# Mexican Electricity Market Operation Year 2021 and 1H 2022

TECHNICAL NOTE: GME 02-2022

2022 November

# Mexican Electricity Market Operation Year 2021 and 1H 2022

**Introduction**

This document contains an analysis of the Mexican's electricity market for the year 2021 and the period of January to September 2022. The document covers operational aspects as well as other relevant market information for the Mexican's electricity systems.

This period was characterized by i) the recovery of the energy consumption after the retraction observed during the COVID-19 pandemic on year 2020; ii) the shortage of natural gas for one week in Feb'21 caused by an extreme climatic event that hit the State of Texas and impacted deeply on natural gas production and natural gas pipelines operation; iii) the new energy global scenario set after the conflict between Russia and Ukraine, and iv) the Mexico's energy sector regulator CRE is reverting several delays in granting permits for new projects.

# 1. Electricity Consumption

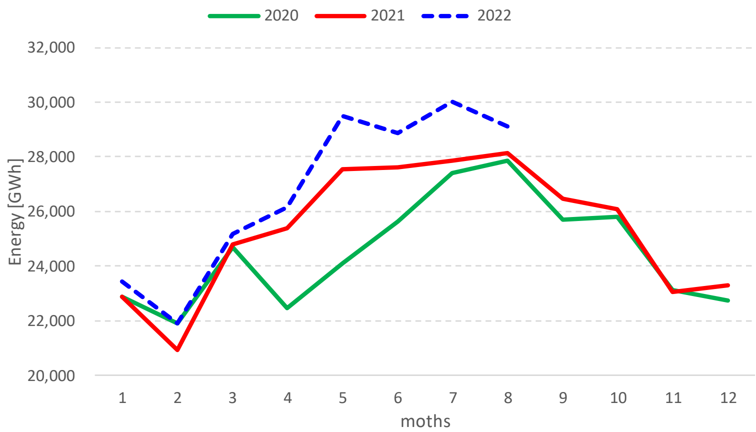
In 2021, the SEN annual net electricity consumption was 322,541 GWh (327,920 GWh gross) a **3.5%** increase compared to 2020. Consumption recovery in 2021 wasn't enough to fill the gap left by the COVID-19 crisis but at least shows the typical demand growth for Mexico.

In summary, at the end of the year 2021 the electricity consumption was practically like the one registered in 2019 revealing a demand delay of two years.

During the year 2022, the SEN electricity consumption shows an increase of 4.3% for the period January to August vs. the same period of 2021.

**Exhibit 1: SEN' system net electricity consumption (2021 – 2022)**

| Month | 2021 [GWh] | 2022 [GWh] |
|---|---|---|
| Jan | 24,065 | 24,708 |
| Feb | 22,034 | 23,052 |
| Mar | 26,017 | 26,495 |
| Apr | 26,696 | 27,496 |
| May | 29,098 | 31,071 |
| Jun | 29,447 | 30,763 |
| Jul | 30,007 | 32,169 |
| Aug | 30,286 | 31,342 |
| Sep | 28,366 | |
| Oct | 27,554 | |
| Nov | 24,387 | |
| Dec | 24,584 | |
| Annual net dem. | 322,541 | |
| Annual gross dem. | 327,920 | |
| Growth Rate | 3.5% | |




Source: own elaboration based on CENACE and SENER data.
Note: Gross demand is net demand plus transmission losses

# 2. Electricity Production

## 2.1. Installed Capacity

In the last four years (2017 to 2021) the SEN added more than 18,100 MW (98% of this expansion was allocated in the SIN) and increased the Mexican installed capacity by 27%. New capacity addition was based on efficient technologies mainly CCGTs running on natural gas, plus Non-Conventional Renewable Energy (NCRE) technologies like solar and wind.

Particularly, the year 2021 continued the dynamic of CCGTs expansions while solar developments slowed down. By the end of the year 1,692 MW of CCGTs, 806 MW of solar and 473 MW of wind plants was added and the total installed capacity in the SEN reached 86,154 MW (95% located in SIN, 3.8% in BCA and 1,2% in BCS). Regarding the ownership, 51% belonged to CFE, 18% to CFE-PIE, 29% to private companies and 1% to PEMEX.

During 2021, CRE delay market access to many solar and wind projects built by not granting the regulatory permits to operate. Nevertheless, in the second half of 2022, CRE is reverting gradually the permits delay.

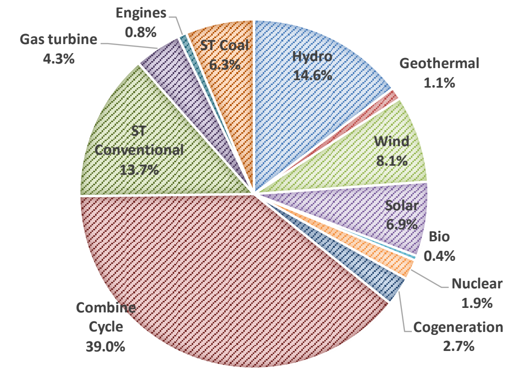
## Exhibit 2: 2021 SEN´s system installed capacity

SEN's SYSTEM INSTALLED CAPACITY

| | 2017-2021 by technology [MW] | | | | | 2018-2021 capacity additions [MW] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Technology** | **2017** | **2018** | **2019** | **2020** | **2021** | **2018** | **2019** | **2020** | **2021** | **Accum.** |
| Hydro | 12,612 | 12,612 | 12,612 | 12,612 | 12,614 | - | - | - | 2 | 2 |
| Geothermal | 899 | 899 | 899 | 951 | 976 | - | - | 52 | 25 | 77 |
| Wind | 3,898 | 4,866 | 6,050 | 6,504 | 6,977 | 968 | 1,184 | 454 | 473 | 3,079 |
| Solar | 171 | 1,878 | 3,646 | 5,149 | 5,955 | 1,707 | 1,768 | 1,503 | 806 | 5,784 |
| Bio | 374 | 375 | 375 | 378 | 378 | 1 | - | 3 | - | 4 |
| Nuclear | 1,608 | 1,608 | 1,608 | 1,608 | 1,608 | - | - | - | - | - |
| Cogeneration | 1,322 | 1,709 | 1,710 | 2,305 | 2,305 | 387 | 1 | 595 | - | 983 |
| Subtotal Clean | 20,884 | 23,947 | 26,900 | 29,507 | 30,813 | 3,063 | 2,953 | 2,607 | 1,306 | 9,929 |
| Combine Cycle | 25,340 | 27,393 | 30,402 | 31,948 | 33,640 | 2,053 | 3,009 | 1,546 | 1,692 | 8,300 |
| ST Conventional | 12,665 | 12,315 | 11,831 | 11,809 | 11,793 | -350 | -484 | -22 | -16 | -872 |
| Gas turbine | 2,960 | 2,960 | 2,960 | 3,545 | 3,744 | - | - | 585 | 199 | 784 |
| Engines | 739 | 880 | 891 | 850 | 701 | 141 | 11 | -41 | -149 | -38 |
| ST Coal | 5,463 | 5,463 | 5,463 | 5,463 | 5,463 | - | - | - | - | - |
| Subtotal Thermal | 47,167 | 49,011 | 51,547 | 53,615 | 55,341 | 1,844 | 2,536 | 2,068 | 1,726 | 8,174 |
| **TOTAL** | **68,051** | **72,958** | **78,447** | **83,122** | **86,154** | **4,907** | **5,489** | **4,675** | **3,032** | **18,103** |

| | 2021 by ownership [MW] | | | | |
|---|---|---|---|---|---|
| **Technology** | **CFE** | **CFE-PIE** | **PRIVADO** | **PEMEX** | **TOTAL** |
| Hydro | 12,125 | - | 489 | - | 12,614 |
| Geothermal | 951 | - | 25 | - | 976 |
| Wind | 86 | 613 | 6,279 | - | 6,978 |
| Solar | 6 | - | 5,949 | - | 5,955 |
| Bio | - | - | 378 | - | 378 |
| Nuclear | 1,608 | - | - | - | 1,608 |
| Cogeneration | - | - | 1,937 | 367 | 2,304 |
| Subtotal Clean | 14,776 | 613 | 15,057 | 367 | 30,813 |
| Combine Cycle | 10,342 | 15,285 | 8,013 | - | 33,640 |
| ST Conventional | 10,448 | - | 923 | 422 | 11,793 |
| Gas turbine | 2,798 | - | 815 | 131 | 3,744 |
| Engines | 355 | - | 346 | - | 701 |
| ST Coal | 5,463 | - | - | - | 5,463 |
| Subtotal Thermal | 29,406 | 15,285 | 10,097 | 553 | 55,341 |
| **TOTAL** | **44,182** | **15,898** | **25,154** | **920** | **86,154** |
| ***Share by owner*** | *51%* | *18%* | *29%* | *1%* | *100.0%* |

2021 by share [%]




Source: own elaboration based on SENER data and PRODESEN 2022-2036.

### 2.2. Electricity Generation

The electricity generation required to meet the demand in 2021 was supply mainly by combined cycles thermal power plants (56,5%) while clean energy sources (hydro, solar, wind, geothermal, biomass and nuclear) provided almost 30.5%. The remaining 13% corresponded to other thermal sources (steam turbine conventional, coal-fired, engines and gas turbines).

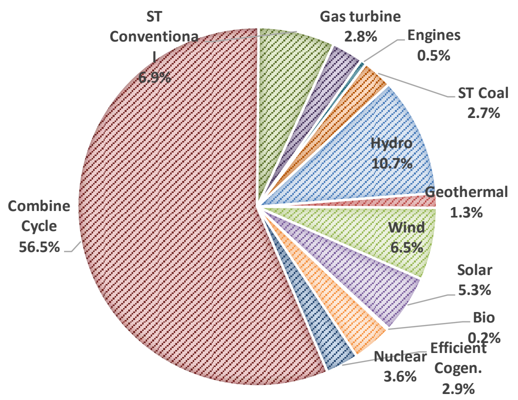
### Exhibit 3: SEN´s system energy generation

SEN's SYSTEM - Net Genaration

| 2017-2021 by technology [TWh] | | | | | | Variations [TWh] | | Variations [%] | |
|---|---|---|---|---|---|---|---|---|---|
| **Technology** | **2017** | **2018** | **2019** | **2020** | **2021** | **2020** | **2021** | **2020** | **2021** |
| Hydro | 31.7 | 32.2 | 23.6 | 26.8 | 34.7 | 3.2 | 7.9 | 12% | 23% |
| Geothermal | 5.7 | 5.1 | 5.1 | 4.6 | 4.2 | -0.5 | -0.3 | -11% | -8% |
| Wind | 10.5 | 12.4 | 16.7 | 19.7 | 21.1 | 3.0 | 1.4 | 15% | 7% |
| Solar | 0.3 | 2.2 | 8.4 | 13.5 | 17.1 | 5.1 | 3.5 | 38% | 21% |
| Bio | 0.6 | 0.6 | 0.7 | 0.6 | 0.6 | -0.1 | -0.0 | -12% | -3% |
| Nuclear | 10.6 | 13.2 | 10.9 | 10.9 | 11.6 | -0.0 | 0.7 | 0% | 6% |
| Efficient Cogen. | 5.8 | 6.6 | 9.2 | 11.4 | 9.5 | 2.2 | -1.9 | 19% | -19% |
| Subtotal Clean | 65.2 | 72.3 | 74.6 | 87.5 | 98.8 | 12.9 | 11.3 | 15% | 11% |
| Combine Cycle | 157.6 | 161.7 | 171.8 | 180.9 | 182.9 | 9.1 | 2.0 | 5% | 1% |
| ST Conventional | 42.9 | 39.3 | 38.0 | 22.4 | 22.2 | -15.6 | -0.2 | -70% | -1% |
| Gas turbine | 6.6 | 7.8 | 9.1 | 6.7 | 9.2 | -2.4 | 2.5 | -37% | 27% |
| Engines | 1.9 | 2.1 | 2.7 | 2.4 | 1.7 | -0.3 | -0.7 | -12% | -40% |
| ST Coal | 28.7 | 27.3 | 21.6 | 12.5 | 8.7 | -9.1 | -3.8 | -73% | -44% |
| Subtotal Thermal | 237.7 | 238.3 | 243.3 | 224.9 | 224.7 | -18.4 | -0.2 | -8% | 0% |
| **TOTAL** | **302.9** | **310.7** | **317.8** | **312.3** | **323.5** | **-5.5** | **11.2** | **-2%** | **3%** |

| 2021 by system [TWh] | | | | | | |
|---|---|---|---|---|---|---|
| **Technology** | **SIN** | **BCA** | **BCS** | **Mulergé** | **SEN** | **Share** |
| Hydro | 34.7 | - | - | - | 34.7 | 10.7% |
| Geothermal | 1.8 | 2.4 | - | 0.0 | 4.2 | 1.3% |
| Wind | 21.0 | 0.1 | - | - | 21.1 | 6.5% |
| Solar | 16.7 | 0.1 | 0.2 | 0.0 | 17.1 | 5.3% |
| Bio | 0.6 | - | - | - | 0.6 | 0.2% |
| Nuclear | 11.6 | - | - | - | 11.6 | 3.6% |
| Efficient Cogen. | 9.5 | - | - | - | 9.5 | 2.9% |
| Subtotal Clean | 96.0 | 2.6 | 0.2 | 0.0 | 98.8 | 30.5% |
| Combine Cycle | 173.4 | 9.5 | - | - | 182.9 | 56.5% |
| ST Conventional | 21.0 | 0.7 | 0.5 | - | 22.2 | 6.9% |
| Gas turbine | 6.2 | 2.2 | 0.8 | 0.0 | 9.2 | 2.8% |
| Engines | 0.2 | 0.1 | 1.3 | 0.1 | 1.7 | 0.5% |
| ST Coal | 8.7 | - | - | - | 8.7 | 2.7% |
| Subtotal Thermal | 209.5 | 12.5 | 2.6 | 0.1 | 224.7 | 69.5% |
| **TOTAL** | **305.5** | **15.0** | **2.8** | **0.2** | **323.5** | **100.0%** |
| ***Share by system*** | *94%* | *5%* | *1%* | *0%* | *100.0%* | |

**2021 by share [%]**



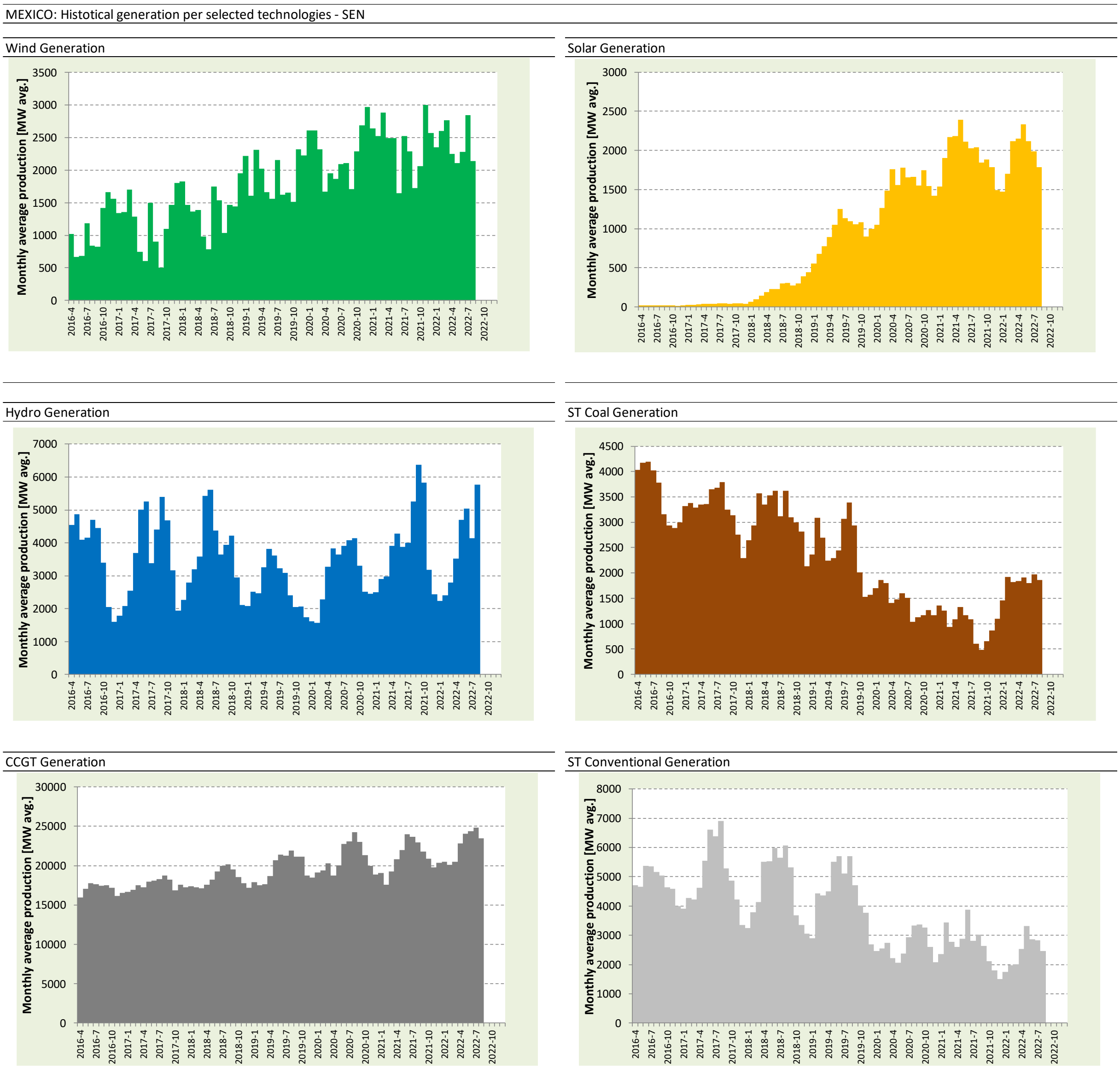

Source: Own elaboration based on SENER data and PRODESEN 2022-2036.

The following exhibits show the historical evolution (2016-2022) of wind, solar, hydro, steam turbine (ST) running on coal, combined cycles, and conventional ST energy generation since 2016 to September 2022. Wind, solar and combined cycles generation is rising, due to the increase in the installed capacity of this technologies. Hydropower production depends on the weather conditions of each year (dry/wet).

Coal-fired production reduce it energy production, from average hourly generation between 3,000 and 4,000 MW/avg in 2016 to 500 MW/avg in 2021. A gradual restitution of units is observed in 2022. The lower production is result of its own forced unavailability.

The electricity generation with ST conventional units tends to fall between 2016 and 2020 due to the lower competitiveness of this technology on account of its low efficiency and high fuel costs. Since then, it remains at similar levels supported on 1) operative decisions to keep high system reliability to address the operational challenge of managing a system with a large amount of NCRE (Non-Conventional Renewable Energy), and a transmission network that presents congestion among regions; 2) the low electricity generation with coal; and 3) the delay to grant permits by CRE to new NCRE units already built.

## Exhibit 4: SEN's historical energy generation by technology (in MW avg.)




Source: Own elaboration based on CENACE data.

# 3. Fuel Prices

In 2021, the natural gas prices used for power generation in Mexico (based on Henry Hub / WAHA prices) gradually increased from near 2.9 USD/MMBTU in January to 3.9 USD/MMBTU in December of that year. The main driver that explains the price increase is the languid recompositing of natural gas production in the Texas's basins (Permian and Eagle Ford). After the shut-down of upstream operations during the Covid-19 crisis the producers were more prudent to start new drillings and gradually increase natural gas production.

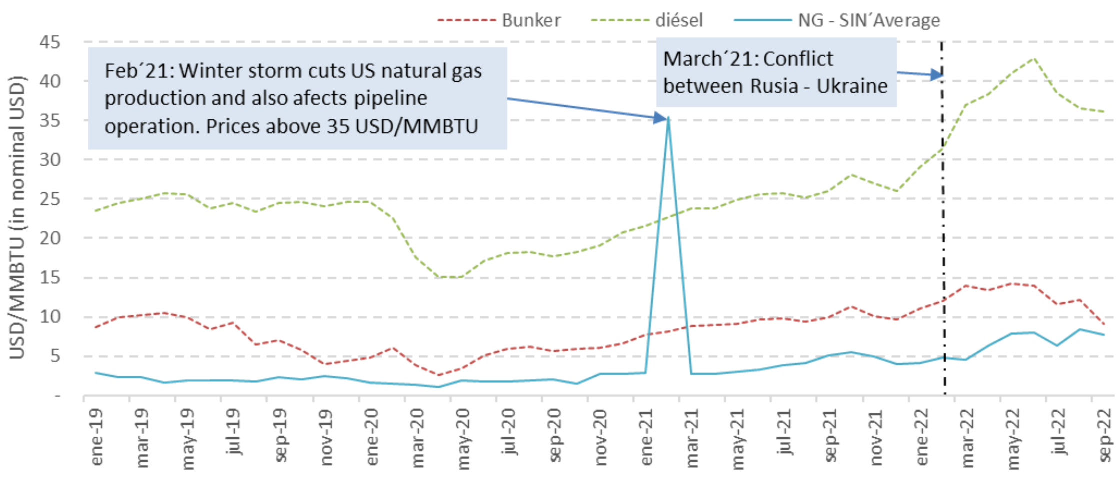
In addition, during February 2021 an extreme climatic event hit the State of Texas and impacted deeply on natural gas production and natural gas pipelines operation. The imported volumes of natural gas from the US were reduced to almost nothing and natural gas prices reached historical records during the climatic event. This event allowed Pemex to reduce the stocks of sub-valuated bunker[1] fuel (*combustóleo*) as the use of liquid fuels was necessary to reestablish and maintain the operation of the electricity system.

Starting in February 2022, the conflict between Russian and Ukraine has impacted fuel prices all around the world.

Natural gas prices in Texas were not the exception and showed increments from the 3.9 USD/MMBTU in December 2021 to an average of 7.7 USD/MMBTU in the period March to September 2022. This increase is driven by the effort of Texas's natural gas producers to help the Europe's natural gas supply crisis.

The prices of crude oil derivates were also impacted by the conflict, but in this case, Pemex is selling the products in the local market including subsidies to help the local economy manage the effects of inflation.

**Exhibit 5: 2019-2022 Historical fuel prices**




Source: Own elaboration based on CRE's observed prices for tariff determination.

# 4. Short Term Market

The spot market is an hourly pool market where market participants[2] (MP) can sell or buy/sell their surplus or deficits with respect to the amounts committed under their supply contracts. There are two spot markets: i) the Day Ahead Market (DAM)

[1] Pemex holds large stocks of *combustóleo* with high sulfur content.

[2] Market Participants are Generators, Qualify Service Suppliers, Basic Service Suppliers and Qualify User Market Participants (users with demands > 5 MW and > 20 GWh/yr).

and ii) the Real Time Market (RTM).

In the spot market the energy is valued at the Locational Marginal Prices (LMP) at the node where the transaction is carried out. The LMPs are built from the marginal cost of supplying the hourly demand, plus losses and congestion in the transmission system.

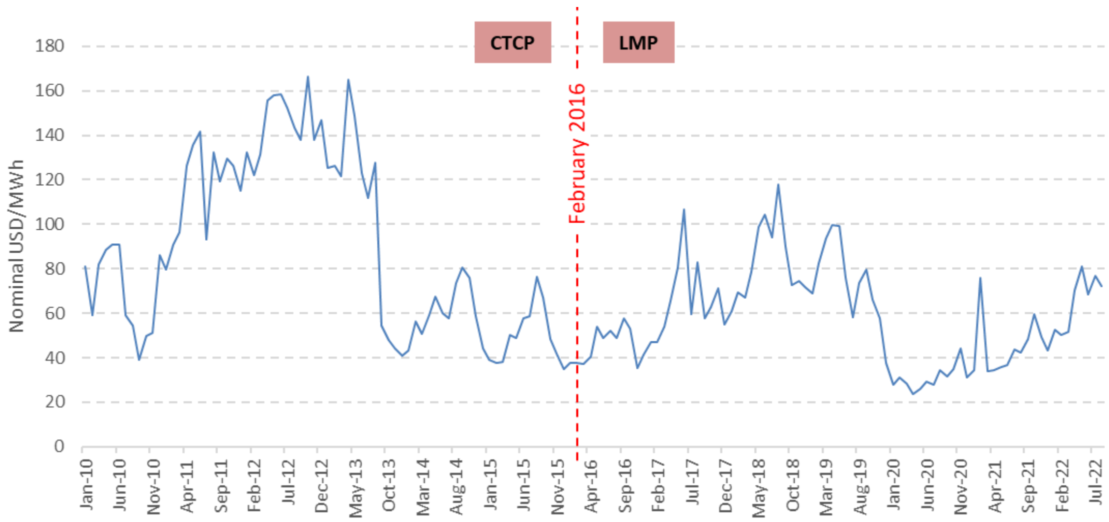
In 2021 and 2022 SIN system prices show the impacts of fuel commodities price increase mentioned above. In particular, the main marginal technology in the SIN system are CCGTs running on natural gas.

**Exhibit 6: 2019 -2022 monthly LMPs at Central node in the DAM[3] [in USD/MWh]**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2019** | 68.7 | 82.5 | 93.4 | 99.7 | 99.4 | 75.9 | 58.1 | 73.7 | 79.5 | 66.2 | 57.6 | 37.6 | **74.3** |
| **2020** | 27.9 | 31.2 | 28.6 | 23.8 | 25.8 | 29.1 | 28.0 | 34.4 | 31.4 | 35.1 | 44.2 | 30.9 | **30.8** |
| **2021** | 34.3 | 75.8 | 34.0 | 34.5 | 35.7 | 36.8 | 43.6 | 42.4 | 48.4 | 59.7 | 49.2 | 43.1 | **44.6** |
| **2022** | 52.6 | 50.3 | 51.5 | 70.4 | 81.0 | 68.7 | 76.9 | 72.0 | 63.5 | | | | **65.3** |

Source: Own elaboration based on CENACE data.

**Exhibit 7: 2010 - 2022 Monthly CTCP and LMPs at Central node**




Source: Own elaboration based on CENACE and SENER data.
CTCP: Short-Term Total Cost, Marginal cost of the SIN system.

[3] DAM: Day Ahead Market.

### 4.1. LMPs in SIN regions

LMPs are different at each node in the power system (nodal prices). The LMPs at each node differ on account of losses and congestion in the transmission system. In electricity exporting regions (e.g., the North, Northeast and Northwest regions in Mexico), LMPs tend to be lower than in other regions in the country.

The lowest LMPs in the SIN were recorded in the Northwest area, affected by transmission constraints that did not allow exporting the electricity available at low marginal cost. Also due to transmission constraints, the Peninsular region had the highest LMPs, as it cannot import electricity from the rest of the SIN at lower marginal costs and it has no low-cost generation to meet the demand.

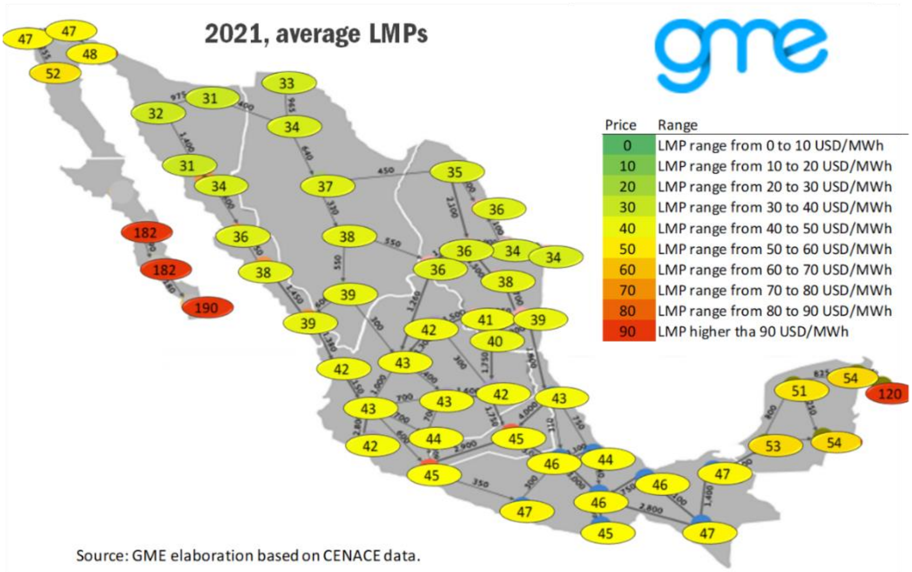
Moreover, the lack of adequate transmission capacity to fully supply the demand in the Cozumel node with continental electricity force the dispatch of local expensive thermal generation that is reflected in a high LMPs in that node.

### 4.2. LMPs in the BC and BCS

LMPs in these isolated regions depend on the local supply/demand balance, as it is not possible to bring cheaper energy from the SIN or to export any energy surplus from the region to the SIN.

BCA region has natural gas availability for thermal generation and CCGT, BCS region, instead, has the highest LMP values in all Mexico due to the absence of natural gas for thermal generation. Therefore, fuel oil and diesel oil used as base fuels, results in high LMPs in the region.

**Exhibit 8: 2021 LMPs heatmap SIN, BCA, BCS [in USD/MWh]**




## 5. Captured Prices by solar and wind projects

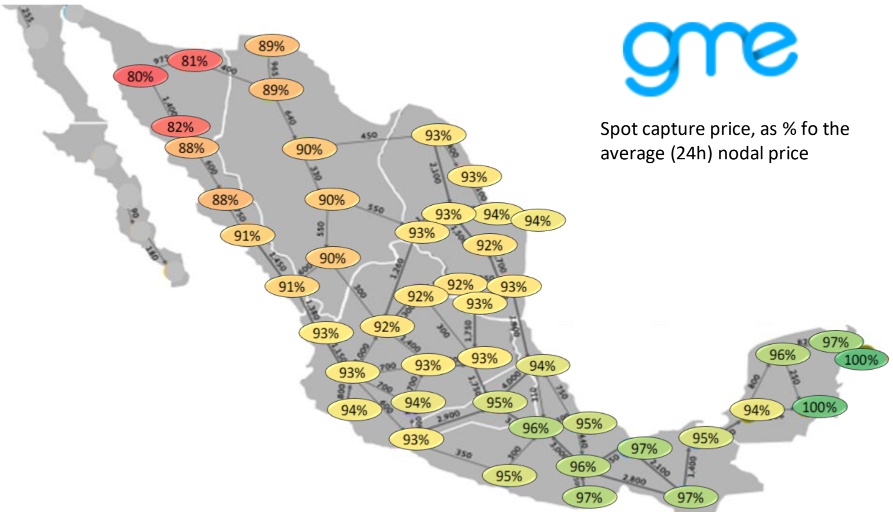
LMPs have hourly variations. As a result, the spot price captured by renewable projects is different from the mean prices mentioned above.

The following exhibit shows the relation between mean nodal prices and captured prices determined for typical solar and wind projects located in each study area.

In 2021, the solar capture prices were 5% lower than the mean prices in central regions. The effect is more significant in the Northwest and North exporting regions reaching in Hermosillo values of 20% lower than the mean prices.

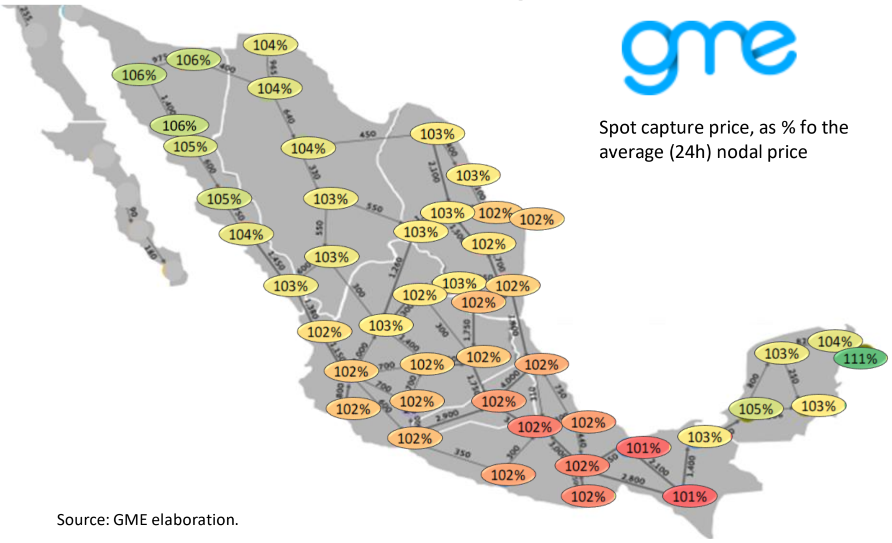
In 2021, the wind captured prices were 2% higher than the mean prices in central regions. Not all the areas have good wind resources but in the northeast region or Oaxaca regions the captured prices are ranging 2% or 3% above average node prices.

**Exhibit 9: 2021 Solar capture price [% of avg node price]**




Source: GME elaboration.

**Exhibit 10: 2021 Wind capture price [% of avg node price]**




Source: GME elaboration.

## 6. End-users Tariff

In 2021 and 2022 (Jan-Oct) the end-user's industrial tariff was increased on average 8% per year. The tariff increases are explained by the increases in the energy and capacity components of the electricity tariff. These two components, in October 2022, imply near 114 USD/MWh for a GDMTH user with a 57% of load factor while the total tariff was near 132 USD/MWh.

**Exhibit 11: Historical evolution for GDMTO, GDMTH, DIST and DIT tariffs - SIN avg**

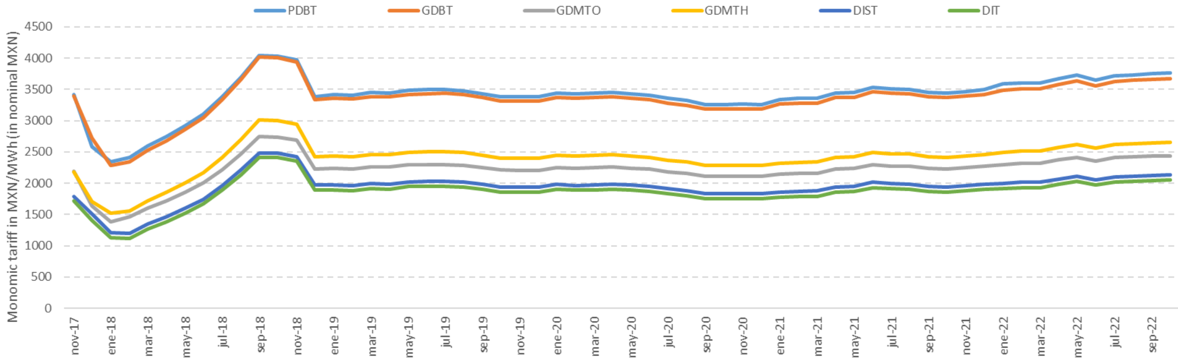
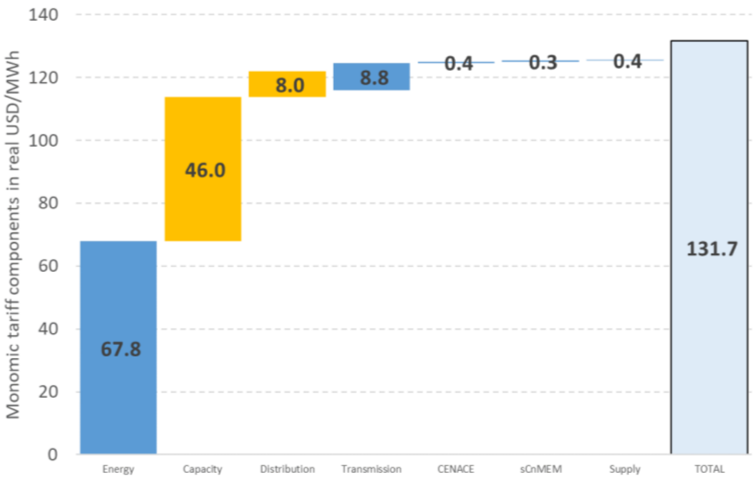



**Exhibit 12: GDMTH tariff components - Oct'2022 for a 57% plant Factor**




# 7. Capacity Balance Market

## 7.1. Capacity Balance Market (CBM)

Capacity Balance Market (CBM) is annually settled by CENACE every February for the previous production year and lets each MP to honor their capacity obligations. The CBM is based on three concepts: i) Capacity Zones, ii) Reference Generation Technology, and iii) 100 Critical Hours.

**Capacity Zones:** Capacity zones stand for SIN, BC and BCS systems.

**Reference Generation Technology:** The Industrial Gas Turbine is the selected Technology for each capacity zone.

**100 Critical Hours:** Market regulation defines the 100 hours of a year with minimum generation reserve as the 100 critical hours for each Capacity Zone. The generation reserve is the difference between the capacity available and the demand to be supplied at every hour. The 100 critical hours are the source to verify capacity demand and offer for each MP during the previous production year.

In 2021, for SIN system, many of the 100 critical hours occurred during night hours/time, outside/not at the summer season (when the demand is not at maximum levels). The first critical hour was on August 21, 2021 and not earlier because a market rule limits the time window for critical hour determination to not earlier than 14 days from the first critical hour identified the previous year (2020).

**Exhibit 13: CBM 2022 – 100 critical hours**

| Month | Hour 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 8 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 | 2 | 9 | 10 | 8 | 4 |
| 9 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 8 | 9 | 3 | - |
| 10 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 8 | 11 | 10 | 7 | 1 |
| 11 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 1 | 1 | - | - |
| 12 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Source: CENACE.

### 7.2. Capacity Price

The capacity price for each capacity zone is the result of the following expression:

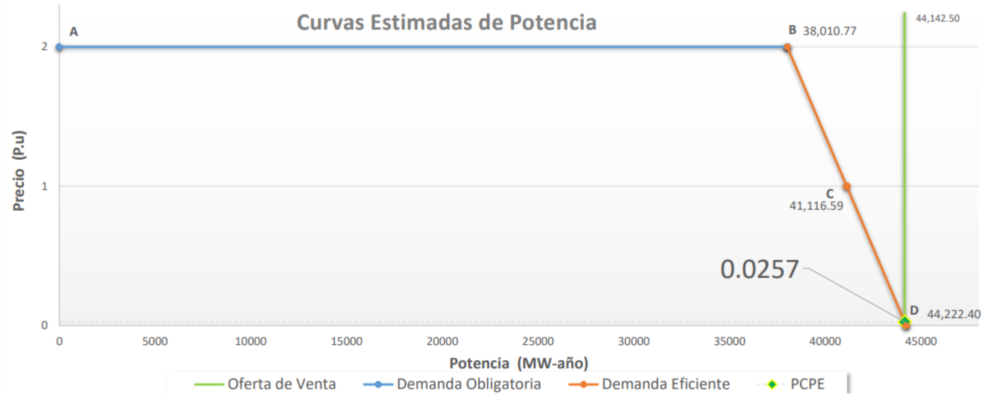
Capacity Price [USD/MW-year] = Levelized_fixed_Cost x FACTOR - IMTGR

**Levelized Fixed Cost** are the annuity of fixed costs (investment costs and fixed O&M) of the Reference Generation Technology defined for each capacity zone.

**FACTOR** is based on generation reserve resulting from capacity demand and offer that CENACE very during the 100 critical hours of previous production year. Depending on the year's generation reserve the FACTOR is a value between 0 and 2 (0 when the reserve is higher than twice the optimal reserve; 1 when the reserve is optimal, and 2 when the reserve is lower than the minimum). Between the maximum and minimum reserve values, the FACTOR is linearly reduced (orange line in the exhibit below). In 2021 the FACTOR determined for SIN was 0.0257 and expose a generation oversupply condition (higher reserve than the optimal one) but most of 100 critical hours in 2021 were computed in low demand season as mentioned above.

**IMTGR** is the theoretical marginal revenue of the Reference Generation Technology calculated for the previous production year. In 2021, the high LMPs resulted in higher IMTGR values compared to those recorded in previous years.

### Exhibit 14: CBM 2022 (production year 2021) – Factor (SIN system)




Source: CENACE.

The following exhibits shows the values of the Capacity Price for the three Capacity Zones for 2022 (production year 2021).

In 2021, the resulting capacity price for the SIN system was 0.0 [USD/kW-y] (cero), as expected due to the high reserves in the system during especially considering that many critical hours were in low demand season.

The capacity prices in the BC and BCS regions remains high since the generation reserve is lower than the minimum, which implies supply risks. While these high prices remain over time in the BC and BCS regions, it indicates that the economic signal associated with the Capacity Balance Market is not attracting new generation investment in these regions.

### Exhibit 15: CBM 2022 (production year 2021) – Capacity Price

| System | Ref. Gen. Technology | Capacity [MW] | Factor [#] | Levelized Cost [USD/MW-year] | IMTGR [USD/MW-year] | Capacity Price [USD/MW-year] | Capacity Price [USD/kW-month] |
|---|---|---|---|---|---|---|---|
| **SIN** | **Ind GT** | **210.0** | 0.0257 | 117,380 | 9,462 | 0.0 | 0.00 |
| **BC** | **Ind GT** | **210.0** | 2.0000 | 104,180 | 37,113 | 171,247.0 | 14.27 |
| **BCS** | **Ind GT** | **47.5** | 2.0000 | 211,037 | 21,727 | 400,348.0 | 33.36 |

Exchange Rate [MXN/USD] = 20.89

Source: CENACE

**Exhibit 16: CBM 2016-2022 – Capacity Price**

| Year | Levelized Cost | Factor | IMTGR | Capacity Prices | |
|---|---|---|---|---|---|
| | [USD/MW-year] | [#] | [USD/MW-year] | [USD/MW-year] | [USD/kW-month] |
| **2016** | 109,430 | 1.1780 | 65,364 | 63,545 | 5.30 |
| **2017** | 102,620 | 1.6170 | 128,587 | 37,350 | 3.11 |
| **2018** | 103,260 | 2.0000 | 200,336 | 6,184 | 0.52 |
| **2019** | 120,401 | 1.5100 | 170,473 | 11,333 | 0.94 |
| **2020** | 118,539 | 0.3233 | 6,850 | 31,474 | 2.62 |
| **2021** | 117,380 | 0.0257 | 9,462 | - | - |

Source: CENACE.

# 8. Market Insights

In February 2021, an extreme climatic event (blizzard) hit the State of Texas and impacted deeply on natural gas production and natural gas pipelines operation, leading to a sudden shortage ("imbalance") of energy in the southern United States. This energy deficit (electricity and natural gas) had an immediate impact on Mexico's industrial sector, especially on the thermoelectric generation plants. In those days, natural gas prices soared to more than thirty times above their levels at the beginning of 2021.

In February 2022, with the economic impacts of the COVID-19 pandemic still beating countries' economies, the war in Ukraine pulled down the expectative of a rapid recovery, put more pressure upon already rising inflation index, and led to rocketing energy prices. This chapter isn't finish, and every day unveils new uncertainties on world stability.

**Policy updates**

"Much ado about nothing" is the sentence that characterized the policy updates in the period 2021 and 2022 (Jan-Oct). The SENER Agreement issued in 2020 by which CENACE was given with greater discretion to improve the reliability of the electrical system was finally revoked by the justice. At early 2021 the LIE Amendment was passed by both chambers, but later it was blocked by the justice under many amparos and that have yet to be resolved. AMLO's initiative to modify the articles of the National Constitution was rejected by the Lower Chamber. Additionally, SENER tried to change the regulation and the gas transportation contracts, an attempt that was also stranded by the justice. At the end, the only active measures we observed was the block/delay to market access to generation projects (many already built) by not granting the CRE permits. Nevertheless, in the second half of 2022, CRE is reverting gradually the permits delay for already built projects.

Do to the above, foreign stakeholders such as the US, Canada, Spain, and Japan are watching with more caution the Mexican's energy policy development and its impact on foreign investments, and they are activating reviewing mechanisms for international trade agreements (USMCA and others)

## 9. Forecast for 2023

- Although the low GDP growth (1.15%) expected by IMF in October 2022 for the Mexican economy in 2023, we observe a dynamic recuperation of the demand that can reach growth rates in the range of 3% showing a detached from historical elasticity between GDP and demand growth.
- In general, the capacity expansions will slowdown in 2023.
- No significant trunk transmission grid improvements are expected in 2023. The congestion among regions will increase based on cheaper and more efficient energy that is produced in exporting regions but cannot reach demand areas, especially in low demand seasons.
- Fuel prices will continue showing uncertainty suffering the global volatility while the conflict in Ukraine continues.
- LMPs price are expected to be in the range as in 2022.
- Capacity Prices expected for CBM 2023 (production period 2022) will continue be low.

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# About GME

At GME we have provided strategic advice to companies and institutions in the global energy markets for nearly three decades. Our interdisciplinary platform implements comprehensive solutions tailored to each type of client, at each link in the value chain.

With a team of more than 70 consultants specialized in technical, economic, and regulatory aspects, we operate from five companies with strategically located offices in Argentina, Brazil, Chile, Mexico, Peru, Uruguay, and South Africa. This allows us to manage more than 300 projects per year for the electricity, oil and gas, and water and sanitation sectors.

We were pioneers in global energy consulting, with the first market reforms in the 90s, and it is thanks to our expertise, our vocation for excellence, and our vision for the future that today we continue to be a strategic partner for all our clients.

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