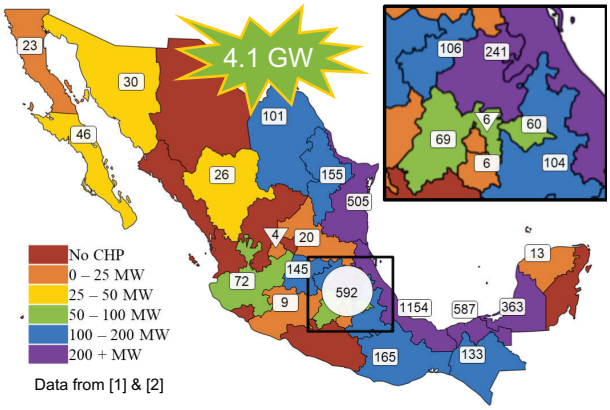
Combined Heat and Power: Opportunities in the Mexican Market

Reforms in Mexican Energy Sector

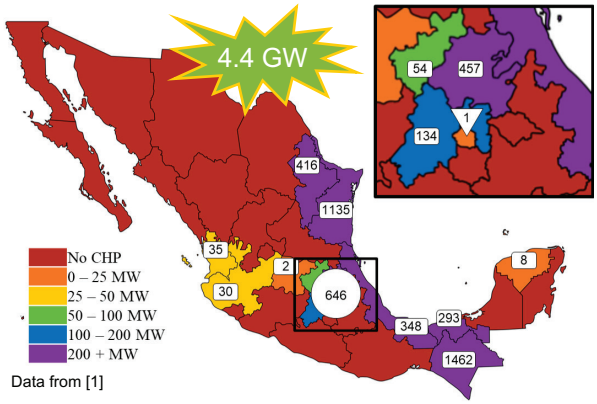
- Ended monopoly in the oil, gas, and electricity sectors
- Increased government investment in natural gas pipeline system and electrical grid
- Opening of Energy Sector to private investment
  - Allowing selling of electricity to the grid
  - Allowing private investment in the grid
  - Facilitating private investment with energy auctions
  - Allowing private investment in natural gas pipelines
- Public policies supporting CHP as a clean energy
  - Classification of "Efficient" CHP as a clean energy
  - Implementing and mandating the use of Clean Energy Certificates (CEL)
- Reform of the Foreign Investment Act to reduce entry barriers to foreign companies
- Reform the tax regime to incentivize oil and gas investments
- Carbon Tax on fossil fuels excluding natural gas

Current CHP Installations



Data from [1] & [2]

In-progress and forecasted CHP Installations

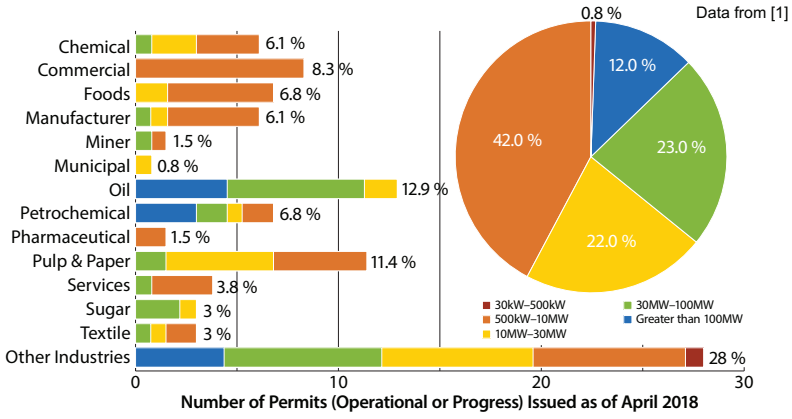


Data from [1]

As of April 2018, there are **4.1 GW** of CHP installed in Mexico (**5.4%** of Mexico's total electricity capacity), and another **2.35 GW** with permits, still in the planning or building stages. The 2018 PRODESEN expects an increase of **2.38 GW**, by 2032.

Installations by Sector

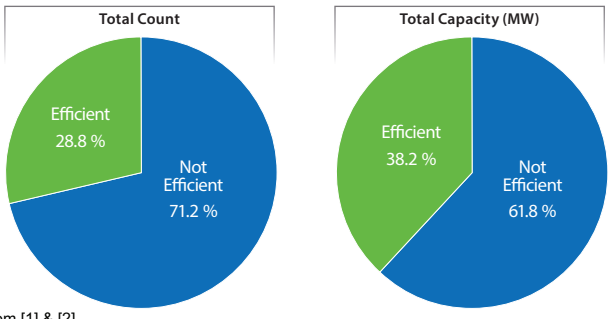
The distribution of CHP installation by sector is diverse (when accounting by the number of permitted systems); the oil and chemical industries remain the most important sectors, while commerce, foods, and pulp and paper are less prevalent applications for CHP units. "Other" Industries may include other industries not listed here and commercial facilities receiving medium voltage electricity.



Data from [1]

Efficient Cogeneration Accreditation

CHP projects have been installed slowly over the past 20 years. Recent reforms have pushed for more clean energy, including cogeneration that is accredited under a minimum energy efficiency standard. Accredited Efficient Cogeneration accounted for none of the 2013 generation, but rose to **583 MW** by 2015 and doubled to over **1,250 MW** in 2018, as established CHP facilities retroactively gained accreditation. Currently almost 30% of all CHP permits have efficient accreditation.



Data from [1] & [2]

Barriers to CHP investment

- **Lack of Information and Education**
  - On permitting, regulations, efficient accreditation, interconnection
  - On CHP project feasibility evaluation and assumptions
- **Market & Financial**
  - High costs (especially for lower power units)
  - CELS not traded on open market
  - Lack of natural gas distribution infrastructure in many areas
  - Fluctuating electricity and low natural gas prices

Determination of Efficient Cogeneration

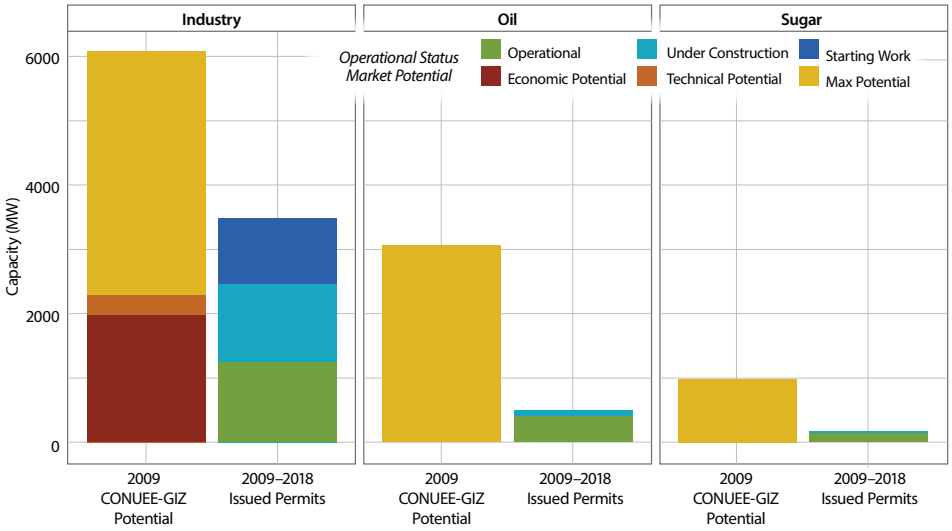
Fuel-Free Energy (ELC) > 0 = MWh CELs generated

$$ELC = \left[\frac{E}{RefE * fp} + \frac{H}{RefH} - F \right] \bullet RefE$$

E = Net electricity produced
F = Energy produced by fossil fuel
H = Net thermal energy generated

RefE = Reference Electrical Efficiency based on fossil fuel system, dependent on capacity (40 – 53%)
RefH = Reference Thermal Efficiency based on fossil fuel system, dependent on system (82 – 90%)
fp = Factor for transmission and distribution losses, dependent on voltage (91 – 100%)

Full details in CRE RES/003/2011 and CRE RES/1838/2016



Mexican CHP Potential

In 2009 CONUEE and GIZ determined that there was **3.1 GW** and **0.98 GW** of potential for CHP in the oil and sugar industries, respectively, and up to **6.1 GW** in all other industries (**2.0 GW** if not considering being able to sell to the grid). Since that study, **1.8 GW** have been installed, with several states installing much more than was expected, but several states still greatly under their potential.

Opportunities for CHP Investment

Growing electricity demand	Increase in Electricity Consumption 37–59% Increase in Peak Demand	Self Supply CHP to reduce demand on grid, decrease risk of forced downtime, increase resiliency of process
Energy sector reforms	Easier to sell excess electricity to grid Increased access to NG and build pipelines	More secure CHP fuel, easier financing with supply contract, more economically feasible
Increase push for clean energy	Target: 38.6% Clean Energy by 2032 Large consumer mandate: 5.8 % of energy from CEL Recent carbon tax excludes NG & Biofuels	Regardless of fuel used, CHP gets credits for Clean Energy Certificates; Earn 1 CEL/MWh generated without fossil fuels

[1] - CRE "Tabla de Permisos …30 de Abril de 2018." https://web.archive.org/web/20180608160352/https://www.gob.mx/cms/uploads/attachment/file/323655/INFO_PAGINA_2018-04-30_-_1TablaPermisos.pdf.
[2] - SENER. 2018. "PRODESEN 2018-2032." https://www.gob.mx/sener/acciones-y-programas/programa-de-desarrollo-del-sistema-electrico-nacional-33462.
[3] CONUEE< CRE and GTZ. 2009 "Estudio Sobre Cogeneración En El Sector Industrial En México." http://www.cogeneramexico.org.mx/anexos/2009-12-Cogen_sec-ind-Mex[1].pdf
– Geographical breakdown of the "economic potential" of the "industry" category

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