SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

CONACYT
Consejo Nacional de Ciencia y Tecnología

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Integrated solar energy supply concepts for climate-neutral buildings and communities for the "City of the Future"

Industry Workshop No 1 Solar Energy Buildings worldwide

Perspectives on Energy Efficiency and Solar Energy Buildings projects & regulations in Mexico

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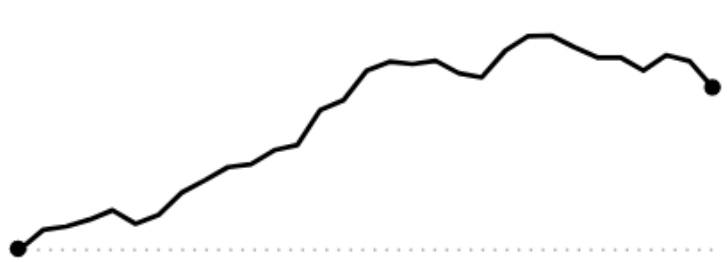
IEA Key energy statistics, 2020: Mexico

Total primary energy supply
Mtoe



175.34

↑ 41.76% from 1990

Electricity final consumption
TWh

307.48

↑ 209.09% from 1990

Total CO2 emissions
Mt of CO2

381

↑ 48.27% from 1990

https://www.iea.org/countries/mexico

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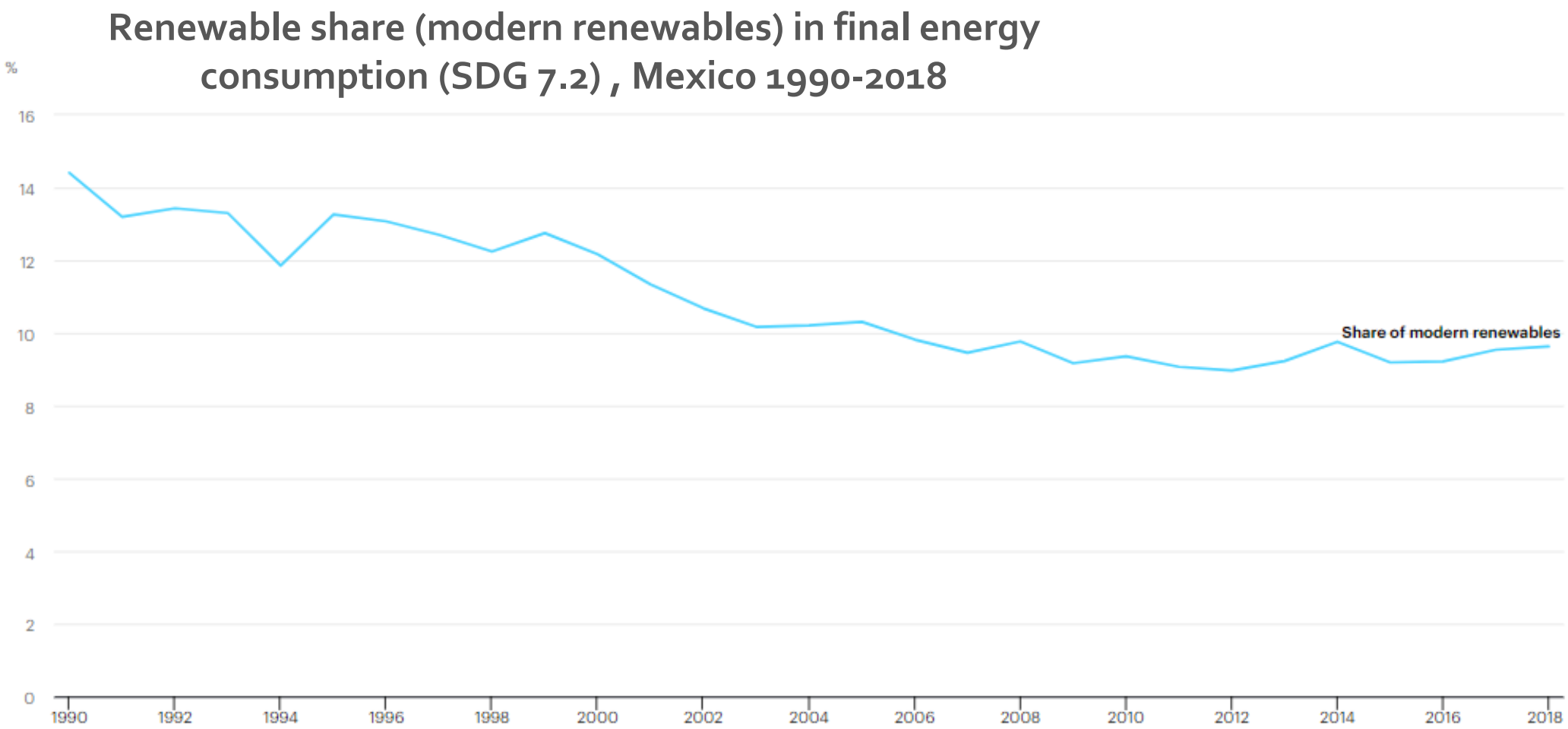
Renewable share & electricity generation



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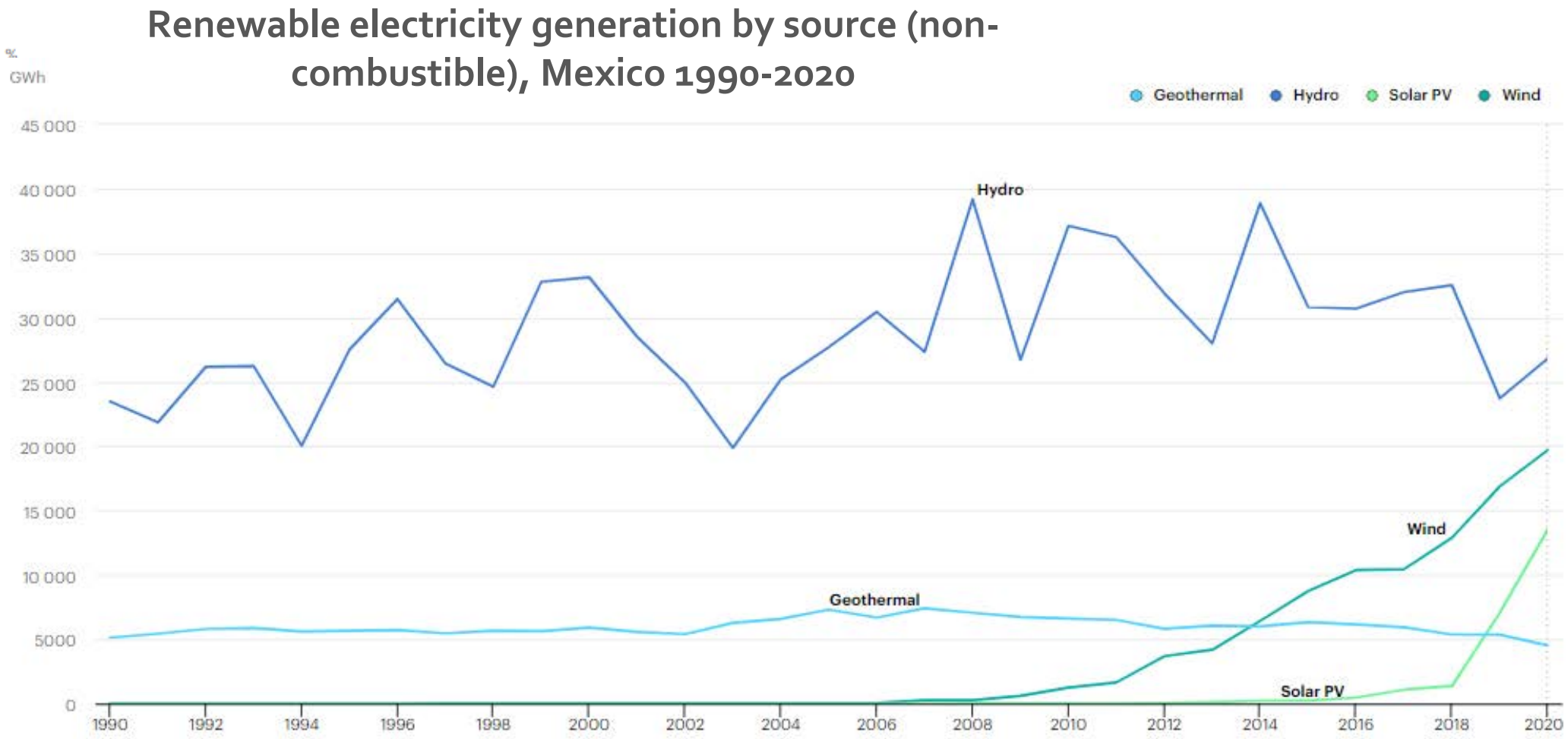
Renewable share & electricity generation



https://www.iea.org/countries/mexico

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Buildings in Mexico

- The building sector accounts for 17% of energy consumption
- The residential sector is the fastest growing subsector
  - 33 million houses
  - 45 m^2 to 60 m^2 (46%) and larger than 60m^2 (41%)
- 15 million of houses by 2030 (600 million m^2)
- Growth in non-residential and commercial buildings also expected
  - Built area of 155 million m^2

https://www.peeb.build/imglib/downloads/PEEB_Mexico%20Country%20Brief_March%202019.pdf

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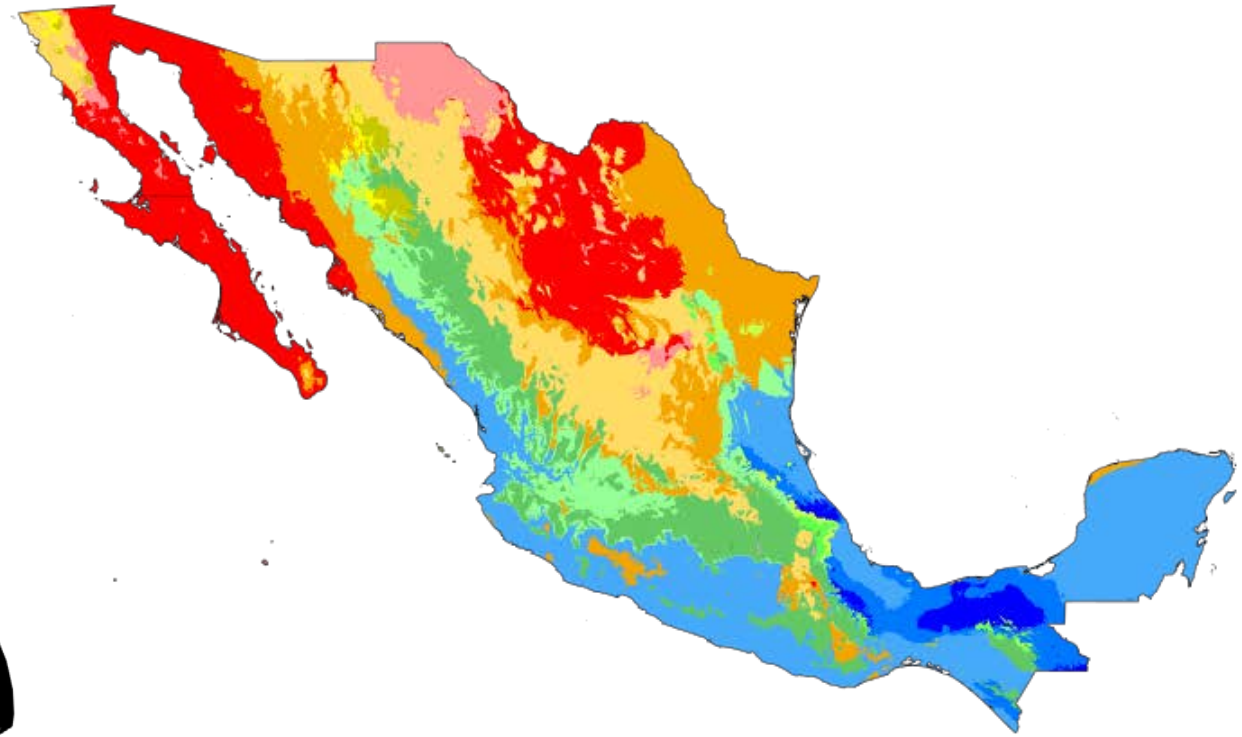
Buildings in Mexico

Köppen-Geiger climate classification map for Mexico (1980–2016)



- Tropical, rainforest (Af)
- Tropical, monsoon (Am)
- Tropical, savannah (Aw)
- Arid, desert, hot (BWh)
- Arid, desert, cold (BWk)
- Arid, steppe, hot (BSh)
- Arid, steppe, cold (BSk)
- Temperate, dry summer, hot summer (Csa)
- Temperate, dry summer, warm summer (Csb)
- Temperate, dry winter, hot summer (Cwa)
- Temperate, dry winter, warm summer (Cwb)
- Temperate, dry winter, cold summer (Cwc)
- Temperate, no dry season, hot summer (Cfa)
- Temperate, no dry season, warm summer (Cfb)
- Temperate, no dry season, cold summer (Cfc)
- Polar, tundra (ET)

Source: Beck et al.: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018)

https://www.peeb.build/imglib/downloads/PEEB_Mexico%20Country%20Brief_March%202019.pdf

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Programs on energy efficiency & renewables

International	• LEED & EDGE
National	• Hipoteca Verde (Green Mortgage) & Sisevive-Ecocasa & LAIF-Ecocasa
National NOM's	• NOM-020-ENER-2011, NOM-008-ENER-2001 & NMX-AA-164-SCFI-2013
Government buildings	• Energy efficiency on federal government buildings (APF)
FIDE – Trust for electricity savings	• Energy efficiency and distributed generation support programs
Mexico City	• Sustainable buildings certification & Solar City

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LEED (Leadership in Energy & Environmental Design)

- Framework for healthy, efficient, carbon and cost-saving green buildings.
- Globally recognized symbol of sustainability achievement and leadership.

Mexico **ranks 8th** of the top 10 countries in the world with the most LEED Certifications (Excluding the U.S.)

370 Projects*

8.41 millions Gross Square Meters*

*Up to 2019

https://www.bbva.com/es/sostenibilidad/

https://www.usgbc.org/leed

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EDGE (Excellence in Design for Greater Efficiencies)

Excellence In Design For Greater Efficiencies

Edge

IFC International Finance Corporation WORLD BANK GROUP

Creating Markets, Creating Opportunities

Green building certification system focused on making buildings more resource-efficient

Zero Carbon Pledge

6,842
Certified houses

324,685 m^2
Final Floor Space Certified

9,358 tCO_2/year
CO_2 savings certified

https://edgebuildings.com/certify/mexico

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NAMA for New Residential Buildings

The objective of this NAMA is to promote Cost and energy-efficient building concepts

Long-term impact and use of energy efficient houses and decreasing GHG emissions

Less carbon-intensive housing sector

NAMA de vivienda nueva

1,850 tCO_2 over 40 years of the house's operation

81,400 Financed houses*

*Up to 2017

https://www.nama-facility.org/projects/mexico-implementation-of-the-new-housing-nama

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Hipoteca verde (Green Mortgage) by INFONAVIT

The **INFONAVIT** it is the national benchmark in financial solutions, with a 74% share of the traditional housing market

"Hipoteca verde", created in 2007, is the credit that grants **an additional credit** to acquire **efficient technologies** that reduce the consumption of water, electricity and gas.

2.8 millions
Credits given*

215 kWh/month
Average Energy saved per home**

$224 MXN/month
Average saved per home**

*Up to 2017 **Data from 2016

https://portalmx.infonavit.org.mx

ECOCASA & LAIF

In 2013 Sociedad Hipotecaria Federal (SHF) started **ECOCASA** to give incentives for the construction of energy-efficient houses.

Promotes a **20-percent reduction in greenhouse gas (GHG) emissions** in comparison to a baseline house.

61,979
Homes Financed*

2,219 $MtCO_2e$
Emissions reduction over the useful life of the houses*

EcoCasa Program, received resources from the **Latin American Investment Fund of the European Union (LAIF)** for the construction of "Passive Homes".

7 states: Sonora, Michoacan, Jalisco, Oaxaca, Nuevo León, Veracruz & Mexico City

Up to 70% subsidy on eco-technologies and sustainability measures

*Data from 2020

https://www.gob.mx/shf/documentos/59439 https://www.gob.mx/shf/documentos/laif

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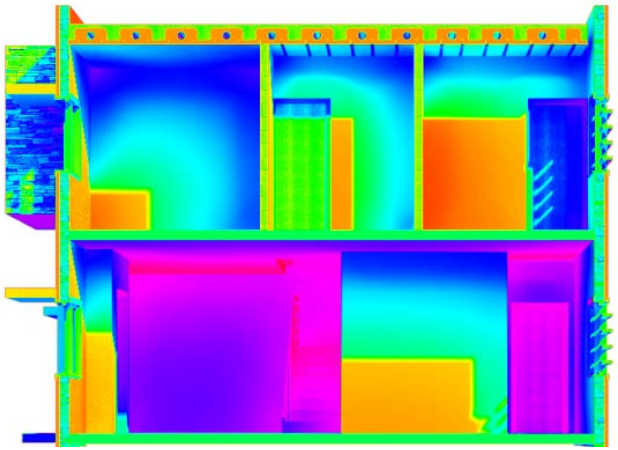
Energy efficiency NOM & Sustainable building NMX

NOM Technical specifications, of **mandatory application** which ensure a more efficient use of energy in appliances, equipment and systems that are manufactured and marketed in the country. ***NMX are voluntary.***

NOMs focused on buildings

NOM code	Scope
NOM-008-ENER-2001	Non-residential buildings envelope
NOM-018-ENER-2011	Thermal insulation for buildings
NOM-020-ENER-2011	**Residential buildings envelope**
NOM-024-ENER-2012	Thermal and optical characteristics of glass
NMX-AA-164-SCFI-2013	Sustainable building - criteria and minimum environmental requirements

NOM-020 -ENER-2011



12.9 GWh/year

Energy saved

*Data from 2020

https://www.conuee.gob.mx/transparencia/

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Energy efficiency program for buildings of the Federal Public Administration (APF)

This Program originated in 1999 and aims to establish a **continuous improvement** process to increase energy efficiency in buildings of the APF.

The Program sets specific annual energy savings goals for participating buildings, vehicle fleets and industrial facilities.

7 582
Participant buildings*

28.88 GWh / year
Energy savings registered*

$54.06 millions MXN/ year
Money savings registered*

*Data from 2017

https://www.gob.mx/conuee/acciones-y-programas/programa-de-eficiencia-energetica-en-la-administracion-publica-federal-apf-2019

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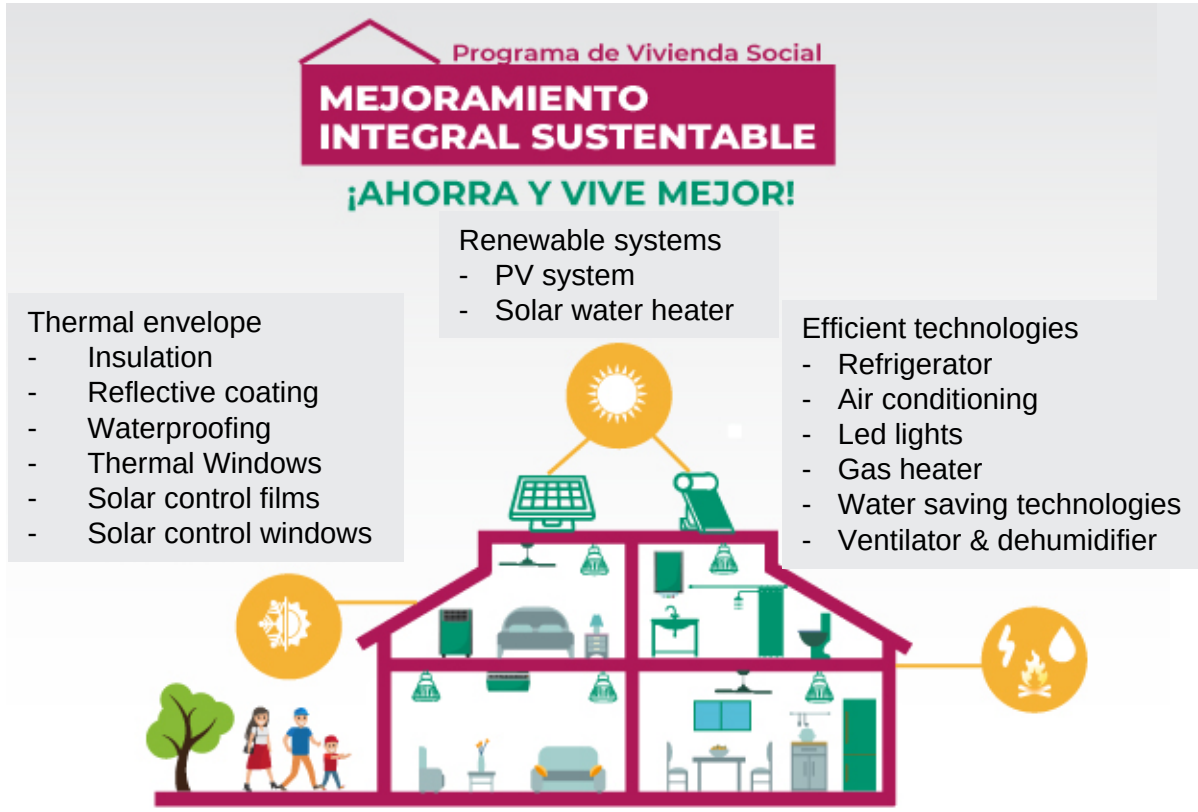
FIDE – Trust for electricity savings

FIDE finances energy efficiency measures & renewable energy systems

Sectors:

- Residential
- Industry
- Micro, small and medium companies



Distributed generation

Project	Number of projects	Total investment (MDP)	Installed capacity (MW)
Industry, companies PV	2,112	851.1	27.38
Residential PV	1,085	166.33	4.48
PV Solar fields	22	174.25	6.97
TOTAL	**3,219**	**1,191.68**	**38.83**

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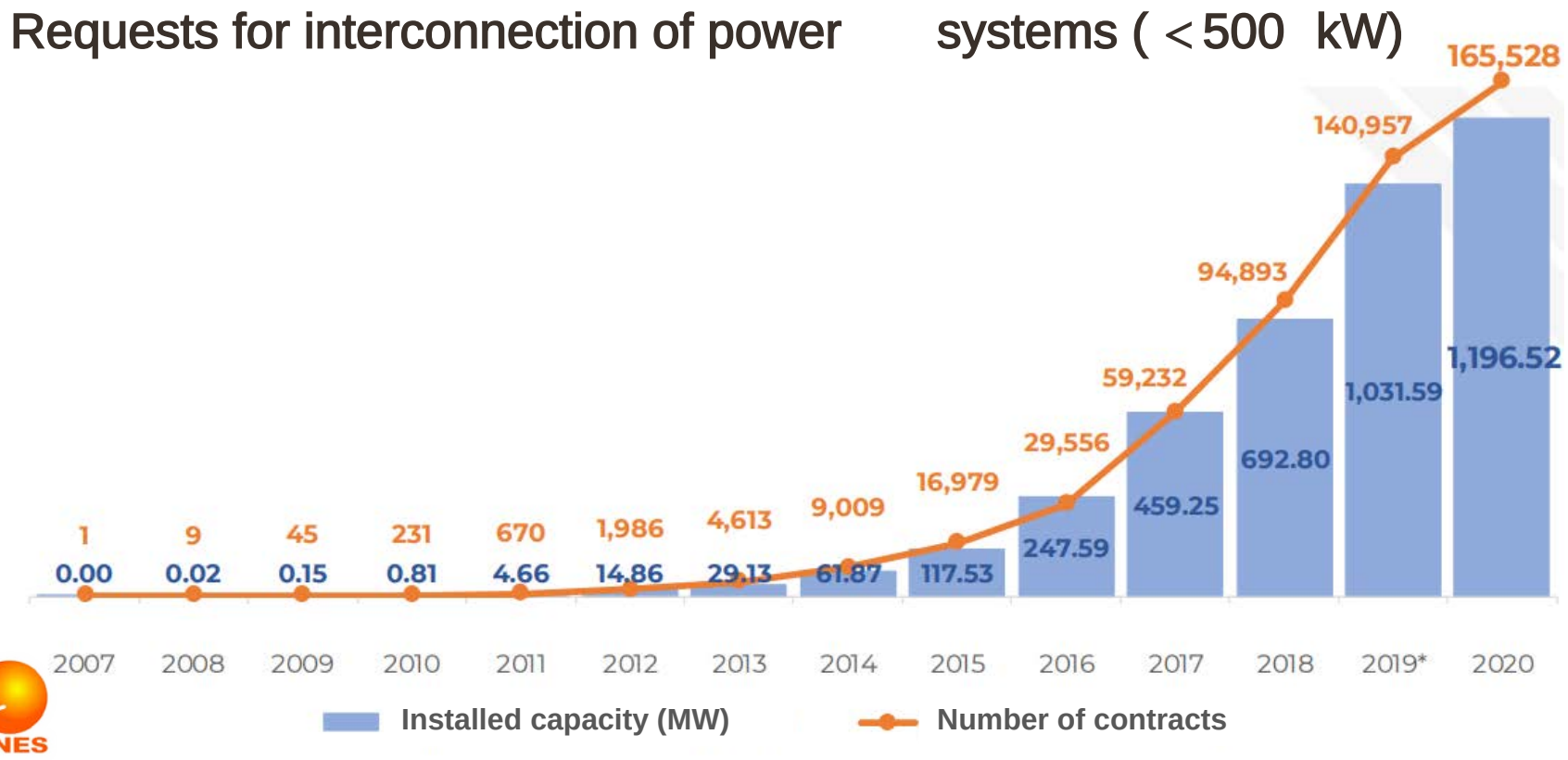
Distributed generation

Currently in Mexico there are 3 models in which a user can be interconnected to the grid and generate energy (Net Metering, Net billing & Total sale)



https://anes.org.mx/wp-content/uploads/2021/05/Estadisticas_GD_2020__Primer_Semestre.pdf

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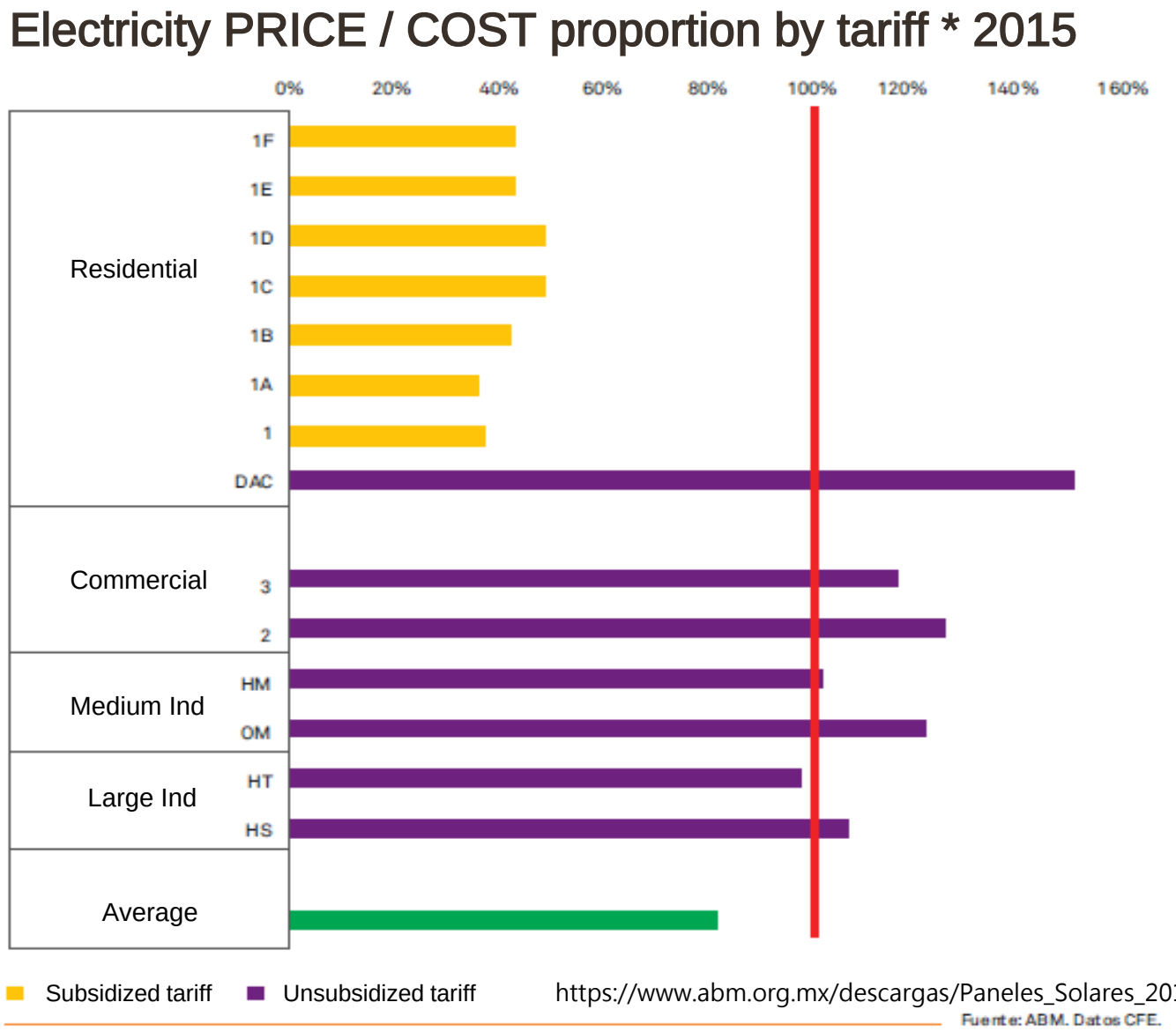
Distributed generation



https://anes.org.mx/wp-content/uploads/2021/05/Estadisticas_GD_2020__Primer_Semestre.pdf

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Mexico City- Sustainable Building Certification Program

Energy obligatory specifications for new buildings:

- To have an efficient envelope
- To include renewable energy system

The sustainable building certification program (PCES) started in 2020

Self-regulatory program

- Efficient use of natural resources during the design, construction and operation of buildings in Mexico City

It is only mandatory for those projects that are considered to have a considerable environmental impact due to their size, location or type of use.

https://www.sedema.cdmx.gob.mx/storage/app/media/DGEIRA/GacetaDel24DeDiciembre2020.pdf

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Mexico City - Solar city

Solar City is the program that seeks to promote the efficient use of energy and renewable sources in Mexico City, it is part of the Environmental and Climate Change Program 2019-2024.

Solar City includes actions and financial aid in the following areas:

- Electric self-generation
- Technical training
- Solar energy for SMEs
- Solar water heating
- Biodiesel plant

SMEs: Small and mid-size enterprises

** Conceptual image*

Some objectives of the program:

- Provide 134 611 houses with solar heaters
- Provide 10 000 SMEs with PV systems (100 MW total)
- Install a PV system in 300 government's buildings
- Train 1 000 technicians in solar systems
- Build the Abasto's PV system with a capacity of 18 MW

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Summary

- In the last decades several programs have been implemented (all levels federal, state and municipal…)
- Programs and actions focused on energy efficiency
- Over the last years, the contribution of renewables is increasing (in buildings particularly solar thermal & PV)
- Complex ecosystem where investment costs, regulations and subsidies coexist
- Production of electricity is still mainly with fossil fuels ($/$CO_2$)

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