids in zones with high prices hoping to reduce them.



Fuente: Precios Marginales Locales 2016-2032, SENER



Source: adapted from Pavlovic (2016) and extracted from IRENA, 2017, with information of PwC.

Note: LMPs are expressed in USD.

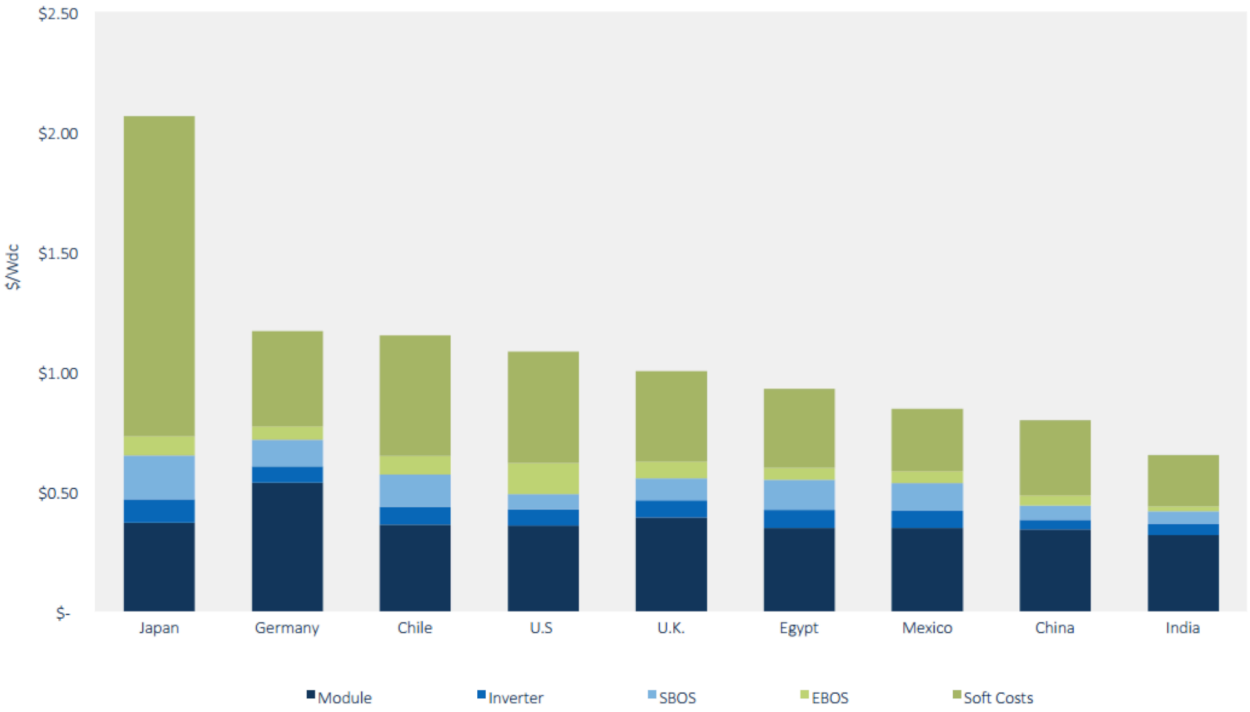
Solar PV price breakdown

Solar PV prices across the world have significantly decreased over the last decade. In the US, between 2010 and 2017, solar PV utility scale prices decreased by 80% (NREL, 2017). Again, LCOE provides the price where the generating asset breaks even; the discrepancy between bids and LCOE in Mexico has already been outlined.

In general, LCOE includes the following costs: capital, fuel, fixed and variable operation and maintenance (O&M), financing and utilization rates costs. Solar PV does not account for fuel costs and its O&M costs are relatively small; its capital costs represent a higher share of the LCOEs than in other technologies (NAS, 2016). The main capital cost component of solar PV energy is the module –the solar panel. Solar panels have been predominantly manufactured in China, dropping 86% in price since 2010 (NREL, 2017). Other hardware costs, mainly the inverter, but also wires, switches and batteries, among others, are included in the Balance of System (BOS) costs. Hardware costs reductions can explain 64% of the price decrease in the US (NREL, 2017). The remaining 36% decrease can be attributed to soft costs. *"Soft costs include financing, customer acquisition, permitting, installation, labor, inspection, and other non- hardware costs"* (SunShot, 2014). In 2016, they comprised up to 64% of the total price in the US and they have not decreased at the hardware costs' pace (Ulrich, 2016). If solar PV prices in Mexico are low, it is because soft costs are narrow, compared to other countries (figure 7).

Within soft costs, this work focuses on permitting challenges. In the US, the SunShot initiative has decreased permitting costs by 12% and they do not represent a significant hurdle nowadays (Ulrich, 2016). However, this contrasts with the Mexican case, which this work is going to elaborate in the following sections.

Figure 7. Lower soft costs explain lower solar PV prices in Mexico.



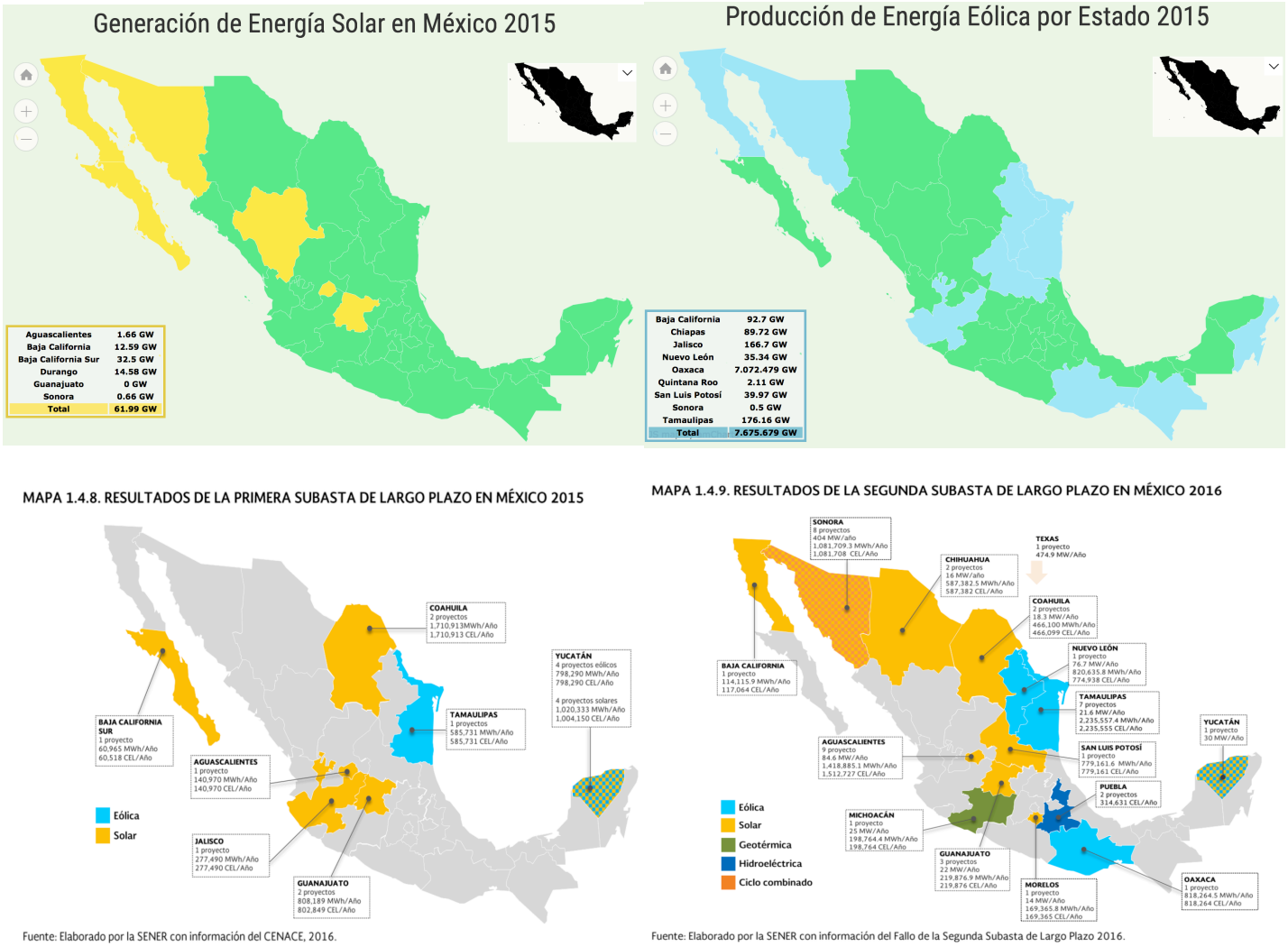
Source: extracted from Greentech Media, 2017.

State capability

The implementation of the Energy Reform is a case of isomorphic mimicry and premature load bearing. The former refers to the reform looking like ones implemented in more developed countries with potential advantages that Mexico can exploit from emulation. However, developed countries' experiences may be inappropriate for the Mexican context and can end up creating a state capability trap (Andrews, et al., 2017). Thanks to the reform, Mexico ranks top ten in the EY 2017 Renewable Energy Country Attractiveness Index and also in late 2017, it was admitted to the International Energy Agency (IEA), a leg of the rich OECD countries. However, little is reported internationally on how social conflicts, particularly communal property issues, have delayed or prevented energy projects development. In early 2017, 54 energy projects were at risk of being developed; 31 were promoted by the Energy Reform (Carriles, 2017).

Premature load bearing refers to unrealistic expectations of the state's capability improvement rate, leading to a stress that will weaken, if not collapse, the system (Andrews, et al., 2017). Before the Energy Reform, renewable energies represented only 4% of the country's generation portfolio –with a 3,206 MW installed capacity. Solar energy's 64 MW, represented less than 0.01% of the portfolio (Pavlovic, 2016). Moreover, only six out of 32 states had solar plants running (OISE, 2017). The LTPAs are expected to add 7,451 MW of renewable energies installed capacity (CENACE, 2017). That is, renewable energies' capacity would be increasing by 232%. Solar PV installed capacity is expected to increase by 5,438 MW (James, 2017; PV Magazine International, 2017), that is, an 8,500% increase. One of the main barriers for renewables deployment is transmission constraints hindering the flow from remote clean sources to distant demand centers (NAS, 2016). Because of the expected increased power flows and the current transmission constraints, the currently centrally planned transmission investments will have to move to a Hybrid Market Structure (Hogan, 2017c) if lower electricity prices are to materialize. Merchant investments would better react to market signals and integrate renewable energies into the grid (Guadarrama, 2017). Furthermore, regarding LTPAs, in a complex institutional setting where municipal and state governments dictate regulations –specifically urban development-, the firms are confronting a different reality than the one idealized by the federal government in the auctions' design. This issue is analyzed next.

Figure 8. Renewables, particularly solar, had a low installed capacity. The LTPAs results will stress the system if no efficient transmission expansion is planned.



Source: extracted from OISE, 2017 and from SENER, 2017 (PROSEDEN).
Note: LTPA3 is expected to add 2,562 MW of renewable's installed capacity, 1,323 of them being solar PV (CENACE, 2017; PV Magazine International, 2017).

Dealing with construction permits

The three LTPAs' outcomes expect 36 solar and 18 wind plants to be built in the next three years (CENACE, 2017).[6] This section focuses on the obstacles that awarded firms in the states of *Sonora* and *Yucatan* faced in obtaining construction permits.

The *Sonoran* case is the more optimistic one. *Sonora* was one of the six states that had solar plants running before the Energy Reform (figure 8). Two awarded firms, EDF and Zuma, submitted bids for LTPA2 once they bought existing plants in order to expand them. "*Projects that start from zero, like in Yucatan, are kamikaze projects. Our company would have never taken that risk."* said Mrs. Sosa, Zuma's Project Development Manager. That claim is not ungrounded. *Yucatan* has high risk hurricane zones, complex topography, jungles and most importantly, archeological sites –the state was the heart of the Mayan civilization. Nevertheless, the state is recipient of nine out of 18 awarded bids in LTPA1 (see the evaluation design in table 1). Jinkosolar holds two of those bids –and one in Aguascalientes. Because of issues in obtaining construction permits, its association with AR Sun Energy's missed a PPA deadline in 2017 and AR Sun Energy is about to miss another deadline in 2018 for the same reasons (Patiño, 2018).

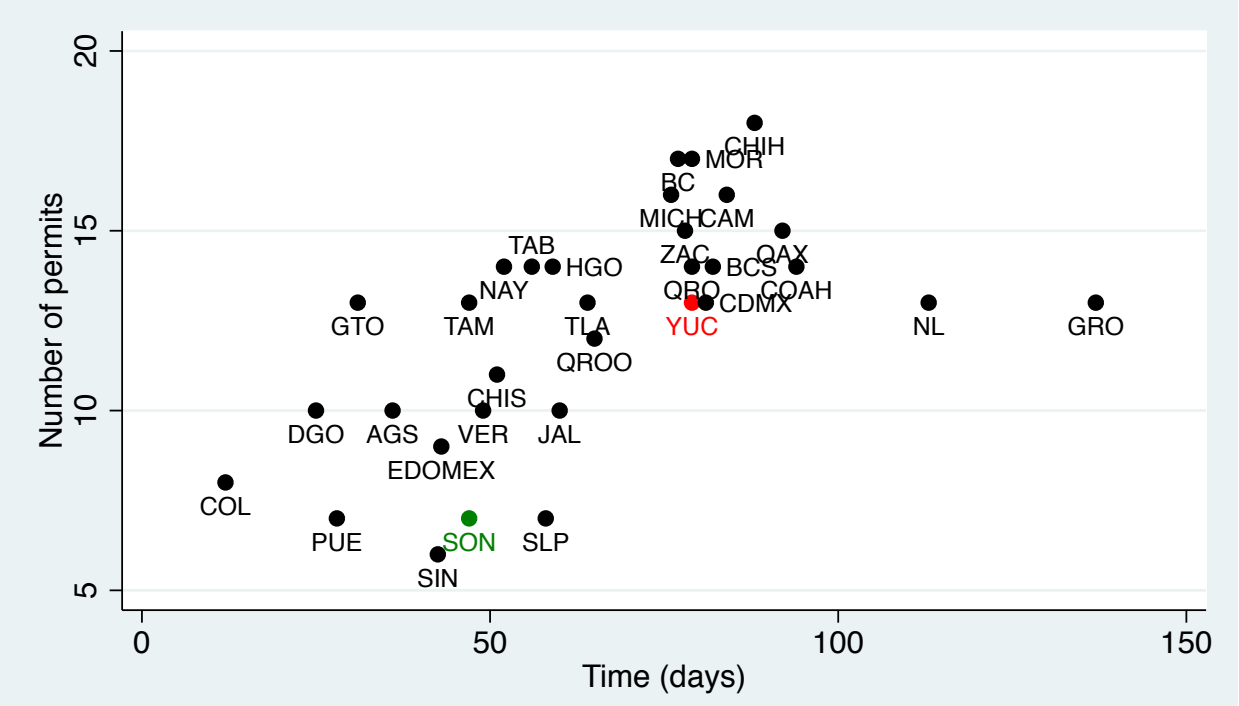
In the World Bank's *Dealing with Construction Permits* efficiency indicator, *Yucatan* ranks average, while Sonora ranks at the top (figure 9).[7] Hence, the issue of obtaining permits in *Yucatan* is relatively easy compared to other Mexican states. Historically, because of communal property rights and vast indigenous communities, projects in the states of Guerrero and Oaxaca –the latter attractive for wind plants- are difficult to develop. In the state of *Chihuahua,* Zuma found an archeological relic in one project development. It had to request a permit from the National History and Archeology Institute (*INAH*) that has taken over a year and it is still not resolved (Sosa, 2017). Leaving unexpected site findings aside, the same construction project can require up to three

[6] Although SENER has tweeted 45 solar and 20 wind plants.
[7] In the Building Quality Control Index, Sonora ranks second last. The efficiency indicator focuses on the number of permits, time and costs: the less the better. The Building Quality Control Index balances the ranking in that states that frenetically streamline permits disregarding regulation are "penalized".

times more permits and take up to three times longer in the states of *Chihuahua* and *Guerrero*, respectively, compared to *Sonora* (World Bank, 2016).

Permits are delaying and endangering PPAs' development. By March 2018, four LTPA1 bids should start supplying electricity in *Yucatan* (CENACE, 2017). However, these plants have not even started construction (Patiño, 2018). Across the country, only one solar plant has started operating (Reforma, 2017) and out of the remaining 53 solar and wind plants, only five have started the construction phase (Patiño, 2018). Next, a closer look into the obstacles that the firms face.

Figure 9. Sonora represents an optimistic permitting case. The state ranks second and eight in number of permits and time in the Doing Business' *Dealing with construction permits* indicator.



Source: World Bank, 2016.
Notes: The Doing Business indicator is based on a simple construction project. The purpose of the figure is to show that Sonora and Yucatan are well positioned when it comes to permitting processes, compared to other states. The actual published data points are taken as a reference for this exercise and differ from the actual permits that a solar plant needs. Sonora ranks second last in the Building Quality Control Index and therefore ranks 11 out of 32 states in the overall rank –which also considers permits' costs.

According to its LTPA2's PPA contract, EDF has to start supplying electricity in January 2019. While the auction's results were announced in September 2016, the contracts were obtained in February 2017 (CENACE, 2017). Hence, the awarded firms have around two years lead time in each tender (Avila, 2018; Patiño, 2018; Villeda, 2017). On average, it takes 9 months to construct a solar PV utility scale plant and 12 months for a wind plant (Lazard, 2016). Focusing on the former –EDF's is a solar bid-, it leaves around 15 months for permits and implementation tests. As of contract, EDF committed to start implementation tests in November 2018, having planned for 11 months of construction. Ideally, the firm would have spent less than six months in the permitting process, but it has spent over a year. Mr. Villeda, EDF's Project Development Manager, was optimistic in November 2017 regarding construction starting in January 2018. The timeline has been shifted to late-February 2018 and they plan to expedite construction.

EDF requested a total of 16 construction permits, many of which are duplicated across different government levels. Moreover, the firm had to interact with 13 different agencies (figure 10). Regarding the time length, the bottleneck are the federal permits. They take around six to eight months, but in some cases, over a year (Sosa, 2017). In particular, the Energy, the Environmental and the Transportation Ministries –*Secretaria de Energia* (SENER), *Secretaria de Medio Ambiente y Recursos Naturales* (SEMARNAT) and *Secretaria de Comunicaciones y Transporte* (SCT)- are overloaded and end up slowing down the process (Sosa 2017; Villeda, 2017). Some of the federal permits could be requested before the auction. Zuma did that with SENER's social impact approval, reckoning for a long resolution time. However, other permits, such as SEMARNAT's, are expensive. Projects have to pay millions to a federal forestation fund and firms are reluctant to pay for these permits before actually being awarded. Nevertheless, in the next auction, regulators intend to require at least a proof of permit request from bidders.

Figure 10. EDF had to request duplicated permits across different government levels in Sonora. It took the firm over a year to obtain construction permits.

Source: Villeda, 2017.
Notes: the bar colors represent duplicated permits across agencies and/or permits which's request could be unified. The Urban Development and Civil Protection municipal agencies took only 10 days to issue the permits (land use permit and risk study approval), once a reasonable fee was agreed. F=Federal, S=State, M=Municipal, P=Private.

Besides long resolution times, firms are also frustrated by the duplicity and the fact that federal permits' resolutions seem not to be binding. *"I do not understand why we had to deal with a* municipal *environmental agency if we held SEMERNAT's positive environmental impact resolution. But even worse, once we dug into the land, we found out it was above a "cenote".*[8] *I blame the owner who sold us the land and my developer, but also SEMARNAT because we had its resolution and it had to know there were cenotes there",* says Mr. Patiño, AR Sun Energy's CEO. Needless to say, the project is stopped. Moreover, he argues that if SENER's social impact study were conducted properly, developers would not face opposition from local stakeholders –municipal governments and indigenous communities.

[8] Water wells commonly found in Yucatan and neighboring states.

Mr. Villeda also complains about the federal permits' inefficiency. First, he argues that most of them are mandated by law to provide a resolution in less than 90 days. Technically, the firms could sue the agencies or continue the project without their resolution. However, because of law enforcement flaws in the country, going to court could delay the project for more than two years and firms are opting not to follow this path. The firms still hope for administrative improvements to come soon. As shown in figure 10, a significant time fraction of STC's and PEMEX's permits consists of *dossiers* going from one regional office to another. *"Often times, local representatives just leave your request on their table. You have to follow up and make sure that they send it to Mexico City, where it will be evaluated. Similarly, you have to follow up with the Mexico City office in order for them to send your request back. In the case of PEMEX's permit, the Mexico City office sends the documents back to the regional office, but the project has to be approved by the agency's legal department in Monterrey. There goes more time! I do not know why it is not sent directly from Mexico City to Monterrey",* says Mr. Villeda. Moreover, the concession payments for transmission lines to cross either federal highways or railroads complicate the process further. At least BANOBRAS tries to align to COFEMER's efficiency recommendations, but FERROMEX, being a private concessionaire, takes the resolution time it pleases, he argues.

At a local level, regulation is not prepared to integrate utility scale renewable energy plants. Urban development plans are regulated at a municipal level.[9] There are over 2,440 municipalities in Mexico. Their attributions and functions were established in the 1917's Constitution for a low population density and agricultural vocation country. In 1917, Mexico's population was close to the 14 million (IMCO, 2012). Today, it is above 120 million (INEGI, 2018). The municipalities have failed to evolve together with the country's demographic changes. They lack the technical, organizational and financial resources to conduct their activities efficiently (IMCO, 2012). Without the municipal construction permits, the firms cannot legally start building their plants.

[9] In rare cases when the municipality does not have a municipal development plan, it aligns to a state one.

As urban development plans do not include solar plants or similar projects, such projects are also omitted in the municipal fiscal codes. This is the case of EDF's selected municipality *Empalme*. The municipality has only 54,131 inhabitants, but an area of 708 squared kilometers. Its main economic activity is agriculture (INEGI, 2010). Once awarded, Mr. Villeda started the permitting process for the 344 hectares' solar plant. Since such a project was not included in *Empalme's* development plan –neither in the zoning map-, the land use permit and the corresponding fees were subject to municipal officials' interpretation. They determined that the solar project fell closest in the "high risk industrial storage plant" category, whose fee in the fiscal code is linked to each project's square meter. Conversely, municipal Civil Protection authorities argued they were entitled to charge 0.35 of the Mexican minimum wage (MXN 80.08, USD 4.45) for each of the 3,440,000 project's square meters. EDF complained and pointed out that the fiscal code contemplates construction and not land square meters in the concept that the authorities were indicating. EDF was willing to pay for two hectares of actual construction –two substations. However, the officials insisted that since the solar panels were attached to the ground, they also counted towards the construction area.

EDF initially estimated to spend MXN 3 in permits, MXN 5 million (USD 280,000) at maximum. However, the Civil Protection agency alone was demanding around MXN 100 million (USD 5,5 million) (Villeda, 2017). In *Yucatan,* the municipality requested USD 500,000 for an environmental license to AR Sun Energy before the project was stopped (Patiño, 2018). Changing municipality was not in EDF's plans. As already outlined, communal property rights in the country severely hinder energy projects development. The firm was not willing to take the risk of changing locations. It already had signed a PPA contract that stipulated penalties for not delivering and they could not start from zero again (Villeda, 2017). Hence, the firm sought for help from state officials. It was then when Mr. Aguiar, Head of the Energy Commission of Sonora, and his team started to get involved in meetings between the awarded firms and the municipalities. They learned that Zuma's experience in *Hermosillo, Sonora's* capital, was less complicated. Although the firm recognizes that local regulation is not prepared to welcome utility scale projects, the firm's public relationship events and social involvement in the region eased the process

of sitting down with local officials to interpret development plans and fiscal codes (Sosa, 2017). Mr. Aguiar's objective was to replicate this success story. He aimed to raise awareness among *Empalme's* officials that it was in every one's best interest to ease EDF's installation. The municipality could collect a reasonable income from issuing permits, the state could stand out as an attractive investment region for further auctions and the firm could deliver its PPA obligations. After several meetings, municipal and state officials went through the municipal fiscal code's "loopholes" to calculate reasonable fees. Later, they asked the state's Improvement Regulatory Commission to intervene to patch these loopholes and reform regulation. That reform process is still ongoing. In the end, the total municipal permits' cost was agreed around MXN 6 million; still above of what EDF initially estimated but far below from the MXN 100 million that the municipality demanded in the first place.

As mentioned initially, the *Sonoran* case is the optimistic one. AR Sun Energy and other awarded firms in *Yucatan* plan to call for *force majeure* causes stipulated in the PPAs contracts to not be penalized for not delivering electricity (Patiño, 2018). The ISO acknowledges that the local permitting issues will be considered as *force majeure* causes, if well documented (Alvarez, 2018). Meanwhile, one of the Spanish multinationals is even planning to sue the state and municipal governments in *Yucatan* for blocking the projects' development (Patiño, 2018).

SECTION III: ACTORS AND POLICY MENU; STATUS QUO, POLICY RECOMMENDATION AND ALTERNATIVES

Introduction to policy menu and actors

The designs of the Mexican Electricity Market and LTPAs are an example of a Plan and Control method with implementation shortcomings and sub-optimal results (Andrews, et al., 2017). They are solution driven plans –drive electricity prices down- designed by experts and based on global best practices. However, the policy makers did not take into

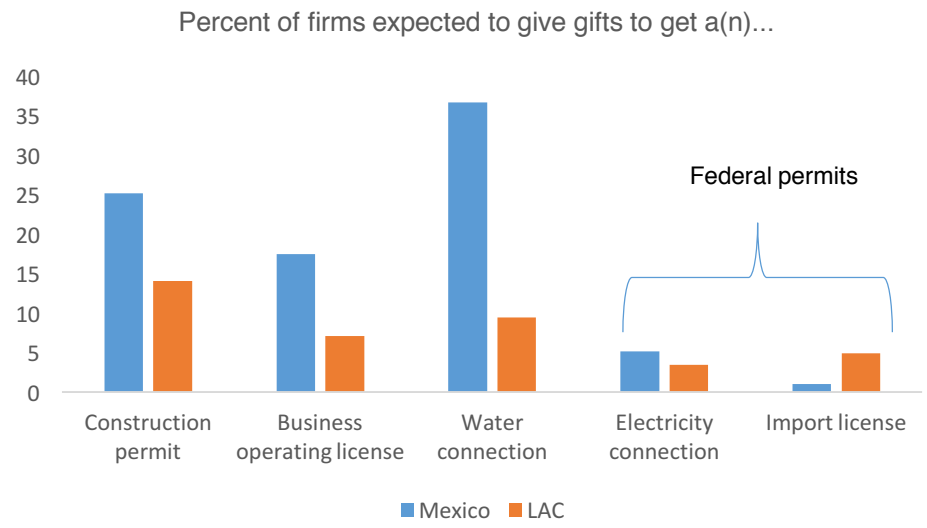
account the peculiar context of permitting in Mexico. As such, the “borrowed” design so far has failed to facilitate smooth implementation of renewable power plants.

This work alerts the Regulatory Improvement Federal Commission (*Comision Federal de Mejora Regulatoria, COFEMER*) about permitting challenges that the awarded firms are facing. It provides a set of recommendations to overcome these challenges and mitigate them in future auctions. Contrary to Plan and Control, the recommendations are based on a Facilitated Emergence method (Andrews, et al., 2017). COFEMER should become an expert facilitator that engages with federal and local officials throughout the simplification and reform processes. Active engagement of broad groups will facilitate understanding of each state’s and municipality’s context, leading to higher implementation success rates. However, the implementation will ultimately depend on local officials and federal counterparts: they should become the agents of change. This work’s main recommendation for COFEMER is to facilitate dialogue between government agencies and firms and work together with the former to streamline procedures and improve regulation. The alternate policies are i) creating a one-stop shop for the awarded firms to obtain permits and ii) assisting the auctioneer in piloting site-specific auctions. The status quo is to let the firms resolve discrepancies with local governments while they wait extended periods of time for federal permits to be resolved.

The same stakeholders are considered across the policy menu. Mexico has a complex institutional setting comprised of agencies at three different government levels: federal, state and municipal. Regarding energy topics, COFEMER should support the federal administration’s policy making efforts. The Energy Reform was not expected to yield results in the short-run; particularly not before the presidential term ends in 2018. In contrast, municipalities are often seen as office seeking institutions (Sheely, 2017). They have a shorter, three years, term and once in office, they tend to extract as much rents as possible. This is coherent with EDF’s and AR Sun Energy’s experiences. World Bank data also supports the rent seeking claim. Besides construction permits, business

licenses, water and sewerage services are provided municipally.[10] The percentage of firms expected to give gifts to obtain these permits are considerably higher in Mexico than in the Latin American and Caribbean (LAC) region. This is not necessarily the case to obtain federal permits, including an electricity connection with CFE (figure 11).

Figure 11. Permits in charge of municipalities are linked to high bribes in Mexico.



Source: World Bank, 2010.

Within municipalities, COFEMER should aim to promote Urban Development officers' involvement. Urban Development Plans tend to be designed with a long-run idealization of the city –or town. COFEMER can find policy making allies in those officials. Mr. Villeda's complaints were stronger about the Civil Protection officers, than the land use technicians. The latter seemed to be hand tighten to what their superiors and the Fiscal Agency wanted to charge.

State governments can complement the facilitator's role. By actively involving them in group dialogues, COFEMER could rely on them to follow up during implementation, particularly on their State Regulatory Improvement Commissions peers. This would be crucial for when the municipal administration changes.[11] Moreover, COFEMER has to

[10] There are some inter-municipal and state water utilities, but the vast majority is municipal. See World Bank, 2017 and IMCO, 2014 for more information.
[11] State governments have a six years' term, same as the federal.

establish connections to any federal or state agency involved in the permitting process – i.e. SEMARNAT or State Roads Commissions- and assist them in streamlining bottlenecks. These agencies' roles would be supportive of COFEMER's efforts. The awarded firms and CFE are also main stakeholders in the policy menu. It is between them that the PPAs are signed. If the awarded firms fail to deliver the committed electricity, they will be subject to penalties defined in contracts. CFE will have then to buy its electricity from the volatile spot market.

Lastly, the regulators are additional stakeholders to consider. They also represent a complex institutional setting. The Energy Ministry, SENER, is in charge of the country's energy policy. However, the electricity sector is also regulated by two other entities. On one hand, generation, transmission, distribution and retail activities are regulated by the Electricity Regulatory Commission (CRE), which also issues operations permit to generators and retailers within LTPAs. On the other hand, the auctions are designed and conducted by the ISO CENACE (National Center of Energy Control). Though listed as independent, CENACE's president is the Energy Minister. Furthermore, the auctions heavily depend on inputs determined by CRE, for instance, the price caps. The OECD has already recommended regulators to minimize duplicated goals and activities. Moreover, it urged them to harmonize and simplify processes and regulation with COFEMER's help (OECD, 2017). For simplicity, the policy recommendations aimed to regulators will refer to SENER. The Energy Minister is the president of the Coordination Council of the Energy Sector (CCSE), a council that assembles SENER, CRE, CENACE, the National Commission of Hydrocarbons (CNH) and the National Center of Natural Gas Control (CENAGAS).

A visualization of the policy menu and the recommendations are presented next.

Table 2. Policy menu visualization summary

Policy option	Technically correct	Administratively feasible	Politically supportable
Let firms resolve discrepancies with local governments while they wait extended periods of time for federal permits	Low	Not difficult	Strong opposition
Facilitate dialogues between government agencies and firms, and assist the former in streamlining procedures and improving regulation	High	Not difficult	Low opposition
Create a one-stop shop for awarded firms to obtain permits	Moderate	Difficult	Strong-moderate opposition
Assist CENACE in piloting site-specific auctions	Moderate	Moderate difficulty	Strong opposition

Status quo: Let firms resolve permitting problems by themselves

Underbuilding is becoming a reality in *Yucatan*. The problem will exacerbate in states and municipalities with lengthier and costlier permits. Therefore, the status quo is not technically correct. If cheaper plants fail to install because of burdensome and expensive permitting processes –the latter particularly important given that it is safe to assume shrunk profit margins (see LCOE)-, electricity prices in the country are going to remain high. The Energy Reform's objective would then be futile.

Status quos tend to be administratively feasible and this is no exception. Not having to mobilize additional resources, the regulators can hope that the firms will push and find reasonable settlements by themselves. However, even in *Sonora* the state authorities' facilitator's help was needed. Lastly, the status quo will not be politically supportable. As firms start sharing their adverse experiences, one can expect further auctions to have less confident investors. Competitive firms can decide not to participate in future auctions, hurting auctions' outcomes. Mexico's auctions and energy investments reputation will be hurt globally, which will put political and social pressure on the regulators to fix the permitting issues.

Policy recommendation: Facilitate dialogues between government agencies and firms, and assist the former in streamlining procedures and improving regulation

COFEMER has been involved at different stages of the Energy Reform, but surprisingly, not at the implementation stage. If COFEMER were involved in the *Sonoran* case, it would have acquired valuable knowledge that could be put into use in future firm-municipality disputes in other states. Furthermore, being a federal agency, it can help its federal agency counterparts in streamlining bottleneck permits –the Energy Commission also assisted firms in requesting SEMARNAT's permits. COFEMER should adopt and replicate Sonora's Energy Commission's role, but across the country. That is, encouraging local and federal agencies to streamline procedures and improving regulation.

The auctions' bids have already been awarded and projects' development faces a deadline. Thus, the permitting issue is one to be dealt urgently. The technical correctness of this recommendation is twofold. First, renewable energies are the technologies that are most feasible to drive electricity prices down in a sustainable way in Mexico –assuming no underbidding. Hence, from the energy policy side, it is technically correct to seek for their prompt deployment. By creating a reform dialogue between local and federal agencies and firms, COFEMER can understand the municipalities' context and tailor a solution for each case. Ultimately, construction regulation exists to protect public safety and it can differ from one region to another. Second, it is also in local governments' best interest to reform and improve their regulation. Accelerating permit approvals can increase construction spending and property tax revenue by 5.7% and 16%, respectively (PwC, 2005). Furthermore, construction regulation is a critical factor for firms when deciding where to establish themselves (KPMG, 2009). Regulation should be transparent and not open to official's interpretations; it should be efficient, but not non-existent.

Administratively speaking, this policy is not difficult to implement. COFEMER has vast experience in working with local governments to improve regulation. This recommendation does not aim to suggest a different approach in COFEMER's *modus operandi*. It highlights an overseen problem. The recommendation does not call for the

creation of a new unit or massive resources mobilization. It assumes that the State and Municipalities Unit has the expertise to encourage local governments to reform regulation and improve their business environment. The learning curve in effectively engaging in dialogue with local governments will be lower compared to creating a unit within the Energy Ministry, as the SunShot initiative is in the US. However, the unit will have to incorporate –or receive cross support- from other COFEMER's officials specialized in federal permits' regulatory impact. With their assistance, the time bottlenecks can be reduced while the resolution content can be improved. In short, COFEMER has the human capital and organizational structure to attack the auctions' permitting problems, making this an administratively easy recommendation to implement.

The recommendation is also politically supportable. COFEMER assistance does not represent a cost for local governments and thus it is well accepted. The State and Municipalities Unit has worked across the country for more than a decade. Previous relationships with local governments and experiences in other projects can ease the reform dialogues. Furthermore, more than a half of the states have both state and municipal regulatory reform committees (World Bank, 2016). There have been plenty of cases where COFEMER, state and municipal governments have worked harmoniously in Regulatory Improvement Agendas. In fact, between 2016 and 2017, COFEMER signed this type of collaboration agreement with the states of Sinaloa and its 18 municipalities, Veracruz, Puebla, Colima and its 10 municipalities, and Tabasco and 15 out of its 17 municipalities (COFEMER, 2017). Puebla and Veracruz have an elected PAN (right) governor, while Tabasco a PRD (left) one. COFEMER is part of the PRI's federal administration. This example shows that COFEMER has the ability of coordinating efforts across different government levels –municipalities included- and parties. That said, the firms usually do not distinguish between government levels. Their government efficiency perception is subject to their experience and it can be improved by an agency helping them in easing the establishment of their businesses. COFEMER can become that friendly face for generators while strengthening investors' confidence in the country.

Alternative 1: Create a one-stop shop for awarded firms to obtain permits

One-stop shops ease obtaining permits for firms by making a public official responsible for getting the permits in the "back-office". This way, firms can focus on more productive activities. *"One-stop shops also allow for more efficient processes and rapid execution, enabling agencies to process greater volumes of permit applications and increase client satisfaction"* (World Bank, 2018). Nevertheless, "back-office" interactions limit the firms' feedback –or concerns- to the initial requesting stage. A one-stop shop led by COFEMER could speed up permits, but ultimately, reach an unsatisfactory permits' fee agreement with local governments.

One-stop shops are not easy to implement. Only 24 countries around the world have a construction one-stop shop and Mexico is not on that list. Their success *"hinges upon efficient coordination among all agencies involved and often requires overarching legislation that ensures information sharing and establishes oversight mechanisms"* (World Bank, 2018). The awarded firms face strict PPA deadlines and cannot wait until agencies agree on how to share information and reform regulation accordingly. The case of Municipal Business Centers in the state of Colima is worth analyzing in order to minimize learning curves. However, Colima is Mexico's lowest population state and has only 10 municipalities. Sonora has 72 municipalities; Oaxaca 570. Municipalities across the country surely will argue that their budget is constrained to think about physical and human needs for a one-stop shop. COFEMER and other federal agencies will then need to mobilize resources to awarded municipalities. Given the deadlines, it could work together with regulators to initiate works in those municipalities that are expected to receive competitive bids. Nevertheless, firms' bids and the awarding algorithm –which specifies not much more than it maximizes the system's benefits- will ultimately decide where the PPAs are to be developed. COFEMER will have then to take the risk of initiating works in a municipality that might in the end not need a one-stop shop. All this makes the recommendation administratively difficult to implement.

Politically, a one-stop shop can also be expected to face at least medium opposition. Local governments are fierce when it comes to other government branches

interfering in their responsibilities. This explains duplicated permits. Even if SEMARNAT determines that the project has no negative environmental impact, the municipality also wants to have a say. As a rent seeking institution, municipal authorities would also dislike the idea of sitting down with federal officials to agree on reasonable permits' fees. They would prefer to negotiate directly with firms –or at least be on the negotiation table with all the stakeholders. Moreover, state officials seek for their states to competitively stand out in order to attract investors. A one-stop shop that smoothens regional differences will undermine efforts that more developed states have taken so far. Opposition from these leading states, such as *Sonora*, can be expected. It will be crucial to make them understand –based on figures 5 and 6– that the electricity system is interconnected and leaving other states behind is not ideal. Lastly, if focused on a Plan and Control method, the one-stop shop's adoption and implementation rates might be significantly lower than initially envisioned. It will be imperative to involve all the stakeholders and avoid trying to mandate best practices without understanding municipalities' contexts.

Alternative 2: Assist CENACE in piloting site-specific auctions

The LTPAs are sealed-bid auctions where firms simultaneously submit undisclosed bids. The auctioneer then ranks and sums the bids until the auctioned volume is covered. This auction type differs from multi-round descending-clock auctions in other countries (see IRENA, 2015a). An auction design is comprised of four main features: i) auction demand, ii) qualification requirements, iii) seller's liabilities and iv) winner selection (IRENA, 2015a). Modifying the auctions' design will not resolve the problems that current awarded firms are facing. However, it can mitigate issues in upcoming tenders. Thus, this recommendation's technical correctness is moderate.

The auctions have imposed few qualification requirements (IRENA, 2017). The bidders are responsible for identifying potential sites and providing the authorities with the relevant documentation. Federal officials are then in charge of assessing firms' legal, financial and technical capacity. The assessments' flexibility of awarding firms that had already initiated lengthy permits –i.e. SEMARNAT's- and others that had not, show the

looseness of the requirements. LTPA4 will require all bidders to have initiated SEMARNAT's and SENER's permits (Alvarez, 2018). However, setting stricter requirements also has its trade-offs. While stricter compliance can reduce the risk of delays and underbidding, it can also limit participation by increasing transaction costs. Less competition would potentially drive prices up (IRENA, 2017).

A site-specific auction can reduce the risk of underbuilding while not hurting competition. Obtaining permits and identifying a site can ultimately represent up to 2% of the project's costs (AURES, 2016). In a site-specific auction, the firms would be shielded against unaccommodating local regulation and federal bottlenecks. The government assumes responsibility for choosing the project's site, securing grid access and siting permits. Site-specific solar PV auctions were conducted in Dubai and Abu Dhabi during 2016, with competitive outcomes as close to the Mexican ones (see figure 2). Before the Energy Reform, the then vertical integrated CFE auctioned a small fraction of its demand to small IPPs through a similar scheme (Alvarez, 2018). Furthermore, they have been conducted for several years across Europe for offshore wind auctions (IRENA, 2015a). Hence, they are not administratively difficult to implement. In fact, the site-specific auctions in France and Denmark were complemented with a one-stop shop for administrative procedures (IRENA, 2015a). It will be crucial to analyze each site's municipal context before emulating this type of practice.

A downside of site-specific auctions is that they prevent competition across different technologies. The site for a wind plant differs significantly from a solar plant. One concern is that the outcomes would not be as competitive as technology-neutral auctions'. Nevertheless, this should not be a concern for the Mexican case. This memo has considered solar PV outcomes, but the lowest bid in LTPA3 was in fact a wind bid, at USD 17.7 MWh + CEC.

Politically, this recommendation will face strong opposition. First, the firms with different technologies will be left out and might complain. Second, some of the one-stop shop trade-offs also apply here. Rent seeking municipalities will dislike interacting with federal officials instead of directly with firms. Conversely, a Plan and Control approach

where federal officials pressure municipalities to issue permits can have a lower implementation success rate. Third, the regulators will oppose redesigning an auction that has been successful in their eyes. The low awarded bids have been a flagship of the Energy Reform's success. Auctions' consistency strengthens bidders' confidence. The periodicity of the LTPAs and their schedule have been clear; competitive bids can be partly attributed to that (IRENA, 2017). It will be challenging to convince regulators to assign additional resources to redesign if a potential outcome is having less confident bidders. Lastly, CENACE as ISO and auctioneer does not think site-specific auctions are appropriate for solar and wind plants. Perhaps for geothermal and hydraulic projects that are more complicated. CENACE reckons that permitting issues will be resolved by asking for SENER's and SEMARNAT's proof of request in the qualification requirements. As the time between auction's launch and results is around five months, those lengthy permits should be resolved by the time that firms are awarded. In its eyes, firms that want a long-term PPA have to take the permitting risk. It claims there are other options to enter the Mexican Whole Sale Market and firms entering LTPAs have to be highly developed. CENACE does recognize the complexity in obtaining municipal permits and is working on a guide to provide awarded firms to request them (Alvarez, 2018). However, a standardized guide will not help firms as permitting processes vary significantly across the country, as shown in figure 9. Moreover, even the most developed firms will not be able to start construction if they clash with the municipal government or indigenous communities.

There are other auction's features worth rethinking. The selection criteria for winning bids are highly sophisticated (IRENA, 2017) and at the same time, not well understood by the bidders (PwC, 2016a). The explanation of the model maximizing the buyer's surplus seems not to be enough and it is worth rethinking a more transparent and simpler way to communicate it. Regarding seller's liabilities, a site-specific auction should decrease projects' lead time given that it accommodates schedules for administrative procedures and financial closure (IRENA, 2017). Conversely, if no specific-auction is to be conducted, lead times for upcoming auctions should be increased. This will entail a risk of some bidders speculating for a cost decrease between bid and execution and thus,

underbidding. Such cases have been documented on several occasions, including in Germany and Brazil (IRENA, 2017).

Considering that the reform mandates at least one LTPA a year, a site-specific auction could be piloted while still conducting technology-neutral auctions.

CONCLUSIONS

The complexity in obtaining construction permits in Mexico is resulting in PPAs delays and underbuilding. In a recent World Bank mission, the head of CRE expressed his concerns about this issue (Elizondo, 2017). If firms decide to publicly denounce the adversities they are facing, Mexico's reputation as a top renewables' destination will be severely hurt. It is crucial for permits to be simplified across different government levels. More importantly, local regulation has to evolve to welcome renewable energy projects. Generators need transparent information as to the number of permits, time and cost they will incur obtaining permits. Projects' development should not be hindered neither by rent seeking authorities, nor by overloaded –or inefficient- agencies.

COFEMER can lead simplification and reform efforts to ease PPAs deployment. In the end, if electricity prices are to decrease –as the Energy Reform aims-, LTPAs' (allegedly) cheaper generators have to operate across the country. It is in governments', firms' and society's best interest to allow renewable projects deployment.

This work's main recommendation is prioritized based on a timing issue and its implementation feasibility. By allowing COFEMER to be involved in municipal legislation's interpretation across the country and federal permits' simplification, awarded firms should obtain permits in a timely and cost reasonable manner to respect their PPAs commitments. The longer regulation reform process can start simultaneously. That is how permitting challenges were overcome in *Sonora.*

The one-stop shop alternative strengthens the main recommendation's viability as a technically, administratively and politically feasible solution to implement. Site-specific auctions can complement COFEMER's efforts in improving local regulation by minimizing permitting risks in the medium-term. Nevertheless, they will not solve the problems that

firms are currently facing. The three policy recommendations are based on a Facilitated Emergence method (Andrews et al, 2017), where COFEMER assumes a facilitator role instead of forcing best practices and standardization. That is the reason why this work does not aim to provide an optimal Gantt diagram –a timeline- based on figure 10. Ultimately, designing a policy based on best practices is one of the main reasons why implementation is currently failing. By engaging stakeholders in policy dialogues, COFEMER will be able to better understand each project's and municipality's contextual problems. It will be then in a better position to design and iteratively test for solutions. If it succeeds in reducing the construction permits processes to less than six months –the worst estimate the firms had, considering that the federal permits are legally required to be solved in less than three months-, the firms should be able to respect their PPAs commitments. That said, prompt renewables plants' deployment is not the only factor of an efficient and cost competitive electricity market. The transmission grid will need to be upgraded and other issues such as electricity theft and losses will have to be addressed for cheaper prices to become a reality. Overcoming issues in obtaining permits is only the first of many steps to take.

These recommendations have, to my best knowledge, not been implemented. The States and Municipalities Unit at COFEMER was unaware of permitting problems and it was not involved in any LTPA case by November 2017 (Archila, 2017). PROMEXICO, the federal agency in charge of attracting investments to the country, was interested in creating a one-stop shop for the awarded firms (Aguiar, 2017), but no further information is publicly available. CENACE's interviewed official expressed the entity's posture against site-specific auctions for solar and wind plants, the technologies that have been predominant across the three LTPAs. Moreover, it has confirmed no collaboration between CENACE and COFEMER or PROMEXICO. The lack of coordination and information sharing across agencies is the main reason why no substantial progress in solving this issue has been made. In a recent Inter-American Development Bank mission to Mexico, SENER's officials were unaware of COFEMER's expertise in working with local governments (Carvalho, 2018).

The biggest assumption in this work is that there was no underbidding. It will be important to follow up on LCOEs estimates and seek for a convincing argument that the auctions' astonishing low prices are real. Even if permits are simplified and regulation is improved, underbidding will result in underbuilding and electricity prices will remain high. In that sense, LTPAs have become stricter over time. After observing firms' manipulation with energy, capacity and CECs packages in the first two auctions, LTPA3 did not allow firms to bid for separate contingent PPAs. In an effort to minimize permitting delays, qualification requirements have become stricter. LTPA3 requested CENACE's interconnection permit and LTPA4 plans to request for the initiation of SEMARNAT's and SENER's permits. However, as qualification requirements increase, so do the transaction costs. The trade-off is having fewer competitors. *"LTPA3's requirements and more so, LTPA4's, are designed for the five big multinationals. No one else can comply with those terms."* says Mr. Patiño. Tighter auctions' rules can create market power problems in the future.

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ACRONYM LIST

BANOBRAS	Banco Nacional de Obras y Servicios Públicos
BNEF	Bloomberg New Energy Finance's
BOS	Balance of System
CCSE	Consejo de Coordinación del Sector Energético
CEC	Clean Energy Certificates
CENACE	Centro Nacional de Control de Energía
CENAGAS	Centro Nacional de Control del Gas Natural
CFE	Comisión Federal de Electricidad
CNH	Comisión Nacional de Hidrocarburos
COFEMER	Comisión Federal de Mejora Regulatoria
CRE	Comisión Reguladora de Energia
FERROMEX	Ferrocarril Mexicano
IEA	International Energy Agency
IMCO	Instituto Mexicano para la Competitividad
INEGI	Instituto Nacional de Estadística y Geografía
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
ISO	Independent System Operator
LAC	Latin American and Caribbean
LCOE	Levelized Cost of Energy
LDC	Local Distribution Companies
LMP	Locational Marginal Prices
LTPA	Long-Term Power Auctions
MWh	Megawatt hour
NAS	National Academies of Sciences
NREL	National Renewable Energy Laboratory
O&M	Operation and Maintenance
OISE	Observatorio de Inteligencia del Sector Energético
PAN	Partido Acción Nacional
PPA	Power Purchase Agreement
PRD	Partido de la Revolución Democrática
PRI	Partido Revolucionario Institucional
PV	Photovoltaic
RPS	Renewable Portfolio Standard
SCT	Secretaría de Comunicaciones y Transporte
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales
SEN	Sistema Eléctrico Nacional
SENER	Secretaría de Energía

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