Mexico
Wholesale Electricity Market
Wholesale Electricity Market
Agenda for Kazakhstan Delegation

- General Outlook.
- The Role of CENACE in the Auctions.
- Design and Operation of the Auctions.
- Web-based Platform used for the Auctions.
- Clearing House.
- Simulation Process in Long Term Auction.
- Mexico Long Term Auction Results.
CENACE General Outlook
What do we do?

- **Operation and Control**: Control the operation of all the elements in the National Electrical System with quality, security and reliability.

- **Wholesale Electricity Market**: Mandatory energy nodal spot-market, with bilateral agreements and auctions for basic services, clean energy certificates and transmission financial rights.

- **Planning**: Planning the expansion and upgrade of the National Transmission Grid and the General Distribution Grid.

- **Open Access**: Establishing the infrastructure and technical requirements to grant non-discriminatory open access to the grid for the interconnection of generators and the connection of load centers.
CENACE General Outlook
Electric Power System
CENACE General Outlook Generation by Technology

Total Generation by Technology
January – October 2016

<table>
<thead>
<tr>
<th>Type</th>
<th>2015 GWh</th>
<th>% Vs Total Generation</th>
<th>2016 GWh</th>
<th>% Vs Total Generation</th>
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</thead>
<tbody>
<tr>
<td>Combined cycle</td>
<td>122,555</td>
<td>50.32</td>
<td>127,923</td>
<td>50.66</td>
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<tr>
<td>Hydro</td>
<td>27,735</td>
<td>11.39</td>
<td>28,142</td>
<td>11.15</td>
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<td>Coal-fired</td>
<td>28,903</td>
<td>11.87</td>
<td>30,764</td>
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<tr>
<td>Steam</td>
<td>34,044</td>
<td>13.96</td>
<td>34,828</td>
<td>13.79</td>
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<tr>
<td>Nuclear</td>
<td>10,438</td>
<td>4.29</td>
<td>8,399</td>
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<tr>
<td>Wind</td>
<td>7,066</td>
<td>2.90</td>
<td>7,859</td>
<td>3.11</td>
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<tr>
<td>Gas turbine</td>
<td>5,644</td>
<td>2.32</td>
<td>7,241</td>
<td>2.87</td>
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<tr>
<td>Geothermal</td>
<td>5,280</td>
<td>2.17</td>
<td>5,093</td>
<td>2.02</td>
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<tr>
<td>Internal combustion</td>
<td>1,559.6</td>
<td>0.64</td>
<td>1,831</td>
<td>0.73</td>
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<tr>
<td>Biomass</td>
<td>163.6</td>
<td>0.07</td>
<td>194</td>
<td>0.08</td>
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<tr>
<td>Biogas</td>
<td>114.5</td>
<td>0.05</td>
<td>105</td>
<td>0.04</td>
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<tr>
<td>Photovoltaic</td>
<td>38.2</td>
<td>0.02</td>
<td>125</td>
<td>0.05</td>
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<tr>
<td><strong>Total generation</strong></td>
<td><strong>243,541</strong></td>
<td><strong>100</strong></td>
<td><strong>252,504</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
### Producción para el Día de Demanda Máxima en el SIN en 2022

<table>
<thead>
<tr>
<th>Tecnología</th>
<th>Energía (GWh)</th>
<th>Participación (%)</th>
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<tbody>
<tr>
<td>Térmico</td>
<td>827.6</td>
<td>73.9</td>
</tr>
<tr>
<td>Nuclear</td>
<td>31.2</td>
<td>10.7</td>
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<tr>
<td>Geotérmica</td>
<td>16.1</td>
<td>5.5</td>
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<tr>
<td>Eólica</td>
<td>96.3</td>
<td>33.0</td>
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<tr>
<td>Hidroeléctrica</td>
<td>110.8</td>
<td>37.9</td>
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<tr>
<td>Solar</td>
<td>37.9</td>
<td>13.0</td>
</tr>
</tbody>
</table>

### Producción para el Día de Demanda Máxima en el SIN en 2024

<table>
<thead>
<tr>
<th>Tecnología</th>
<th>Energía (GWh)</th>
<th>Participación (%)</th>
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</thead>
<tbody>
<tr>
<td>Térmico</td>
<td>736.1</td>
<td>62.0</td>
</tr>
<tr>
<td>Nuclear</td>
<td>31.2</td>
<td>10.7</td>
</tr>
<tr>
<td>Geotérmica</td>
<td>16.1</td>
<td>5.5</td>
</tr>
<tr>
<td>Eólica</td>
<td>228.3</td>
<td>50.7</td>
</tr>
<tr>
<td>Hidroeléctrica</td>
<td>114.1</td>
<td>25.3</td>
</tr>
<tr>
<td>Solar</td>
<td>60.7</td>
<td>13.5</td>
</tr>
</tbody>
</table>

**Clean Energy= 26.1 %**

**Clean Energy= 38 %**
CENACE General Outlook
Major Transmission Projects

Sistema Eléctrico Nacional
2022-2024
Centro Nacional de Control de Energía
Subdirección de Planeación

Macrored: Sección 1
HVDC Sureste - Peninsular

Macrored: Sección 2
HVAC Noroeste - Norte - Occidente

Macrored: Sección 3
HVDC Monterrey - Querétaro
CENACE General Outlook
Wholesale Electricity Market Implementation

**Day Ahead Market**
- January 2016
- Energy
- Ancillary Services
- Only MP

**Long Term Auctions**
- March 2016
  - Clean Energy
  - Capacity
  - Clean Energy Certificates
- Non MP can participate
- April 2017
- November 2017

**Legacy FTR**
- November 2016
  - FTR assigned to Legacy Contracts
- Only MP with Legacy Contracts
- Assigned by Hourly Blocks and Season

**Real Time Market**
- January 2017
  - Ex-post Real Time Market
- Energy
- Ancillary Services
- Only MP

**Capacity Market**
- February 2017
- Energy
- Capacity
- Ex-post Accreditation
- Based on the 100 Critical Hours of the System
- Only MP

**Mid Term Auctions**
- August 2017
  - Energy
  - Capacity
- Non MP can not offer in the 1st year
- February 2018

**FTR Auctions**
- November 2018
  - FTR
  - ARR
  - Only MP

**CECs Market**
- 2019
  - Clean Energy Certificates
- Business Practice Manual still in Draft
- Only MP
CENACE General Outlook
Wholesale Electricity Market Objectives

1) Competitive Prices which reflect economic signs for the expansion of generation and growth of the industrial loads.

2) Harmonious development of the grid in order to achieve sufficient generation and its composition in compliance with the Reliability Standards.

3) Optimization of the use of the generation capacity and transmission grid.

4) Development of clean energies.
The Role of CENACE in the Auctions

Mexico’s Energy Reform Goals

Fair market-based competition

Clean energy expansion

Efficient industry and reliable power supply
The Role of CENACE in the Auctions
Mexico’s Energy Regulatory Framework

**Generation**
- CFE: Expansion plan
- SENER: Generation “mode”
- CENACE: Operation of the short- and long-term markets
- CRE: Clean energy requirements
- Manages CECs (CEls)

**Control/Dispatch**
- CFE: Dispatch rules
- SENER: Reliability standards
- System and Market operation
- CENACE: Initial market rules
- CRE: Reliability standards
- Monitors WEM

**Transmission**
- CENACE: Transmission Planning and interconnection studies
- SENER: Approves expansion plan

**Distribution**
- SENER: Approves expansion plan
- CRE: Regulated rates
- Oversees interconnections

**Supply**
- SENER: Involvement in final rates
- Final rates
- Minimum demand to become a qualified user
- Quality of service requirements
- Final rates (basic service)
The Role of CENACE in the Auctions
Mexico’s Energy Regulatory Framework
The Role of CENACE in the Auctions
Mexico’s New Industry Structure

- **Generation**
  - CFE
  - Subsidiary “A”
  - Subsidiary “n”
  - PEMEX
  - IPPs
  - Private Parties

- **System Control and Market Operation**
  - Short Term Transactions
  - Spot Market
  - Long/Mid Term Contracts
  - Auctions

- **Retailing**
  - Unregulated Supply
  - Qualified Users
  - Basic Service Users
  - Regulated Supply

- **Consumption**
  - Transmission
  - Distribution

- **Transmission**
  - Distribution
# Design and Operation of the Auctions

## Objectives

**Advance quickly toward Mexico’s clean energy goals.**

**Acquire clean energy at minimum cost for users.**

## Strategies

**All technologies compete on a level playing field, recognizing the value of each one.**

**Reduce risk assigned to generators, to make projects more bankable.**

## Design

**Bids for each product based on the retailer's needs.**

**Sale offers by package according to each plant’s capabilities.**

**Adjustments for location and time of generation.**

## Outcome

“Deploying a mix of technologies can:

- Lead to more stable variable renewable energy, and
- Reduce periods of variable renewable energy excess.

Hence boosting System Value.”

*IEA: Next Generation Wind and Solar (Overview of Mexico Auctions), June, 2016.*

“Both auctions (2015 and 2016) have been:

- They generate incentives to encourage investment in Capacity (Power) and acquire CELs at market prices.
- Attract significant participation.
- They do not allow collusion."

*Power Auction: Evaluation of Auctions and Capacity Market*
# Design and Operation of the Auctions

## Mexico Long Term Auction

### Main Characteristics of the Long Term Auction in Mexico

- **Technology Free Auction.** New or Installed Power Plants
- **Energy Value by Location and Time**
- **Capacity, Clean Energy & Clean Energy Certificates**
- **LSE’s Purchase Offer by Product**
- **Generators Sale Offer per Package**
Expected Differences in the LMPs by Transmission Zone (Price Zone) send economic signals to develop renewable projects in the places of greatest benefit to the system.

For the 2017 estimation:

- Long Term Planning parameters and inputs for the model were improved.
- Changes were considered in the number of new firm (in terms of interconnection contract) power plants in relation to the 2016-2030 PIIRCE.
- New Commercial Operation Dates are considered for some projects in relation to PIIRCE 2016-2030.
Interconnection and Integration (Clean Energy) Limits are calculated by CENACE.
Interconnection Process and LT Auction Process are independent.
Design and Operation of the Auctions

**Capacity**
Reflects the commitment to maintain installed generation capacity to offer it to the Short-Term Energy Market during each annual period corresponding to the power acquisition obligations.

**Clean Energy**
Reflects the energy delivered in the real time market for one year, at the point of interconnection of each power.
Cumulative electricity must be necessarily generated in power plants entitled to receive CECs (firm and intermittent).

**Clean Energy Certificates (CECs)**
These are securities issued by CRE which acknowledge the production of a certain amount of electric energy coming from clean energy, which serve to meet the requirements associated with the consumption of the load centers.
Mexico

Long and Mid Term Auction Process

- Preliminary Bidding Terms
- Final Bidding Terms
- Registration of Potential Buyers
- Economic Evaluation of Sales Bids
- Receipt of the Economical Sale Offers
- Receipt of the Technical Sale Offers
- Threshold Percentage Determination
- Accepted Purchase Offer Publication
- Receipt of Purchase Offers
- Maximum prices determined by the CRE
- Clarification Meetings
- Decision of the bidding process
- Call for the Auction
- Participation Payment Period
Mexico

HR Involved in the Long Term Auction

Director General

- Internal Oversight Body (OIC)
- Head of Social Media and Communications Unit
- Head of Institutional Relations Unit
- Head of Transparency Unit

System Planning and Operations

Directors

- Management of Wholesale Electricity Market (WEM)
  - WEM Operations
    - Operations
    - Planning
    - Engineering Services for Operations
  - WEM Design
  - WEM Conciliation and Contracts

- Information and Communication Technologies
  - ICT Infrastructure
  - ICT Applications
  - ICT Operations

- Strategy, Normalization and Financial Management
  - Strategy and Normalization
  - Financial Management

- Management and Finance
  - Finance and Treasury
  - Management

- Legal
  - Legal (Executive)

- Planning and Transmission Rights Unit
  - MT Auctions & Capacity Market Dept.
  - LT Auctions & Clean Energy Certificates Market Dept.
  - FTR Auctions & Legacy FTR Dept.

- Head of Institutional Relations Unit
- Head of Social Media and Communications Unit
- Head of Transparency Unit
- Head of Internal Auditing Area
- Head of Accountability Area
- Head of Grievance Area

Wholesale Electricity Market (WEM)

- Directors Deputy Directors
- Managers and Heads of Unit
  - National (Main) Center
  - Alternate (Backup) Center
  - Regional Control Center North
  - Regional Control Center Northeast
  - Regional Control Center Northwest
  - Regional Control Center Baja California
  - Regional Control Center West
  - Regional Control Center East
  - Peninsular Regional Control Center
  - Central Regional Control Center

- Regional Control Center North
- Regional Control Center Northeast
- Regional Control Center Northwest
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- WEM Design
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- ICT Applications
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- Financial Management

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- Planning and Transmission Rights Unit
- MT Auctions & Capacity Market Dept.
- LT Auctions & Clean Energy Certificates Market Dept.
- FTR Auctions & Legacy FTR Dept.
The number HR involved through CENACE is between 50 to 100 people; From the General Director to the Operations Supervisors

**Key question. Is the auction process going to be performed by the organization or by third party (external consultant)?**
### Web-based Platform used for the Auctions

#### Necessary Modules

<table>
<thead>
<tr>
<th>In-house Development</th>
<th>Third Party Development (AKLARA)</th>
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<tbody>
<tr>
<td>• Registration Module</td>
<td>• Registration Module</td>
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<tr>
<td>• Payments and Billing Module</td>
<td>• Notifications Module</td>
</tr>
<tr>
<td>• Notifications Module</td>
<td>• Clarification meeting Module</td>
</tr>
<tr>
<td>• Clarification meeting Module</td>
<td>• Help Desk Module</td>
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<tr>
<td>• Help Desk Module</td>
<td>• Electronic Security Vault Module</td>
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<tr>
<td>• Electronic Security Vault Module</td>
<td>• Prequalification of Technical Sale Offers Module</td>
</tr>
<tr>
<td>• Registration of Potential Buyers Module</td>
<td>• Prequalification Constancy Module</td>
</tr>
<tr>
<td>• Electronic Forms Module</td>
<td>• Presentation of Economic Sale Offer Module</td>
</tr>
<tr>
<td>• Purchase Offer Module</td>
<td>• Economic Evaluation of Sales Offers Module</td>
</tr>
<tr>
<td>• Prequalification of Technical Sale Offers Module</td>
<td>• Iterative Process Module</td>
</tr>
<tr>
<td>• Seriousness Guarantees Module</td>
<td>• Full Detail Event Logs Module</td>
</tr>
<tr>
<td>• Prequalification Constancy Module</td>
<td>• User Profiles Module</td>
</tr>
<tr>
<td>• Presentation of Economic Sale Offer Module</td>
<td>• Simultaneous Auctions Capacity</td>
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<tr>
<td>• Economic Evaluation of Sales Offers Module</td>
<td>• Technical Data Entry Module</td>
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<td>• Iterative Process Module</td>
<td>• Internal Control Alerts Module</td>
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<tr>
<td>• Full Detail Event Logs Module</td>
<td>• Link with the Clearing House Module</td>
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<tr>
<td>• Reports Generator Module</td>
<td>• Contract Development Module</td>
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<tr>
<td>• User Profiles Module</td>
<td>• Electronic Signature Module</td>
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<tr>
<td>• Simultaneous Auctions Capacity</td>
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<td></td>
</tr>
</tbody>
</table>
Web-based Platform used for the Auctions
Web Projects Structure

Internet

Servidor de Aplicaciones

Capa de Presentación

FIREWALL

Zona Desmilitarizada - Intranet

Servicios Web

Capa de Lógica de Negocio

Capa de Datos

Bases de datos
Web-based Platform used for the Auctions Management Auction System Infrastructure

Capa de Presentación (Front End)

Capa de Negocio (Middleware)

Capa de Datos (Back End)
Web-based Platform used for the Auctions
Secure Data Transfer

• It uses the HTTPS protocol for data transfer.
• This protocol creates an encrypted channel between the application server and the client's browser.
• Use a domain ownership certificate
Web-based Platform used for the Auctions
Role-based Security
Web-based Platform used for the Auctions
Traceability

Log of events, for each action performed within the SAS
Web-based Platform used for the Auctions
Open Web Application Security Project
(OWASP)

- International non-profit organization.
- Open community dedicated to maintaining reliability in applications.
- Advocates for the security of applications, processes, technology, among others.
- OWASP Top 10 Application Security Risks - 2017
- The majority of these 10 points were considered to increase the security of the applications.
- Website [www.owasp.org](http://www.owasp.org)
The direct access to the database can only be done by authorized ICT personnel.

- Backups of information.
- Registration of access to the database and the server.
- Monitoring of sessions.
- Monitoring of actions executed in the database.
- Vector cryptography is used in the sensitive information stored in the Database.
Web-based Platform used for the Auctions
Server Security

- Security of the server that hosts the applications approved by the Digital Government Unit.

- Vulnerability tests were carried out between CENACE and Alestra.

- Stress tests were performed considering a scenario of 5000 simultaneous sessions and considering an increase every 10 seconds of 5000 more sessions, until reaching 50,000 obtaining a good response time of the application.
OBJECTIVES

• Manage risks (Market and Credit Risk).
• Centralize the administration of Contracts.
• Allow participation from buyers, other than Basic Service Supply.
• Reduce counterparty risk, increasing the bankability of projects.

DESIGN

• Counterparty for buyers and sellers (buyer before sellers, seller before buyers).
  • Clearing House is not a guarantor, it’s only a contract administrator.
    • Receives and manages collateral.
      • Flat position.
  • It manages collections and payments in a centralized manner and executes the Default Waterfall to guarantee fulfillment of obligations.
    • Unsecured Credit, depending on Creditworthiness of buyers.
With the Clearing House you get:

- Less complex contract administration.
- Increase in volume.
- Risk management.

Benefits of the Clearing House:

- A Generator makes a single contract instead of several at the same time.
- Allows more buyers into the Auction so demand increases.
- Through the Default Waterfall, the risk of non-compliance decreases.
Long Term Auction SLP No.1/2017
Clearinghouse Characteristics

- It is a contract administrator
- Operates in accordance with the Operating Guide
- Regular Assessment of Creditworthiness of buyers
- Builds forward curves and calculates MtM exposure to manage collateral
- Do not create additional costs for the BSS, except for the operating cost of the Clearing House
- Manage the risk of non-payment of LSE other than BSS
- Clearing House operates by Portfolio

- Manage the obligations and rights of buyers and sellers
- The clearinghouse has a flat position
- Operates before the Wholesale Electricity Market as a Non-Supplier Marketer
- Does not create risks for the associated BSS due to non-compliance with another LSE
- Does not transfer risks to other Auctions
Buyers
- May Request a Credit Quality Report
- Evaluation
- Credit Quality Report

Clearing House

Long Term Auction SLP No.1/2017
Process to Enter Clearing House

- Register as Potential Buyers
- Deliver Reliability Guarantees
- Make Purchase Offers

Winning Offers
- Mixed Integers Model

Generatos
- Deliver Reliability Guarantees
- Make Sale Offers

Contract Allocation

Signing of Contracts

Delivery of Guarantees
- Compliance Guarantees
- Contribution to the Reserve Fund
Long Term Auction SLP No.1/2017
Hedging Short and Long Term Exposure

Clearing House

Buyers other than CFE

Collateral Calculation

Short Term Exposure (ECCP)

\[
ECCP = \begin{cases} 
\text{Open AR} \\
\text{Market Exposure (MtM} \leq 3 \text{ años)}
\end{cases}
\]

Minimum Amount of Collateral (MMGC)

\[
CG = ECCP \times 1.25
\]

Compliance Guarantee (GC)

\[
CG = \text{Letter of Credit} + \text{Cash} + \text{Unsecured Credit}
\]

Long Term Exposure (ECCLP)

\[
ECCLP = \begin{cases} 
\text{Potential Future Exposure} \\
\text{Market Exposure (MtM} > 3 \text{ años, till end of Cak} ) \times r \times 0.08
\end{cases}
\]

Minimum Reserve Fund Contribution (MMCFR)

\[
RFC = ECCLP \times 1.25
\]

Reserve Fund Contribution (CFR)

\[
RFC = \text{Letter of Credit} + \text{Cash}
\]
Long Term Auction SLP No.1/2017
Default Waterfall

Managing defaults in an orderly way

Clearing House

Sellers

If all the lines of defense are fully utilised, then any outstanding losses are mutualised across all Sellers using their PAF.

Default Waterfall

Compliance Guarantee
Stop delivery
Individual CRF
Line of Credit (10%)
CRF of all buyers

Buyers

If all the lines of defense are fully utilised, then any outstanding missing product would be allocated to Buyers using their PAF.

Rebalancing of portfolio
Conventional Penalties due to early termination
Right to the products
Collection of conventional penalties through the WEM
Mutualize outstanding losses

La Posición Neta de Pagos y Productos de la CC será Neutral.
-Se minimizan los riesgos en la Operación de la CC-
Simulation Process in Long Term Auction

Economic Evaluation of the Sale Offers

Requirement

Prequalification Constancy

- Payment Indexation (MXN or USD)
- Interconnection Status

Stage 1

Stage 2

- Price Offered per Package per year.
Simulation Process in Long Term Auction
Economic Evaluation of the Sale Offers

Tie-break Factor

Expected Differences in the Regional LMPs

Economic Indexes

Payment Indexation

Price Offered

Adjustment

Adjusted Price

\[ PrA_p = \left( Pr_p + \frac{H_r R_p - H_r l}{1000} + \Delta P M L_p E E A_p \right) \left( FrPP \ast FrDE_p \right)^{USD_p} \]

(1) Tie-break Factor
(2) Expected Differences in the Regional LMPs
(3) Economic Indexes
(4) Payment Indexation
Simulation Process in Long Term Auction
Economic Evaluation of the Sale Offers

Prices Offered

Mixed-Integer Programming

Optimization Model
AMPL/CPLEX

Objective Function

Solution

Preliminary Winners

Interconnection Status
Sale Offer
Purchase Offer
Irregular Dates
Transmission Grid Limits
Packages Conditioned To
Excluding Packages
Simulation Process in Long Term Auction

Objective Function

Maximize

\[ \sum_{bp \in BP} x_{bp} PrUP_{bp} + \sum_{be \in BE} y_{be} PrUE_{be} + \sum_{bc \in BC} z_{bc} PrUC_{bc} - \sum_{p \in PAQ} u_p PrA_p \]

Total Amount for the Purchase Offers Assigned.

Total Amount for the Accepted Sales Offers.
Simulation Process in Long Term Auction
First Iteration

Is the obtained threshold obtained greater than the reference threshold?

NO

An iterative process will be carried out; The auction process continues.

YES

The auction process ends and CENACE declares the selected sales offers as preliminary winners, they are published and the validation process begins.
Simulation Process in Long Term Auction Thresholds

Threshold Obtained = \( \frac{\text{Total Economic Surplus}}{\text{Maximum Economic Value}} \)

Threshold Obtained

Reference Threshold

100%

Auction efficiency is measured by the Threshold Value Obtained
Simulation Process in Long Term Auction

Iterative Process

Is there an increase of at least 1% in the value of the objective function?

YES

The iterative process continues.

NO

The auction process ends and CENACE declares as preliminary winners the sales offers selected in the previous execution, they are published and the validation process begins.
Simulation Process in Long Term Auction
Economic Evaluation of the Sale Offers

Content of the Adjudication

- Winning sales offers
  - Winners Information
  - Price Offered
  - Amount of Products Assigned
  - Commercial Operation Date
  - Capacity to Install
  - Technology
  - More details...

- Non-winning sales offers
- Sale offers without economic offer
- Sale offers who desist to participate
- Sale Offers without a favorable opinion or that were discarded
## Mexico Long Term Auction Results

<table>
<thead>
<tr>
<th>Product Allocation in the Long Term Auction SLP No.1/2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Potencia (MW)</strong></td>
</tr>
<tr>
<td>Purchase Offer</td>
</tr>
<tr>
<td>Awarded Sale Offer</td>
</tr>
<tr>
<td><strong>Awarded Percentage</strong></td>
</tr>
<tr>
<td>Combined Cycle</td>
</tr>
<tr>
<td>Wind</td>
</tr>
<tr>
<td>Geothermal</td>
</tr>
<tr>
<td>Hidro</td>
</tr>
<tr>
<td>Solar</td>
</tr>
</tbody>
</table>

Resulting in an average Price of 33 USD per MWHr+CEC
Mexico Long Term Auction Results

Product Allocation in the Long Term Auction SLP No.1/2015

<table>
<thead>
<tr>
<th></th>
<th>Capacity (MW)</th>
<th>Clean Energy (MWh)</th>
<th>Clean Energy Certificates (CEC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purchase Offer</strong></td>
<td>500.00</td>
<td>6,361,250.00</td>
<td>6,361,250.00</td>
</tr>
<tr>
<td><strong>Awarded Sale Offer</strong></td>
<td>-</td>
<td>5,370,167.00</td>
<td>5,348,539.00</td>
</tr>
<tr>
<td><strong>Awarded Percentage</strong></td>
<td>0.00%</td>
<td>84.42%</td>
<td>84.08%</td>
</tr>
<tr>
<td>Wind</td>
<td>-</td>
<td>1,384,021.00</td>
<td>3996890.00</td>
</tr>
<tr>
<td>Solar</td>
<td>-</td>
<td>4,018,859.50</td>
<td>3,996,890.00</td>
</tr>
</tbody>
</table>

Resulting in an average Price of 47 USD per MWHr+CEC
Mexico Long Term Auction Results

Ofertas ganadoras

<table>
<thead>
<tr>
<th></th>
<th>SLP-1/2015</th>
<th>SLP-1/2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empresas</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Ganadoras</td>
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<td></td>
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</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ofertas</td>
<td>18</td>
<td>56</td>
</tr>
</tbody>
</table>
Mexico Long Term Auction
1st + 2nd LT Auctions Investment by State

Investment by Source

Breakdown per State

Approx. 6.6 billion dollars of total investment.
15 states with investment in new projects.

Source: SENER

<table>
<thead>
<tr>
<th>State</th>
<th>Investment Amount (USD thousands)</th>
<th>Investment (%)</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamaulipas</td>
<td>1,060,949</td>
<td>16%</td>
<td>Wind</td>
</tr>
<tr>
<td>Coahuila</td>
<td>1,019,874</td>
<td>15%</td>
<td>Solar</td>
</tr>
<tr>
<td>Yucatán</td>
<td>895,561</td>
<td>14%</td>
<td>Solar, Wind</td>
</tr>
<tr>
<td>Aguascalientes</td>
<td>790,426</td>
<td>12%</td>
<td>Solar</td>
</tr>
<tr>
<td>Guanajuato</td>
<td>524,475</td>
<td>8%</td>
<td>Solar</td>
</tr>
<tr>
<td>Sonora</td>
<td>517,297</td>
<td>8%</td>
<td>Solar</td>
</tr>
<tr>
<td>San Luis Potosí</td>
<td>389,732</td>
<td>6%</td>
<td>Solar</td>
</tr>
<tr>
<td>Oaxaca</td>
<td>368,392</td>
<td>6%</td>
<td>Wind</td>
</tr>
<tr>
<td>Nuevo León</td>
<td>331,760</td>
<td>5%</td>
<td>Wind</td>
</tr>
<tr>
<td>Chihuahua</td>
<td>307,800</td>
<td>5%</td>
<td>Solar</td>
</tr>
<tr>
<td>Jalisco</td>
<td>135,000</td>
<td>2%</td>
<td>Solar</td>
</tr>
<tr>
<td>Puebla</td>
<td>97,828</td>
<td>1%</td>
<td>Hydro</td>
</tr>
<tr>
<td>Morelos</td>
<td>94,500</td>
<td>1%</td>
<td>Solar</td>
</tr>
<tr>
<td>Baja California</td>
<td>50,535</td>
<td>1%</td>
<td>Solar</td>
</tr>
<tr>
<td>Baja California Sur</td>
<td>31,050</td>
<td>0%</td>
<td>Solar</td>
</tr>
<tr>
<td>Total</td>
<td>6,615,179</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
Mexico Long Term Auction
International Comparison

**SOLAR**

- Brazil
- France
- Germany
- India
- Jordan
- 1st Mexican Auction
- 2nd Mexican Auction
- Peru
- Saudi Arabia
- South Africa
- United Arab Emirates
- United Kingdom

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>130.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>115.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jordan</td>
<td>70.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>58.5</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>Peru</td>
<td>47.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Mexican Auction</td>
<td>45.2</td>
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</tr>
<tr>
<td>2nd Mexican Auction</td>
<td>31.9</td>
<td></td>
<td></td>
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<tr>
<td>2014-2016 USD/MWh</td>
<td>20.0</td>
<td>40.0</td>
<td>60.0</td>
</tr>
</tbody>
</table>

**WIND**

- Australia
- Brazil
- Germany
- India
- Jordan
- 1st Mexican Auction
- 2nd Mexican Auction
- Peru
- South Africa
- United Arab Emirates
- United Kingdom

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>145.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>67.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>57.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>48.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peru</td>
<td>37.3</td>
<td></td>
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</tr>
<tr>
<td>1st Mexican Auction</td>
<td>55.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd Mexican Auction</td>
<td>35.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014-2016 USD/MWh</td>
<td>20.0</td>
<td>40.0</td>
<td>60.0</td>
</tr>
</tbody>
</table>

**SOLAR, ASSIGNED CAPACITY (MW), 2016**

- 1st & 2nd Mexican Auctions
- United Arab Emirates
- Peru
- India

**WIND, ASSIGNED CAPACITY (MW), 2016**

- 1st & 2nd Mexican Auctions
- Australia
- Peru

Source: SENER
Mexico Long Term Auction International Comparison

IRENA, 2017 (forthcoming).
THANK YOU FOR YOUR KIND ATTENTION