D2.1-MX, November 2019

Auctions for the support of renewable energy in Mexico

Main results and lessons learnt

AURES II has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817619

D2.1-MX, November 2019. Auctions for the support of renewable energy in Mexico

Authors: Pablo del Río (CSIC)
Reviewed by: László Szabó, Enikő Kácsor (REKK), Hugo Lucas (IDAE)
Submission date: M14
Project start date: 01 November 2018
Work Package: WP2
Work Package leader: REKK

Dissemination level: PU (Public)

Any dissemination of results reflects only the authors' view and the European Commission Horizon 2020 is not responsible for any use that may be made of the information Deliverable D2.1 contains.

Contents

1 Characteristics of RES-E auctions in Mexico

1.1 Goals of the government with organizing auctions

Mexico has a fast-growing electricity sector, with demand increasing on average by 2.9% per year since 2000. 98.7% of the population has access to electricity and the challenge consists in connecting the remaining, remote areas (IEA 2019).

Several context conditions should be taken into account in Mexico, as they influence goals in the energy area and the design of policies. These include high retail electricity prices, excellent RES resources and ambitious clean energy targets.

Electricity prices are on average 25% higher than retail electricity prices in the US for residential and commercial users (Barrie 2016)[1]. On the other hand, there are significant potential untapped renewable energy resources (and particularly wind and solar PV potential), which are concentrated mainly in the northern and western parts of Mexico, but distant from most population centers and industrial activity, which are located in the central and southern regions of the country (Viscidi 2018, p.1).

Mexico's generation mix is dominated by thermal sources. According to SENER (2018), as of June 2018, fossil-fuel generation accounted for 75.8% of electricity generation. The share of renewables was 17.3%, dominated by large hydro (10.3%), and followed by wind (3.6%), geothermal (1.6%), bagasse (0.8%), PV (0.7%) and biogas (0.2%). Nuclear (4%) and cogeneration (2.8%) account for the rest.

The country has ambitious clean energy targets. The Energy Transition Law (issued in 2015) establishes a clean electricity generation minimum share of 25% by 2018, 30% by 2021, and 35% by 2024. The 2012 Climate Change Law had set the goal that at least 35% of total electricity generation in 2024 should be from clean energy sources. According to the Electricity Law, "clean energy sources" are wind, solar, geothermal, hydroelectric, and other forms of renewable energy plus nuclear, certain biofuels and efficient cogeneration. The Energy Transition added the interim goals for 2018 and 2024. In 2016, Mexico had 73 GW of installed electricity generation capacity, including 29 percent (21 GW) from clean energy. Mexico's Programa de Desarrollo del Sistema Eléctrico Nacional (PRODESEN) forecast a three percent average annual growth rate for electricity demand between 2017 and 2031 (SENER 2017). This demand growth would require an installed capacity of 113 GW by 2031. PRODESEN projected that nearly 50 percent of this (56 GW) would be from clean energy sources (Molina et al 2018, p.4). The following table summarises the main energy transition targets.

Table 1: Main energy transition targets.

2015	Energy Transition Law	Clean energies in power generation (mandatory): • 25 percent by 2018; • 30 percent by 2021; • 35 percent by 2024.
2016	Transition Strategy to Promote the Use of Cleaner Technologies and Fuels	Clean energies in power generation (indicative): • 35 percent by 2024; • 37.7 percent by 2030; • 50 percent by 2050. Energy efficiency, average annual reduction of the final energy intensity, indicative targets:

[1] As of March 2019, the price of electricity in Mexico for households is 0.08 USD/kWh (GlobalPetrolPrices 2019).

		• 1.9 percent during 2016 – 2030; • 3.7 percent for the period 2031 – 2050.
2018	The Special Programme for the Energy Transition 2017-2018	By 2018. On transmission, distributed generation and storage: • Reaching 90 percent optimisation of administrative procedures for project licensing; • Issuing 25 geothermal exploration licenses; • 527 MW clean distributed generation. On Technology R&D and value chain: • Increase value chain index from 3.01 to 4.1; • Certification of 2,481 professionals. On democratization of clean energies: • MXN 960 million in credits for clean distributed generation; • 1,480 MW efficient co-generation installed.

Note: The author would like to thank Hugo Lucas for providing this table.

Complying with climate change commitments and driving down electricity prices through clean energy are general goals of the Mexican government. An energy reform was introduced in 2013 (see next section). The aim was to provide an energy boost after the declining production of Mexico's state owned oil and gas company Pemex and to reduce the wholesale electricity price (Barrie 2016). According to ACPM (2017, p.11-12), "the purpose of electricity auctions is to reduce the dependency on fossil fuels in electricity generation and to ensure a reliable and efficient electricity service through firm sources (…). These auctions will encourage new investments in electricity plants based on clean energy, contributing to the fulfillment of environmental goals and to the achievement of highly competitive prices in order to reduce its costs for the basic consumers".

1.2 Main pillars of the RES-E support policy in Mexico

Mexico launched an Energy Reform in 2013 which included the unbundling and restructuring of Comisión Federal de Electricidad (CFE), opening up the power sector to participation by the private sector and the introduction of competitive electricity markets for energy, capacity and clean certificates (IEA 2016). As part of the new regulatory framework, the Electricity Industry Law was promulgated in 2014 to open power sector generation and the wholesale market to competition. The law establishes a new regulatory framework for Mexico´s electricity sector.

The law permits certain retailers to buy and sell energy in the wholesale electricity market at prices negotiated freely between generators, retailers and qualified users. The state- owned CFE will buy energy through auctions in order to meet its power needs at competitive prices. In this new scheme, qualified users and retail suppliers are subject to renewable energy quota obligations. They have to acquire Clean Energy Certificates (Certificados de Energía Limpia, or CELs). The regulator, the Federal Energy Commission (CRE) regulates transmission and distribution rates and the corresponding subsidies to supply basic users (IRENA 2015, p.32).

CFE was transformed from a government administration into a "productive state enterprise" and unbundled, both vertically and horizontally. Responsibility for system operation has been transferred from CFE to a new, independent entity, the Centro Nacional de Control de Energía (CENACE)(IEA 2016, p.92). Independent power producers (IPPs) can and do own and operate power plants; but they must sell all power produced to CFE under long-term power purchase agreement (del Río 2017).

1.3 Design elements of RES-E auctions

On November 19, 2015, the Ministry of Energy / Secretary of Energy (Secretaría de Energía, or SENER) published the rules for the long-term energy auction (the "Auction Manual"). The Bidding Guidelines ("Call") are published by CENACE for every yearly auction.

So far, three long-term power auctions (LTPAs) have been organized (in 2015, 2016 and 2017)[2]. The former two were analysed in a previous report for the AURES project (del Río 2017). This report focuses on the third LTPA. The LTPAs result in Power Purchase Agreements (PPA) between renewable energy generators and retailers, with CFE being the main retailer to date (Guadarrama 2018). The LTPAs are designed to help generators avoid the risks of volatile short-term prices and to benefit from stable revenues in order to finance their investments (IEA 2017, p.174).

At a simple level, the auctions work as follows: retailers announce their demand for energy (MWh), capacity (MW) and Clean Energy Certificates (CELs) to be auctioned by CENACE and generators bid for them separately or in packages. The contract duration for energy and capacity is 15 years and 20 years for CELs (Guadarrama 2018).

Table 2: Main characteristics of auctions and framework conditions

Characteristics	Description of the auction
Characteristics of the national electricity market	(see text and IEA (2017) for further details)
Name of auction scheme	Long-term electricity auctions
Contractual counterparty	The system operator (CENACE) is the organiser of the auction. Off-takers: CFE, Iberdrola and CEMEX.
Main features	-Multi-technology auctions with regional and hourly adjustments of bid prices whereby packages of three products are auctioned (capacity, electricity generation and CELs).
Technology focus and differentiation	Multi-technology auctions. Eligible technologies (for energy and CELs): Wind, solar, geothermal, biomass, hydro, nuclear, waste to energy, carbon capture, efficient cogeneration and tidal wave. Fossil-fuel technologies are also eligible for capacity.
Lead time before auction	6 months CENACE published the call (RFP) on April 28th 2017. Awarded winners were published on November 2017.
Min./max. size of project	Neither maximum nor minimum sizes are required.
What is auctioned? Auctioned bids (in terms of budget, electricity or installed capacity)	Packages of energy, capacity and CELs
Budgetary expenditures per auction and per year	Undefined
Frequency of auctions	At least yearly
Volume of the tender	Capacity (1414 MW/year), Electricity (6089532 MWh/year) and CELs (6089532). The bids accepted

[2] A fourth auction was envisaged for 2018 but it was cancelled.

	cover 41.9 % of capacity (592), 90.2% of electricity (5492575) and 97.7% of CELs (5952575) (ACPM 2017).
Costs related to grid connection/access	Grid connection costs fall on the awarded bidder.
Balancing and profile costs	Unavailable.

Table 3: General auction design

Design elements	Description
Auction format	multi-unit, multi-product auction
Auction procedure	Price-only, static auction. Pay-as-bid (PAB) with nodal pricing. Off-takers submit (to CENACE) the purchase volume and maximum price of generation, CELs and capacity, including the energy demand curve for the purchase offer per product and segment / range. The awards are based on matching the energy demand and supply curves, as well as CELs and capacity. An optimisation program selects the best bids in terms of cost, capacity and profit margin. The optimisation program aims to contract the largest amount of capacity, energy, and CELs at the lowest possible price. This means that not all the auction volume demanded by the buyer (i.e. CFE) may be contracted. CENACE has the right to declare unsuccessful the tender process in case of low participation interest and to call for additional auctions under certain circumstances. The bids include: quantities of each of the products to be offered (MWh of electricity, CELs and/or MW of capacity), the anual price (in MX/year), the indexation of the offer (in USD or pesos), the interconnection point and the date of commencement of operations (PWC 2016) Bids can be done for one, two and/or three products and bids can have conditional character between themselves. Awarded bids will have to sign a PPA with the off-takers. Although the auction is static, an iteration may be triggered in case the economic benefit reached (total surplus) is below a pre-defined threshold. So far, there has not been a need for an iteration because the threshold was reached. If the auction leads to an iteration, CENACE announces the price and quantities of each selected offer. All bidders can submit counteroffers in the iteration, in whichbidders may reduce the price for one or

	more of their bids but may not modify the other attributes of their bids. This process is repeated until the value of the total surplus in the last solution is less than or equal to 101% of the surplus of the previous solution (PALLC 2016, p.3).
Pre-qualification requirements - Financial	In order to participate, the bidder has to issue different guarantees: Bid Bond ("garantía de seriedad") issued in order to participate in the bid process: 300,000 UDIs[3], regardless of the number of offers and products presented + 65,000 UDIs per MW of capacity offered in the auction + 30 UDIs per each MWh of electricity offered in the auction + 15 UDIs per each CEL being offered in the auction. Performance guarantee ("garantía de cumplimiento") issued at signing date of PPA until end of contract: 65,000 UDIs per MW of capacity offered in the auction + 30 UDIs per each MWh of electricity offered in the auction + 15 UDIs per each CEL offered in the auction. The amount of the performance guarantee can vary if certain milestones are fullfilled (option to reduce amount) or not fullfilled (obligation to increase amount). The bid must include the interconnection point and certain technical design details of the project offered. In addition, the off-taker has to provide guarantees based on the PPA contract: Performance guarantee ("garantía de cumplimiento"): 32,500 UDIs per MW of capacity offered in the auction + 15 UDIs per each MWh of electricity offered in the auction + 7.5 UDIs per each CEL being offered in the auction.
Pre-qualification requirements - Material	Indentification of the plant: Bidders are required to identify the plants that will

[3] An UDI or "Investment Unit" is an unit of account whose value in Mexican pesos is published periodically by the Bank of Mexico. The value of an UDI in March 2017 is around 5.7 pesos. One $ = 19.5 pesos (i.e., one USD 1 UDI). ← 1 $ is around 3 UDI then, right...?

	back their bids for electricity products (IRENA 2017, p.70) **Technical & Execution capability**: the bidder must have built and operated project(s) with a similar technology in the last 10 years with a capacity equivalent to at least 33% of the size of the capacity offered in the auction. In addition, bidders must provide evidence of being a service provider and having maintained direct or indirect participation in the project company for a certain period of time (up to 3 years after COD) **Financial capability**: the bidder must have obtained financing in the past in order to develop projects of a similar or higher size to the one offered in the auction (del Río 2017, p.11). Moreover, investors are responsible for identifying potential sites and producing the relevant documentation (resource assessment, grid connection)(IRENA 2017, p.70).
Pricing rule	Pay-as-bid
Award procedure[4]	Three types of adjustments: Regional, hourly and inflation/exchange rate. -REGIONAL ADJUSTMENT (NODAL PRICING): Regional adjustments of bid prices (hourly adjustment factors per zone) are included. They reward or penalize those zones where new capacity is needed or where production overcapacity exists, respectively (PWC 2016). In other words, ceteris paribus, a project in a node with higher generation costs would be rewarded. The application of the adjustment factor does not mean that the price of the contract will change, but such factor is used for the evaluation of the bid. The awarded price will be the bid price, not the adjusted one. For each yearly auction, the applicable adjustment factor per each node will be defined. The locational signals were reduced in the 2nd auction (the locational penalty decreased by 95%)(IRENA 2017). -HOURLY ADJUSTMENT: Electricity from intermittent clean sources will be paid at the price included in Seller's bid as adjusted up or down by "hourly adjustment factors" to account for the expected value of the energy delivered at the interconnection node on the hour of delivery relative to the expected value of the average hourly price during the year at the same node (Mayer Brown 2016, p.3), i.e., more will be paid for the electricity generated at times of higher demand and less for the electricity at times of lower demand. Sup-

[4] Based on del Río (2017).

	pliers with intermittent clean sources shall receive a monthly payment equal to the Schedule Hourly Adjustment Factors multiplied by the number of MWh of energy produced on a per-hour basis HOURLY-ADJUSTEMENT PAYMENTS = Number of MWh of cumulative energy produced per hour × Scheduled hourly adjustment factors provided by CENACE (EY 2016). Note that the regional adjustments are used for the evaluation of bids. The hourly adjustments are used for the actual payments to winning bidders. -INFLATION AND EXCHANGE RATE ADJUSTMENT: The price is also adjusted to account for inflation and variations in the peso/dollar exchange rate. Each bidder may choose that its payments be indexed to Mexican inflation or the peso/dollar exchange rate. At commercial operation date (COD), the price offered in the bid will be adjusted pursuant to a formula to account for variations in the peso/dollar exchange rate (70% weight), US inflation in proportion to the peso/dollar exchange rate variations (20% weight) and Mexican inflation (10% weight). Such adjusted price is referred to as the "Initial Price". The Initial Price is multiplied by the average of the monthly adjustment factors used to calculate the adjusted monthly prices for the corresponding year (Mayer Brown 2016, p.3).
Price limits	Disclosed ceiling prices: Between USD1,673,752.12 MW/year and USD1,063,742.54 MW/year for capacity (depending on the zone), USD 751.53 for energy (MWh/year) and USD404.64 for CELs (MWh/year)(ACPM 2017, p.54).
Support period	Long-term contracts (15 years for energy and capacity, and 20 years for clean energy certificates)
Favorable treatment of specific actors	No
Realization time limit	COD should be between January 1st 2020 and January 1st 2022. According to the RFP (or Bases) (numbers 1.2.9 and 1.2.10), the "standard" COD will be January 1st 2020, but the bidder may propose a different date, which can be up to two years later the "standard" COD.
Penalties	Penalties for non-realisation of projects include the withholding of the bid bond (Hochber and Poudineh 2018, p.30). As stated in del Río (2017, p.12), if commercial operations are not commenced by the scheduled COD as indicated in the bid, the awarded bidder must pay a penalty equivalent to 5% of the monthly payments under the PPA. In addition, the amount of the performance guarantee, which is gradually paid back, has to be increased in case of delays

	- in achieving milestones before scheduled COD by 0.75% of the contract price of the PPA, or - of scheduled COD for each month of delay by 10% (delay attributable to electricity generators), 2% (delay attributable to federal government) and 5% (delay attributable to state/municipal government), subject to an overall cap of two times the original guarantee amount (Clifford Chance 2016, p.3). Generators may defer up to 12% of the contracted CELs to be delivered to the off-taker for up to 2 years, but any CELs so deferred shall be increased by 5% p.a. for each deferred year. If after deferring for 2-years there is a deficiency in CELs, the generator must purchase CELs in the market (Clifford Chance 2016, p.3).
Form of support auctioned	-Electricity generation-based support (+ CELs). -The total PPA revenue for the project includes the package price and the hourly adjustment factors. In the auction, SENER calculates future energy prices for different locations across Mexico to assess the expected value of new investments and adjusted bids in the auction on this basis. If the expected price exceeds the average marginal price of electricity, the intermittent producer receives the value of the bid plus the benchmark value. Similarly, if the project feeds power into the grid at a moment when the benchmark price is negative, this amount will be deducted from the contract price. Benchmark prices are updated for each new auction to account for the evolution of local supply and demand considering the (future) commissioning of previously awarded projects. The benchmark price varies on an hourly basis and can be positive or negative. In essence, those producers offering electricity with a higher-than-average value can reduce their bids in two steps. In the first step, project developers consider the time-related benchmarks that will apply in the location of their choosing. They will incorporate this into the price they bid into the auction. In the bid selection, the regulator applies a correction factor related solely to location (IEA 2017, p.150). Capacity payments are limited to capacity that is available during the 100 "critical hours" of the year (Hochber and Poudineh 2018, p.25). For 2016 and 2017, the critical hours will be are the 100 hours will the highest demand, whereas for the year 2018 and onwards, it will be those hours with the lowest Level of Generation Reserve (CENACE 2017, p.3).
Support level adjustments	See adjustments in "award procedure"
Transferability of support right	As stated in del Río (2017, p.13), the generator cannot sell/transfer any of its rights over the power plant to a third party unless the transfer has no ma-

	terial impact on the generator's operating or financial capacity, the transferee assumes all of generator's obligations, and relevant authorizations are obtained (Clifford Chance 2016).
Other	- Mexican Pesos or USD (indexed). Generators are paid in Mexican Pesos, but can opt to have their tariffs indexed to the US Dollar exchange rate and inflation.

Compared to the previous auctions, the design of the third one has some particularities.

- *Opening to private off-takers.* The third auction was open to private buyers in addition to the CFE. However, the CFE continued to be the largest off-taker, offering to buy 91 percent of energy and CELs in the auction (Viscidi 2018, p.9). The remaining percentage was offered to Menkent (CEMEX) and Iberdrola. The off-takers will ratably share the risk of non-performance by all generators of the third auction and those generators will ratably share the risk of payment default by all off-takers of the same portfolio (Molina et al 2018, p.5). Potential financiers should consider, however, that CFE has the ability to assign, without the developers' prior consents, all of its rights and obligations under its PPAs to any other off-taker of the portfolio and to any other off-taker (Clifford Change 2017).
- *Introduction of a Clearinghouse.* The government established a clearinghouse (Cámara de Compensación or CdeC) to execute separate contracts with the developers and off-takers. The independent entity will act as counterparty between sellers and buyers in the long-term auctions, assessing the financial credibility of the market participants and socialising the risk of default. Previously, the guarantees of performance under the contracts awarded in a tender were provided by CFE. The CdeC will collect and hold specific guarantees. Thus, the PPA's risk will not be a specific company but the Mexican electricity market as a whole. However, the CdeC will have a safety net in the form of a reserve fund into which all parties will pay and will also house the performance guarantees from each party (Yaneva et al 2018, p.9).
- *Lower nodal price adjustment* (with respect to the 1st LTPA). CENACE reduced the nodal price adjustments from a range of USD45/MWh in the first auction (+USD10.7/MWh to -USD34.3/MWh) to a span of USD13.5/MWh in the third auction (Molina et al 2018, p.5). LTPA2 and LTPA3 did not strongly favor any region as the regulators change the local marginal price projections for each auction (Guadarrama 2018).
- In contrast to the previous auction, in the third one bidders could not bid separately for different products for the same plant (PWC 2017, p.5)
- Whereas the energy ministry (SENER, together with CENACE) ran the first three auctions, it was envisaged that the CRE (Energy Regulatory Commission) would lead the 4th tender (Viscidi 2018, Yaneva et al 2018, PWC 2017).

1.4 Other regulatory factors and changes

The energy reform introduced CELs for each megawatt-hour of clean electricity generated. CELs will be awarded for the next 20 years, are bankable and generators can hold them indefinitely. However, only capacity commissioned after August 2014 is eligible for CELs. The aim isto encourage new investments.

The targets up to 2024 are to be met through a quota and a clean energy certificate system. Retail suppliers (i.e., CFE) and large consumerswill be obliged to obtain a given share of their electricity supply (for large consumers, a share of electricity consumption) from clean sources. SENER sets the annual quota obligation, which increases gradually over time (Table 4). 2018 is the first year of quota obligation, and also when annual CEL market trading starts (IEA 2017, p. 148). Electricity generation from wind, solar, tidal, geothermal, biomass, hydro, nuclear, waste to energy, carbon capture and efficient cogeneration is eligible to receive CELs. Hydro projects which were already deployed before the Law for the Development of Renewable Energy and Financing the Energy Transition had been passed would count for the clean energy quota but could not receive CELs (Hochberg and Poudineh 2018, p.25).

Table 4: Clean energy targets and CEL demand

Year	Clean energy target (%)	Clean energy portfolio standard (%)	Number of CELs (millions)
2018	25	5	12
2019		5.8	14
2020		7.4	21
2021	30	10.9	33
2022		13.9	45
2023		March 2020	
2024	35	March 2021	

Source : Hernández (2017).

It is important to acknowledge the very relevant role played by CELs in the auction prices. Most of the energy bids (in MWh) were bundled, one-to-one, to CELs in the first two LTPAs. CELs allowed for more aggressive energy bids as the longer CELs contract duration lowered capital cost financing (Guadarrama 2018). However, according to Viscidi (2018, p.18), some critics believe that the scheme is not aggressive enough to move Mexico towards zero carbon energy given that the prices may be too low to act as incentives for renewable energy investment and that Mexico's clean energy targets and CEL-eligible projects include efficient cogeneration.

The logic behind the CELs is to cover the extra cost of clean energy over fossils by rewarding their environmentally friendly attributes. However, utility scale solar and wind have proven to be more competitive than fossil alternatives in the long-term auction. Bidders have offered a package of energy and CELs, the very competitive bidding prices indicate that the price tag of CELs within the package is either very low or zero. Under these circumstances, CELs would not provide an additional incentive and would thus not promote additional renewable energy capacity.

Nevertheless, besides the use of CELs as financial support to new clean energy projects the CELs have the secondary objective of promoting sustainability by increasing the rates paid by major electricity users in accordance with the "polluter pays" principle. CELs can increase awareness on the cost of energy and the benefits of clean energy among the main energy consumers. In addition, the CEL market platform allows any corporation to implement social corporate responsibility principles by voluntary sourcing clean energy through procuring and cancelling CELs.

To improve effectiveness, the CEL market will have to send price signals in the near future. This can come by increasing the demand, i.e. establishing a higher mandatory quota on consumption or reducing the offer. One possibility could be to exclude competitive technologies such as photovoltaic and on-shore wind from being awarded CELs. This could be in fact an opportunity to more expensive but dispatchable technologies such as geothermal and biomass.

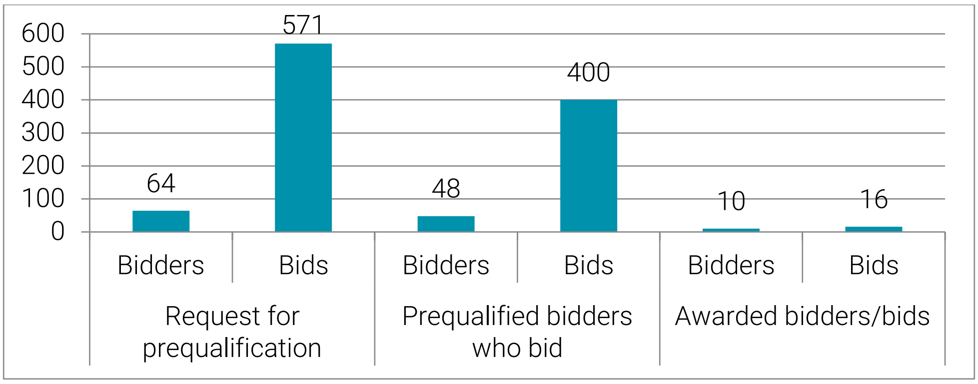
In addition to the CELs, several other support instruments for renewable energy are available. These include "a tax incentive allowing for a 100% income deduction for investments made in renewable energy and efficient cogeneration, and for net metering for installations with installed capacity under 500 kW, soft loans, a regional pilot project to introduce 5.8% blending of ethanol in gasoline in three regions, a Sustainable Energy Fund to promote projects on energy efficiency and renewable energy and a risk-mitigation mechanism for potential geothermal projects during the exploration stage" (IEA 2017, p.177).

2 Evaluation of the auction results

The auction seems to have been an undeniable success in terms of the prices achieved. This is true in comparison to global experiences (see ACPM 2017, Deign 2018, Guadarrama 2018) as well as compared to previous auctions in Mexico. The average bid price for the whole package in the third auction was 20USD/MWh, compared to 47USD/MWh in the first and 33USD/MWh in the second auctions.

Arguably, a high degree of participation and competition was behind the low prices in the third auction (CENACE 2017a, ACPM 2017). There were 48 prequalified bidders submitting 400 bids. 10 bidders and 16 bids were selected (Figure 1).

Figure 1. Bidders and bids in the third auction.



Source : Own elaboration from ACPM 2017 and CENACE 2017a.

Also, the competition in the third auction was greater than in the previous ones. The ratio "number of awarded bids / number of prequalified bids" was lowest in this third auction (see table 5).

Table 5: Awarded and prequalified bids in the Mexican auctions.

	Request for prequalification (bids)	Prequalified bids	Awarded bids	Ratio awarded bids/prequalified bids %
First auction	468	227	18	7,9
Second auction	442	368	56	15,2
Third auction	571	400	16	4,0

Source: Own elaboration from Rodríguez (2018).

The preliminary results led to an economic surplus of 50.77%, which is the difference between the maximum prices at which off-takers are willing to buy and the sale offers which had prequalified[5]. Since the difference was higher than 27.3%, the iteration procedure was not activated (CENACE 2017a). The average bid price has dropped significantly between the first and the third auction (by 57%). The following table provides a comparative view of the results of the three auctions in Mexico. A remarkable feature of the three auctions is the undersubscription of electricity, CELs and capacity.

[5] The winner is selected based on an optimisation model that maximizes the economic surplus of the buyer. The economic surplus of the buyer is defined as the difference between the maximum price the buyer is willing to pay for the product (ceiling price) multiplied by the quantity purchased, minus the sum of all the prices of the packages awarded in the auction. (IRENA 2017, p.71).

Table 6: Mexican long-term power auctions.

	First SLP (03/2016)	Second SLP (09/2016)	Third SLP (11/2017)
Volume of the tender			
Electricity (MWh/year)	6,360,000	10,600,000	6,086,475
CELs (CEL/year)	6,360,000	10,600,000	6,083,845
Firm Capacity (MW/year)	500	1,483	1,415
Volume awarded			
Electricity (MWh/year)	5,402,881	8,909,819	5,492,575
CELs (CEL/year)	5,380,911	9,275,534	5,952,575
Firm Capacity (MW/year)		1,187	593
Bids received	227	326	392
Winning bids	18	56	16
Winning companies	11	23	9
Average prices (MWh + CEL)	47.78 USD	33.47 USD	20.57 USD
Minimum Prices (MWh + CEL)	Wind: 42.85 USD PV: 35.46 USD	Wind: 35.77 USD PV: 25.03 USD	Wind: 17.00 USD PV: 19.00 USD
Expected start of commercial operation	September 2018	January 2019	June 2020

Source: SENER. Note: The author would like to thank Hugo Lucas for providing this table.

However, the prices achieved in the Mexican market are unlikely to have a significant impact on the electricity prices in the short term since the auction-winning generation plants will not be operational until the second half of 2019. Furthermore, the MWh quantities purchased by the basic and qualified service providers correspond to approximately 1.8 % of the annual generation in the country (Zárate and Silva 2019).

In addition to strong competition, several factors are behind the low prices, as stressed by different authors (see Table 7).

Table 7: Factors explaining the low prices in the Mexican auction.

Reference	Main insights on the factors behind the low prices.
Davis (2017)	Resource availability, funding from multilaterals with very low capital costs and cheap labor can explain the low auctions' prices.
PWC (2017)	The conclusion of this survey among 30 companies in the sector and financial institutions is that the main driver of those prices were the high competition expected in the third auction (25%), followed by the reduction in investment costs (22%) and price signals in international auctions (18%)
Hochberg and Poudineh (2018)	The low prices in the third auction are related to the additional competition due to the introduction of other off-takers in addition to CFE (despite its share of 91% of the market). This is in addition to Mexico's excellent renewable energy resources and " long-term PPAs denominated in USD, the possibility of avoiding noncompliance penalties, low interest rates globally, the impact of large developer participation on capital costs, and overall comfort with and knowledge of the Mexican auction process" (Hochberg and Poudineh 2018, p.35)
Fernández (2019)	The reasons for the low prices include: 1) Most bidders were highly experienced and very professional international companies with sound corporate policies; 2) Projects size favored scale economies; 3) the biggest bidders got favorable financial conditions, 4) Legal and regulatory framework as well as 15 years contract terms for energy and 20 years for CELs increased investors confidence, 5) PV equipment prices in the international market have been remarkably cheaper in recent years, and labor costs in Mexico are lower than in other countries, 6) Contract conditions assume yearly deliveries which are cheaper to achieve than monthly deliveries, 7) Mexico's macroeconomic conditions foster investor confidence, 8) Guarantee of seriousness is worth around 90,000 USD per project, plus 9 USD per offered MWh, and 4.5 USD per CEL, 9) International auctions prices are consistent with Mexico's prices, 10) CFE contracts, backed by Mexico's sovereign debt, are very attractive to lenders.
Yaneva et al (2018)	According to this study, "the locational adjustments were one of the reasons to which the price fall between the first and second auction was attributed as the significance of these adjustments was greatly reduced in the second auction. Other factors cited were increased investor confidence and the depreciation of Mexican currency. In addition, besides cost declines and the appeal of the market's potential, the steadily declining prices across the auctions may reflect the revenue streams available to project developers as they can also sell surplus generation at nodal prices, participate in the capacity market, or sell CELs on the secondary market" (Yaneva et al 2018, p.11).

Regarding effectiveness, it is obviously too early to judge the realization rate of this auction, but this is not the case for the first and even the second auctions (LTPA1 and LTPA2). According to Fernández (2019), the winning projects in the first auction should have been operational at the end of 2018. However, Guadarrama (2018, p.17) argues that there are already delays for the projects awarded in the first auction. One interviewee in that paper noted that "By March 2018, four LTPA1 bids should start supplying electricity in Yucatan. However, these plants have not even started construction". A recent report by IRENA (2019) shows that 53% of projects awarded in the first two auctions have been completed on time, 37% were delayed and 10% have been cancelled (or the project status is unknown). In its Mexico Energy Outlook in 2016, the IEA already warned that the fact that players are not obliged to demonstrate acquired land rights (they need to apply for necessary permissions only after the announcement of the results of the auctions) introduces the risk that not all projects will be implemented as planned (IEA 2016, p.51).

Many authors argue that permits are delaying and endangering PPAs' development (Guadarrama 2018, Viscidi 2018, Molina et al 2019, IEA 2017, James 2017, Climatescope 2019 and Barrie 2016)[6]. According to Guadarrama (2018), the complexity in obtaining construction permits in Mexico is resulting in PPAs delays and underbuilding and is currently the main obstacle for renewable projects deployment in Mexico. Viscidi (2018) notes that project developers in Mexico face major challenges in acquiring land rights and the consent of local communities to build power plants and transmission lines. Similarly, Molina et al (2019, p.24) note that license and environmental and social permits may be problematic for developers who have not secured land and development rights and obtained agreement from local communities. This author argues that some areas with high wind power potential in Mexico have been blocked from development by conflicts with local communities with traditional land tenure systems. According to James (2017), "the 997 MW of projects approved in Yucatan state in the first auction still have a number of hurdles to overcome. Environmental impact studies may find challenges at a number of levels: it is a hurricane country; the topography is rocky; jungles are prevalent and so flora & fauna may be affected by some of these projects. Importantly, it is also the heart of Mayan civilization and they may encounter cultural and anthropological resistance". According to Climatescope (2019) "investors are also wary of environmental and other regulatory risks in some areas of Mexico due to land disputes with indigenous communities, which remain an important barrier for project development in the country and a primary reason for project construction delays in specific regions, such as Yucatan".

The IEA recommends that Mexico makes "it easier for industry, citizens and stakeholders to navigate through the array of new legal, regulatory and permitting processes" (IEA 2017, p.38). Guadarrama (2018) provides three recommendations to overcome permitting challenges: i) to facilitate a dialogue between government agencies and firms, and assist the former in streamlining procedures and improving regulation, ii) to create a one-stop shop for awarded firms to obtain permits and iii) to 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 other alternatives. According to this author, it was envisaged that the LTPA4 (which was finally cancelled) would have required all bidders to have initiated permits from the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) and from the Secretaría de Energía (SENER). This is a signal that the permitting issue was acknowledged by the government and the auction organizer as a fundamental issue which may negatively influence the effectiveness of the scheme.

Nevertheless, 80% of the interviewees in the PWC's survey mention that the main challenge for the awarded projects is to securethe financing. This is followed at a large distance by delays in the grid connection (5%) and obtaining the environmental and social impact assessment (5%)(PWC 2017, p.16). Furthermore, permitting can be wielded by developers as force majeure event in order not to build the project. Indeed, the Independent System Operator (ISO) acknowledges that the local permitting issues will be considered as force majeure causes, if well documented (Guadarrama 2018). A winning bidder might be able to avoid paying a penalty if it fails to have an operational plant because the government did not fulfill its own deadlines (PALLC 2016).

On the other hand, there is some concern about the possibility of underbidding in this auction. For example, Viscidi (2018, p.18) mentions that "the prices offered in recent auctions are so low that they may not be economically feasible, and the developers will be unable to acquire financing to actually build the promised capacity. Some companies may even be hoping to renegotiate their contract later." This author argues that, in recent auctions, some bidders have reportedly used low-quality data and failed to perform proper assessments before submitting bids—for example, by submitting a bid for a project to be built in a protected national park. If developers face unforeseen environmental or social challenges that increase the costs of the project and alter the financial structure of the deal, they may be unable to move forward with construction (Viscidi 2018, p.18). Similarly, Hochberg and Poudineh (2018, p.33) note that "the resulting low prices are also a cause for concern due to the potential for substantial project non-realisation". According to Davis (2017), there have been "hyper-aggressive bidding" in the 3rd auction due to betting on the future. "These projects will start operations in 2020 so there is some time for further decreases in PV costs and developers are likely taking this into account". For James (2017) "cost of capital has changed in Mexico in recent months, while PPAs

[6] Transmission constraints represent another bottleneck for project development, given that most of the country's wind and solar resources are in remote areas far from population centers (Guadarrama 2018 and Viscidi 2018).

are hardwired. Projects with tighter pricing from the second auction are at greater risk".

Several authors argue that prequalifications are low (Guadarrama 2018, Viscidi 2018, O'Mealy 2018, IEA 2017 and IRENA 2017), although there is not a consensus on this issue. For IRENA (2017), the auctions have imposed few qualification requirements. "Mexican auctions aim to attract new players and so impose relatively few qualification requirements" (op.cit., p.70). Viscidi (2018, p.18) agrees: "the high number of prequalified bidders for the auction is also tied to the low requirements for prequalification". O'Mealy (2018) argues that there have been relatively few qualification requirements. For IEA (2017) "the high number of participants can be explained in part by the relatively low hurdles of pre-qualification, resulting in the risk for project delays during implementation (permitting, local consultations, etc.)" (IEA 2017, p.177).

In contrast, Kruger et al (2018, p.36) mention that "qualification requirements are strict, requiring substantial evidence of technical and financial capacity and experience, as well as site-specific documentation (including resource assessments and grid access)". Bidders also have to post bid bonds (see Table 3). Similarly, Hochberg and Poudineh (2018, p.31) state that "prequalification is strict (financial and technical)". Likewise, for Davis (2017), prequalifications would not be so low "under the terms of the latest auction, if a developer fails to deliver they must pay a "guarantee" equal to about nine months of revenues". According to Guadarrama (2018), in an effort to minimize permitting delays, qualification requirements have become stricter.

Regarding technological diversity, there is a concentration on PV and wind projects awarded in the third auction. Wind projects account for 44.6% of the electricity generation awarded (2453 GWh) and PV for 55.4% (3040 GWh). A look at the three auctions shows that this result is similar to the first and second auctions. Apart from wind and PV, other three technologies have been awarded in one of the auctions and for at least one of the products: Geothermal (electricity, capacity and CELs in the 2nd auction), hydro (CELs in the 2nd auction) and CCGT (capacity in the 2nd and 3rd auctions). Biomass and CSP have not been awarded in any of the auctions (Table 8). It can be observed that, in contrast to the previous auction, when about 60% of RES bids bid for capacity, only three out of the 14 awarded bids in the third auction bid for capacity (PWC 2017, p.6). One interviewee argues that it will be difficult to see new biomass and geothermal developments since auctions have been more successful for those renewable energy technologies for which projects are easier to develop and which can be better standardized, such as wind and especially solar photovoltaic projects. In addition, auctions are less suited for technologies such as biomass, and especially geothermal, that demand more resources to be invested, and risked, in the project development phase to prepare the bids.

Table 8: Electricity, CELs and capacity awarded in each auction per technology.

	FIRST AUCTION			SECOND AUCTION			THIRD AUCTION		
	ELECTRICITY (MWh)	CELS	CAPACITY (MW)	ELECTRICITY (MWh)	CELS	CAPACITY (MW)	ELECTRICITY (MWh)	CELS	CAPACITY (MW)
WIND	1920055	1920055	0	3874459	3828757	129	2453000	2482000	83
PV	3484825	3457856	0	4836598	4933382	184	3040000	3472000	10
GEOT	0	0	0	198764	198764	25	0	0	0
HYDRO	0	0	0	0	314631	0	0	0	0
CCGT	0	0	0	0	0	849	0	0	500
TOTAL	5404880	5377911	0	8909821	9275534	1187	0	0	593

Regarding actor diversity, Table 9 includes details on the awarded winners in the third auction. 10 bidders and 16 bids were selected. Awarded bidders include international energy companies (Enel Green Power, Engie, Canadian Solar, Acciona, and Invenergy) and global IPPs backed by private equity funds and institutional investors (X-Elio, Zuma and Neoen). The bidders with the largest contracted amounts in the three auctions were 1) Enel Green Power (with 24 percent of the awarded CE capacity and 23 percent of the CELs; 2) Zuma (12 percent of the awarded CE capacity and CELs); and 3) Engie (11 percent of the awarded CE capacity and CELs). Overall, awarded winners in this auction are from France (845 MW), Italy (593 MW), USA (550 MW), Canada (294 MW), Spain (200 MW) and Japan (80 MW) (CENACE 2017b). The third auction awarded contracts to two private off-takers (Iberdrola and Cemex) for approximately 10 percent of the CE capacity (534 GWh) and CELs (532,000 certificates) plus 21 percent of the firm capacity (124 MW)(Molina et al 2018, p.6).

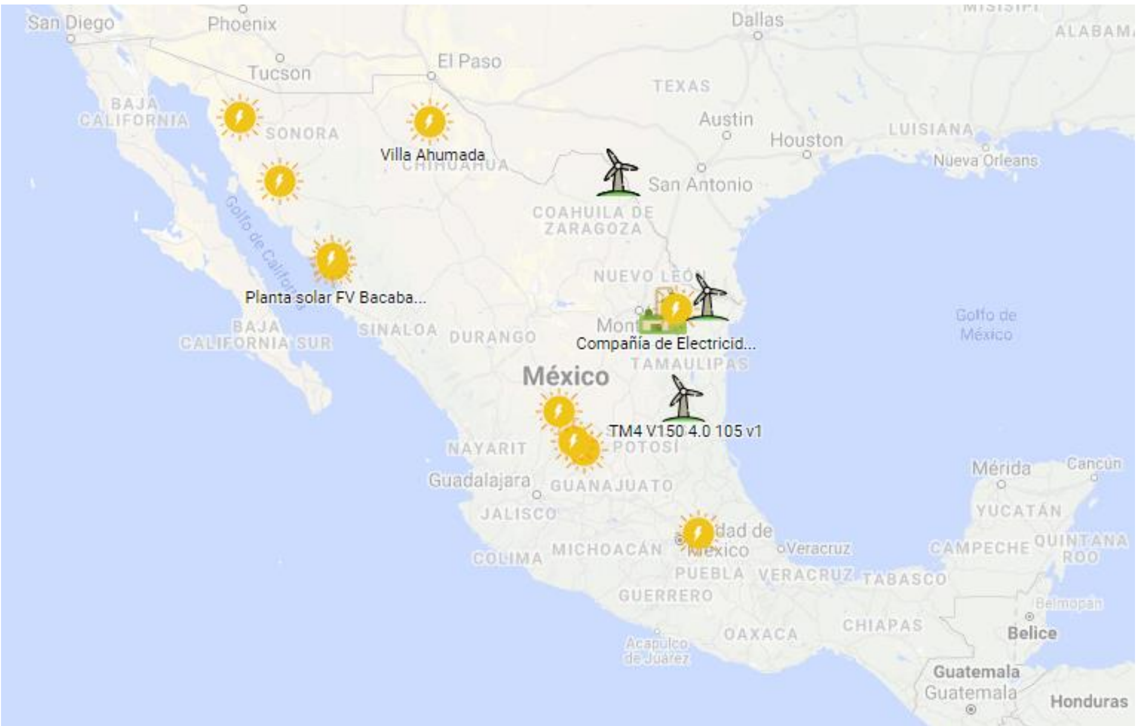
Table 9: Awarded winners in the third auction.

Companies	Country of origin	Bid number	Products offered		
			Capacity (MW)	Energy (MWh)	CELs
X-ELIO ENERGY, S.L.	Spain	SLP2017010076-002	10.00	435,354.48	483,727.00
NEOEN INTERNATIONAL S.A.S.	France	SLP2017010093-002	0.00	616,692.00	770,864.00
COMPAÑÍA DE ELECTRICIDAD LOS RAMONES S.A.P.I de C.V.	Mexico	SLP2017010101-002	499.95	0.00	0.00
CANADIAN SOLAR ENERGY MEXICO, S. de R.L. de C.V.	Mexico	SLP2017010102-004	0.00	235,640.00	265,095.00
		SLP2017010102-009	0.00	206,017.00	247,220.00
		SLP2017010102-011	0.00	210,426.00	252,511.00
CONSORCIO ENGIE EOLICA	Mexico	SLP2017010111-056	30.62	362,935.00	391,805.00
CONSORCIO ENGIE SOLAR 1	Mexico	SLP2017010115-014	0.00	280,054.99	302,332.00
		SLP2017010115-026	0.00	486,312.70	524,997.00
CONSORCIO ENGIE SOLAR 4	Mexico	SLP2017010117-002	0.00	379,603.36	434,486.00
ENEL RINNOVABILE S.A. de C.V.	Mexico	SLP2017010122-004	0.00	373,016.51	373,016.00
		SLP2017010122-007	0.00	357,031.92	357,031.00
		SLP2017010122-011	0.00	510,680.05	510,680.00
		SLP2017010122-063	0.00	848,883.17	848,883.00
Mitsui & Co., Ltd. & Trina Solar (Netherlands) Holdings B.V.	Japan & Nederlands	SPL2017010123-001	0.00	189,928.00	189,928.00
ENERGÍA RENOVABLE DEL ISTMO II S.A. de C.V.	Mexico	SLP2017010131-003	52.04	0.00	0.00

Source: ACPM (2017).

Regarding geographical diversity, the PV projects awarded in the third auction are concentrated in the North-west and center of the country, whereas the wind projects are located in the North-east (figure 2). No projects have been awarded for the Yucatán region, in contrast to the first and second auctions.

Figure 2. Geographical distribution of projects awarded in the third auction.



Source: ACPM (2017). https://www.google.com/maps/d/edit?mid=1nXXB5zWZo56ouplMRE9Dc9_kDIQujwe3&ll=25.087517785605442%2C-105.23112989999998&z=6

3 Conclusions

The Mexican long-term electricity auctions in general and the third auction in particular suggest some lessons both regarding the process as well as the design elements in the auction.

Regarding the process, transparency, regulatory clarity and information provision have been clear facilitators of participation, by reducing the risks and costs of participation, with positive effects on competition and bid prices. According to the survey of PWC (2017) among 30 firms in the sector as well as financing institutions in the third auction, 70% of the respondents stated that the methodology for the calculation of the interconnection capacities and the export limits was unclear. However, 70%, 100% and 95% declared that information on noncompliance penalties, the RFP (Bases) and the CENACE website, respectively, were clear. Acevedo (2017) also criticises the complexity (and lack of transparency) in the evaluation of the bids (with a mixed integer optimisation program) which could discourage investments because the rules of the game are not clear and uncertainty on the assessment method is generated.

In contrast, lack of coordination between the auction and permitting procedures seem to have been a bottleneck for deployment of the projects being awarded in the auctions, and this might also be the case with the third one. Several alternatives may exist to circumvent the permitting issue in Mexico. On the one hand, policy-makers should ensure local community support for renewable energy infrastructure by improving the process for land consultation and disputes. On the other hand, to create more certainty for participants in the bidding process, the government should provide more information to bidders about renewable energy potential and social and environmental conditions in areas where renewable energy projects could be developed (Viscidi 2018, p.23). Finally, in this case, site-specific auctions may be useful in order to reduce uncertainty and to achieve good regional coordination (del Río and Linares (2014). In a site-specific auction, the firms would be shielded against unaccommodating local regulation and federal bottlenecks (Guadarrama 2018).

Whereas a simple (albeit not too simple) design of the auction is often defended, the Mexican case shows that a sophisticated design also has its merits. In particular, it allows the inclusion of relevant aspects, such as the consideration of the system value of electricity generation and combination with other market-based support schemes, such as TGCs. The auction captures the relative value for the system of different generation technologies by location and production profile, with projects being encouraged to generate electricity when it is most valuable to the system.

Finally, this case study shows the importance of having a minimum frequency of auctions overtime, which strengthens bidders' confidence. The periodicity of the LTPAs and their schedule have been clear and competitive bids can be partly attributed to that (IRENA 2017, Guadarrama 2018). According to IRENA (2017, p.70) "the clear schedule and periodicity of auctions in the context of a well-defined target for renewable gives investors clear indications of the roadmap for the sector".

While this has been a positive element in the past, the future prospects are not as clear. The suspension of the 4th auction, which was expected to have taken place in 2018, was a negative event in this context. Also, the director of the CFE stated on March 2019 that no more auctions would be held in the upcoming years (Bellini 2019). This is a negative signal for the market. There is a risk that this leads to the stop-and-go which was deemed one of the most important factors behind the failure of RES auctions in the past (e.g., see del Río and Linares 2014). As argued by Maria Chea, an analyst for the Americas at IHS Markit (cited in Bellini and Zarco 2019b), "the cancellation of the fourth auction does not affect the schedule of the previous tendered projects but clouds the visibility of new renewable generation after 2020".

4 References

Acevedo, V.H. (2018). Revisión de las subastas eléctricas de largo plazo en Mexico. Centro de Investigación y Docencia Económica (CIDE). Master thesis. October Ciudad de México.

ACPM (2017). Testimonio para la subasta de largo plazo SLP-1/2017. ACPM, Ciudad de Mexico. Barrie, D. (2016). Mexico's path to a clean economy. Renewable Energy Focus, 17(2), 80-82.

Bellini, E. (2019). Mexico wants to review contracts awarded in energy auctions. Retrieved from: https://www.pv-magazine.com/2019/03/29/mexico-wants-to-review-contracts-awarded-in-energy-auctions/

Bellii, E. & Zarco, J. (2019). Mexico to kick-off first private renewables auction this week. Retrieved from: https://www.pv-magazine.com/2019/06/24/mexico-to-conduct-first-private-renewables-auction-this-week/

CENACE (2017a). Anuncian SENER y CENACE resultados preliminares de la Tercera Subasta de Largo Plazo. Retrieved from: https://www.gob.mx/cenace/prensa/anuncian-sener-y-cenace-resultados-preliminares-de-la-tercera-subasta-de-largo-plazo-141668

CENACE (2017b). Presentación del Fallo de la Subasta de Largo Plazo (SLP) 2017. CENACE, Ciudad de México, 22 de noviembre de 2017. Retrieved from: https://www.youtube.com/watch?v=U3aa5yDJr78

CENACE (2017c). Reporte del primer semester 2016 de las 100 horas críticas. Retrieved from: https://www.cenace.gob.mx/Docs/MercadoOperacion/CalculoAcrReqPotencia/2017/Reporte%202016%20S1%20100%20hs%20Cr%C3%ADticas%20y%20Nivel%20Reserva%20Gen%20v2016-10-10.pdf

Clifford Chance (2016). Mexico's Second Auction: PPA features and Bankability considerations. Retrieved from: https://www.cliffordchance.com/briefings/2016/10/mexico_s_second_auctionppafeaturesan.html

Climatescope (2019). Climatescope 2018 for Mexico. Retrieved from http://global-climatescope.org/results/MX

Davis, L., & Irastorza, V. (2017). Are Mexican Renewables Really This Cheap. Energy Institute at Hass Blog. Retrieved from: https://energyathaas.wordpress.com/2017/12/04/are-mexican-renewables-really-this-cheap/

Deign, J. (2018). Mexico's Energy Auction Just Logged the Lowest Solar Power Price on the Planet. Greentechmedia. Retrieved from: https://www.greentechmedia.com/articles/read/mexico-auction-bids-lowest-solar-wind-price-on-the-planet

Del Río, P. (2017). Auctions for renewable support in Mexico: instruments and lessons learnt. Report of the EU-funded AURES project. Retrieved from: http://auresproject.eu/news/res-e-auctions-in-chile-mexico-peru-and-zambia

Del Río, P., Linares, P. (2014). Back to the future? Rethinking auctions for renewable electricity support. Renewable and Sustainable Energy Reviews 2014; 35: 42-56.

Ernst and Young (2016). Long-Term Clean Energy Auctions - process and results.

FACTOR (2017). Subastas de energía renovable en Latinoamérica y Caribe. Bilbao.

Fernández, A. (2019). Mexico's Long Term Power Auctions and RE Investment. Iniciativa Climática de México.

GlobalPetrolPrices (2019). Mexico electricity prices. https://www.globalpetrolprices.com/Mexico/electricity_prices/ Accessed November 1st 2019

Guadarrama, C.A. (2018). Renewable energy auctions in Mexico: The gap between design and implementation. Master Thesis. Harvard Kennedy School and COFEMER.

Hernández-Ochoa, C.E. (2017). El nuevo sector electrico mexicano. Presentation of the Secretaría de Energia.

Ciudad de Mexico.

Hochberg, M., & Poudineh, R. (2018). Renewable Auction Design in Theory and Practice: Lessons from the Experience of Brazil and Mexico. Oxford Institute for Energy Studies.

IEA (2016). Mexico Energy Outlook. World Energy Outlook Special Report. Retrieved from: https://www.iea.org/publications/freepublications/publication/MexicoEnergyOutlook.pdf

IEA (2017). Energy Policies beyond IEA Countries - Mexico 2017. Retrieved from: https://www.iea.org/publications/freepublications/publication/energy-policiesbeyond-iea-countries---mexico-2017.html.

IEA (2019). Mexico. Retrieved from: https://www.iea.org/countries/non-membercountries/mexico/

IRENA (2015). Renewable Energy Prospects: Mexico. Retrieved from: https://www.irena.org/publications/2015/May/Renewable-Energy-Prospects-Mexico

IRENA (2017). Renewable energy auctions. Analysing 2016. Executive summary. Retrieved from: https://www.irena.org/publications/2017/Jun/Renewable-Energy-Auctions-Analysing-2016

James, C. (2017). Making Sense of Mexico's Renewable Energy Auctions. Retrieved from: http://carlosstjames.com/renewable-energy/making-sense-of-mexicos-renewable-energy-auctions/

Kruger, W., Eberhard, A., & Swartz, K. (2018). Renewable energy auctions: A Global Overview. UKAid and University of Cape Town.

Madrigal, M. (2018). Mexico´s Clean Energy Market Reform: Results so far and perspectives. CRE. Retrieved from: https://www.iamericas.org/documents/energy/webinars/Marcelino_Madrigal_Webinar.pdf

Energy Regulatory Commission (2017), Mexico, Institute of the Americas. Energy Webinars Series 2017. August 24, San Diego, California.

Mayer Brown (2016). Mexico's Clean Energy Auction: Material Provisions of the Power Purchase Agreements. Legal Update March 31, 2016. Retrieved from: https://www.mayerbrown.com/-/media/files/perspectives-events/publications/2016/03/mexicos-clean-energy-auction-material-provisions-o/files/get-the-full-report/fileattachment/160331-update-energy-mexico-prjfin.pdf

Molina, J., Scharen-Guivel, N. & Hyman, E. (2018). Analysis of Renewable Energy Auctions in Six Countries. Washington, DC: Crown.

Agents USA, and Abt Associates, Prepared for the U.S. Agency for International Development.

Power Auctions LLC (2016). Evaluation of Auctions and Capacity Market Design for Electric Power. Retrieved from: https://www.gob.mx/cms/uploads/attachment/file/196108/PA_Auction_Opinion_for_SENER.pdf

O'Mealy, M. (2018). Analysis of Renewable Energy Auctions in El Salvador, Mexico, and Peru. USAID and CEADIR. Presented at the Asia Clean Energy Forum June 2018.

PWC (2016). 1a Subasta de Largo Plazo. Reflexión sobre el proceso y resultados de cara a la próxima subasta.

PWC (2017). 3a Subasta de Largo Plazo analisis de resultados e implicaciones de futuro

Rodríguez, A. (2018). La política energética de AMLO: Retos y más Retos. Real Instituto Elcano, CIICAp and Universidad Autónoma del Estado de Morelos.

SENER (2017). Programa de Desarrollo del Sistema Eléctrico Nacional 2017-2031. Mexico City: Secretaria Nacional de Energía. Retrieved from: http://base.energia.gob.mx/prodesen/PRODESEN2017/PRODESEN-2017-2031.pdf

SENER (2018). Reporte de Avance de Energías Limpias Primer Semestre 2018. México 2018. Retrieved from: https://www.gob.mx/sener/documentos/informe-sobre-la-participacion-de-las-energias-renovables-en-la-generacion-de-electricidad-en-mexico-al-30-de-junio

Viscidi, L. (2018). Mexico's Renewable Energy Future. A Working Paper. Wilson Center, Mexico Institute. Retrieved from: https://www.wilsoncenter.org/sites/default/files/mexico_renewable_energy_future_0.pdf

Yaneva M.; Tisheva, P & Tsanova, T. (2018). The big Mexico Renewable Energy Report. Renewables Now. Presented at Mirecweek 2018.

Zárate, A. and Silva, O. (2019). Long term energy sector auctions - Third auction results and summary on the previous two. KPMG

AURES II is a European research project on auction designs for renewable energy support (RES) in the EU Member States.

The general objective of the project is to promote an effective use and efficient implementation of auctions for RES to improve the performance of electricity from renewable energy sources in Europe.

www.aures2project.eu

AURES II has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817619