SENER

SECRETARÍA DE ENERGÍA

Value Based Auctions

Cajeme Villarreal

Director General of Analysis and Oversight for the Wholesale Electricity Market

SENER

September 6, 2018

Table of Contents

1. Mexico's Objectives on Renewable Energy

Renewable Energy Law (2011)

Cut fossil fuel generation

35% 2024

50% 2050

Climate Change Law CCL (2012)

Reduce CO_2 emissions

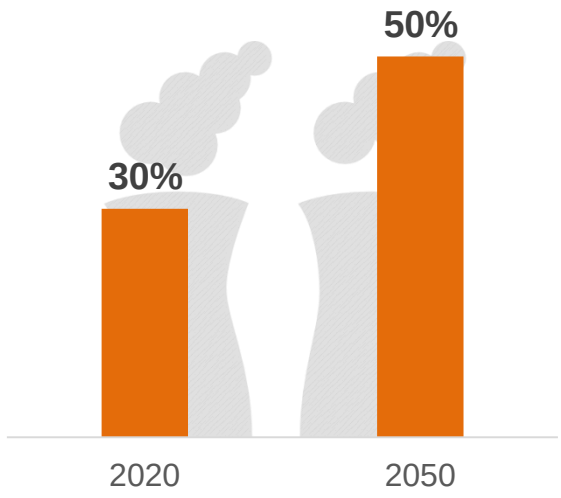
50% 2050

Energy Transition Law (2015)

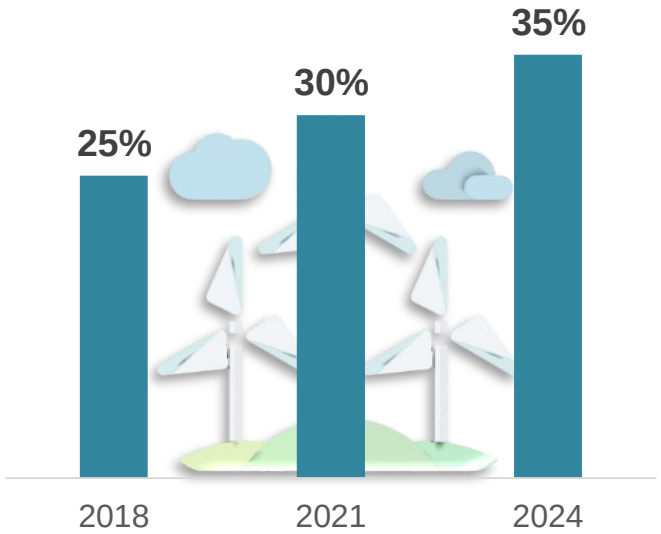
Clean energy target

35% 2024

Emissions Reduction Targets CCL



Clean Energy Targets



2. 2013 Energy Reform

Targets

- Improve prices and services for final users.
- Increase the use of clean energies in the energy mix.
- Promote investment and employment.

Tools

- Wholesale Electricity Market.
- Unbundling of the state monopoly and new emphasis on profitability.
- Clean energy certificates.
- Open access to the National Transmission Network (NTN).
- Private sector participation in NTN: funding, construction and operation.

Clean Energy Targets were integrated into the industry design without subsidy mechanisms for RE deployment.

2.1 Long-Term Electricity Auctions

Structure of the WEM

Wholesale Electricity Market

- **Long-Term Electricity Auctions**
- Clean Energy Certificates Market
- Spot Market
- Capacity Balancing Market
- Financial Transmission Rights Auctions

Objectives

- Incent the deployment of Renewable Technologies.
- Transparency in the costs of Renewable Energy.
- Reduce investment risks.
- Guarantee a stable income stream for 15-20 years.
- Guarantee a stable price for final users.

Products

- Clean Energy Certificates.
- Energy.
- Capacity.

2.1 Long-Term Electricity Auctions - Features

Renewable Technologies can bid on Energy, Capacity and CEC.

Conventional Technologies can only bid on Capacity.

- **Held at least once a year** for delivery starting three years later.
- Offer **long-term contracts** (15 years for energy and capacity, 20 years for CEC).
- Developers can **bid individually for capacity, energy, CECs** or bundles of them.
- **Auctions are technology-neutral for clean energy options.**

LTEA process

- Buyers: Utilities companies (CFE and privates) send bids.
- CENACE: Accepts or decline buyers' bids.
- Sellers: Sealed-bid on quantity.
- CENACE: Accepts or decline sellers' bids.
- Sellers: Sealed-bid on price.
- CENACE: Select winners maximizing economic surplus.

2.1 Time- and Location-dependent Incentives

Time

Signal the temporal relative value of the energy for the system.

Are a premium/penalty on the final price, which depends on the expected Locational Marginal Price for each time and price zone.

Participants include them into their financial valuations, inducing better returns for producing in particular hours of the year.

Location

ISO publishes Expected Price Differentials by Price Zone.

Potential sellers adjust their bids to maximize the likelihood of their projects being chosen.

Projects end up located in zones with potential for RE deployment (Solar and Wind).

2.1 Effects of Adjustment Factors

Northwest and Center

- Higher sunlight concentration.
- Geothermal resources.
- Energy more valuable for the system due to high temperatures during summer.

Northeast and Caribbean

- Exceptional wind corridor coming from the Gulf of Mexico and the Caribbean.
- Energy particularly valuable to the Caribbean zone due to the lack of gas pipelines and tourism activities.

South

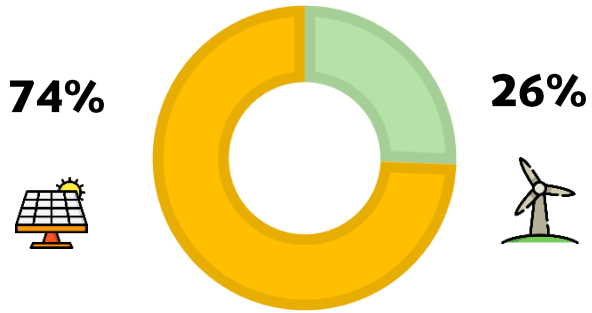
- Wind corridor coming from the Pacific Ocean.
- Energy valuable to the center of the country.

2.1 Long Term Electric Auctions Results

LTEA-1/2015

Awarded March 31, 2016

AVERAGE PRICE MWH+CEC: $47.8 USD



Investment
2,600 millions USD
(3 years)

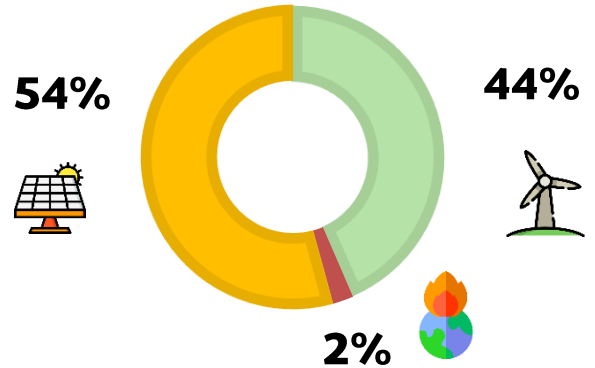
Added Capacity
2,085 MW

18 projects of
11 companies

LTEA-1/2016

Awarded September 23, 2016

AVERAGE PRICE MWH+CEC: $33.5 USD



Investment
4,000 millions USD
(3 years)

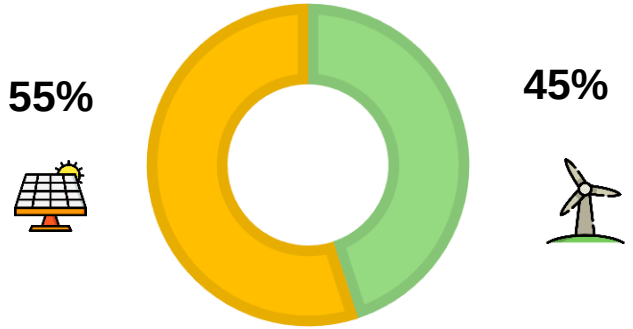
Added Capacity
2,871 MW

56 projects of
23 companies

LTEA-1/2017

Awarded November 22, 2017

AVERAGE PRICE MWH+CEC: $20.6 USD



Investment
2,369 millions USD
(3 years)

Added Capacity
2,562 MW

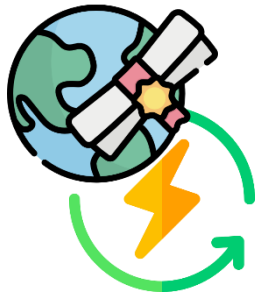
16 projects of
10 companies

2.1 4th Auction Preliminary Results

7 **Buying Offers Accepted**

6 **Private Utilities**

1 **State-Owned Utility**



5,908,127

MWh+CEC/year

270% ↑

Demand from Private Utilities

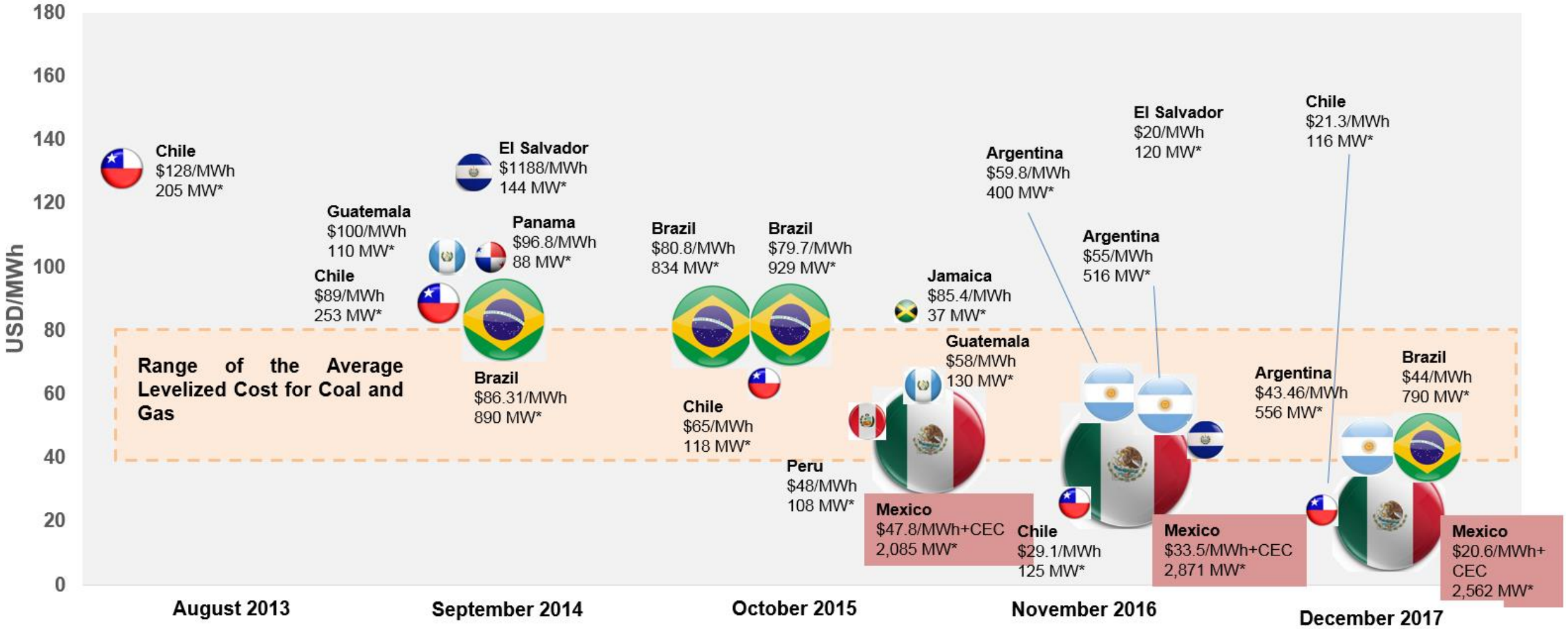
2017: 542,636 MWh+CEC
2018: 2,006,760 MWh+CEC

2,132 **51%** ↑

MW/year of Capacity

2.1 Average Bids for Energy and Capacity for Solar PV in LA

- **Mexico contracted more capacity in its first 3 auctions than the rest of LA.**
- **Solar PV in Mexico is increasingly competing with coal and natural gas.**
- **In 2018 Mexico ranked 12th (out of 40 countries) in EY's Renewable Energy Country Attractiveness Index. Mexico ranked 24th in 2016.**

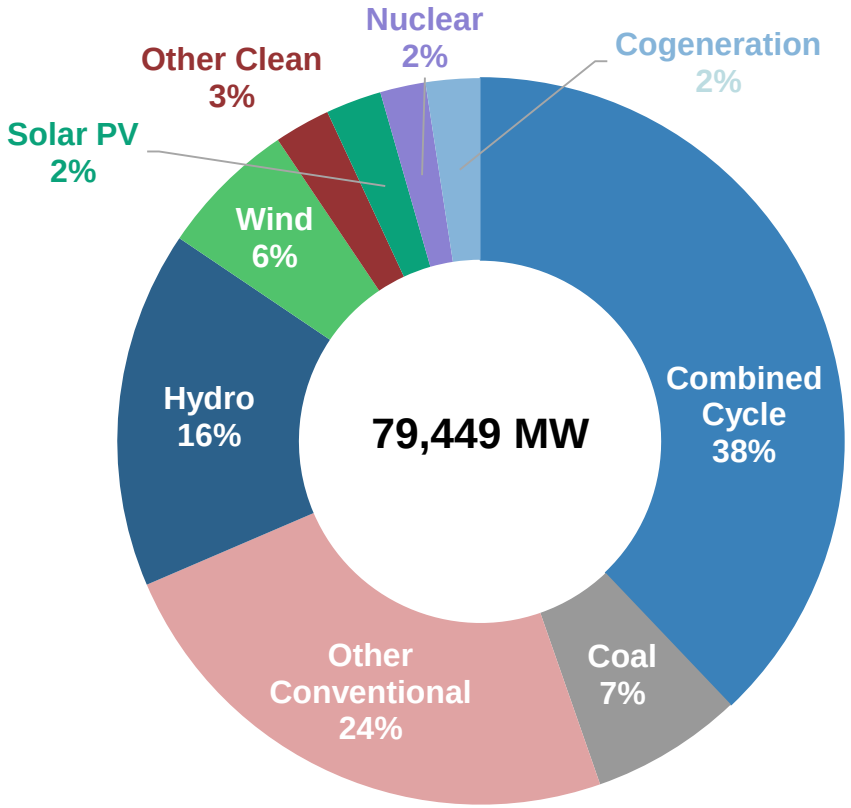


* Megawatts. The size of the circles are associated to the capacity of each country.

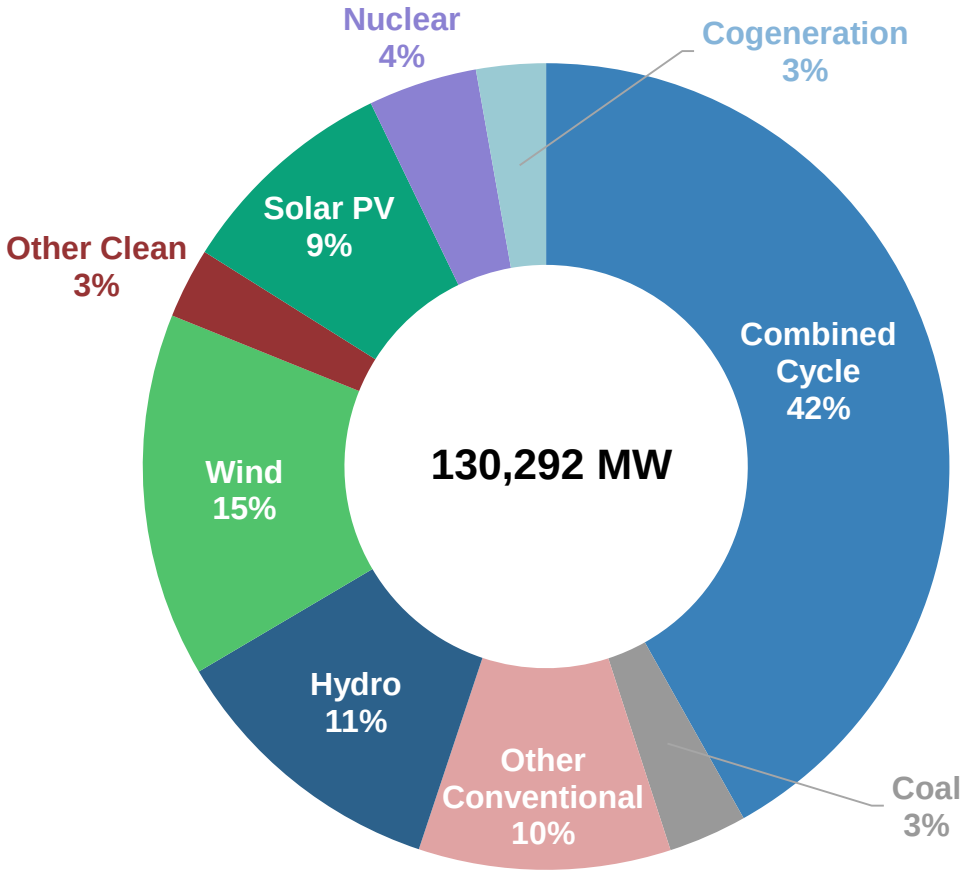
2.1 Long Term Results

- **In 2018 25.7% of the installed capacity is from Renewable Technologies.**
- **In 2032 36.2% of the installed capacity is expected to come from Renewable Technologies.**

2018



2032



Source: PRODESEN 2018-2032,

2.2 Clean Energy Certificates

SENER defines every year (for year t+3) a Clean Energy requirement (% of total consumption).

Penalty fees range from 27 USD to 1,392 USD for each CEC not acquired.

Utilities companies, secondary market traders and load serving entities on isolate supply must acquire CECs.

CEC monthly allocation is based on ISO's generation reports (CRE's guidelines, 2015).

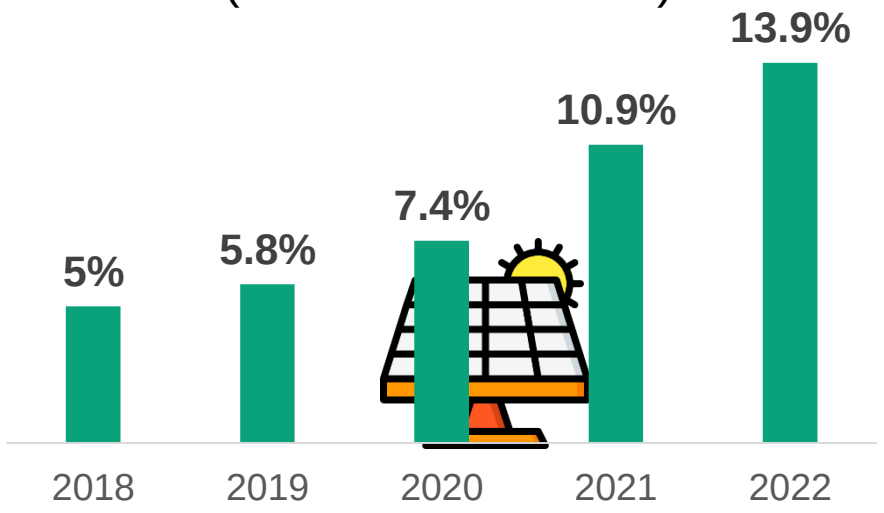
1 CEC = 1MWh
Produced with Renewable Resources

1 CEC ≠ 1MWh
Produced by co-generation

CEC can be traded:

- Bilaterally.
- In a long term auction, bundled with energy and capacity.
- On the market (expected 2019).

CEC MANDATORY TARGET
(% OF CONSUMPTION)



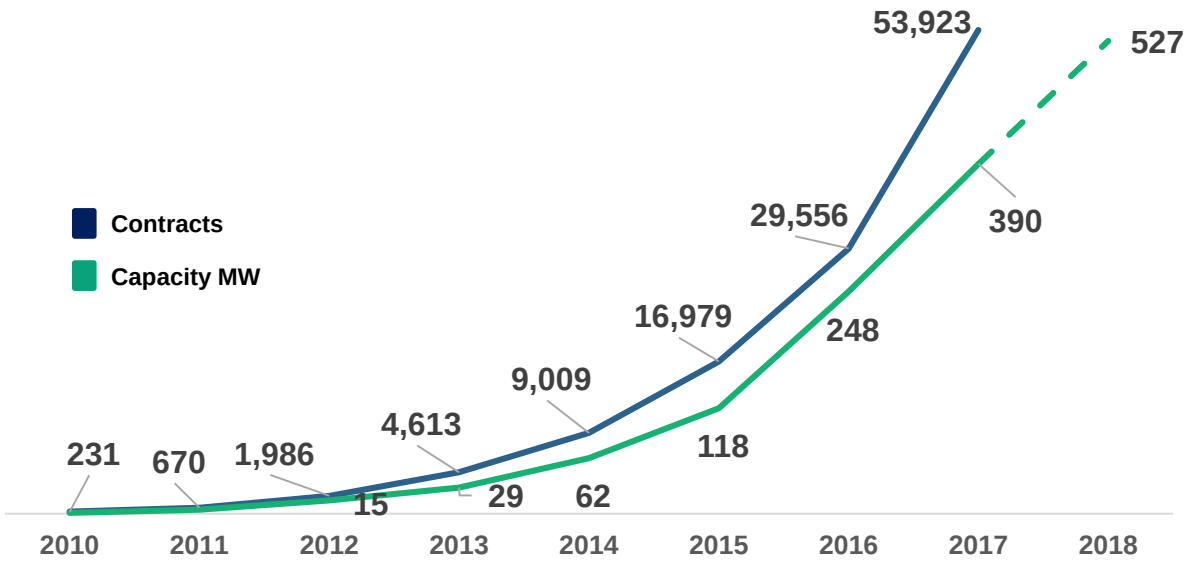
2.3 Distributed Generation

What is it?

- Generation capacity less than 0.5 MW (exempt generator).
- Interconnected to a Load Service Entity serving a large concentration of users.

- Increase installed capacity to 527 MW in 2018.
- Estimated installed capacity for 2022: 2.2 GW (CRE).

Installed Capacity and Interconnection Contracts 2010 - 2017



Installed Capacity 2017