

Private Investment in Mexico's Electricity Sector (Technology and Energy Selection)

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Summary

This paper is supplementary to a report produced recently for the CEC on private-sector investment in Mexico's electricity sector.¹ Based on the official information of the Mexican power sector authorities, and in particular the register of permits issued by the Energy Regulatory Commission (Comisión Reguladora de Energía — CRE) for electricity production, an overview is provided here of the characteristics and status of permits issued to generation facilities, the amounts and sources of the corresponding investments, and the primary technologies and energy sources used in power generation by the private sector.

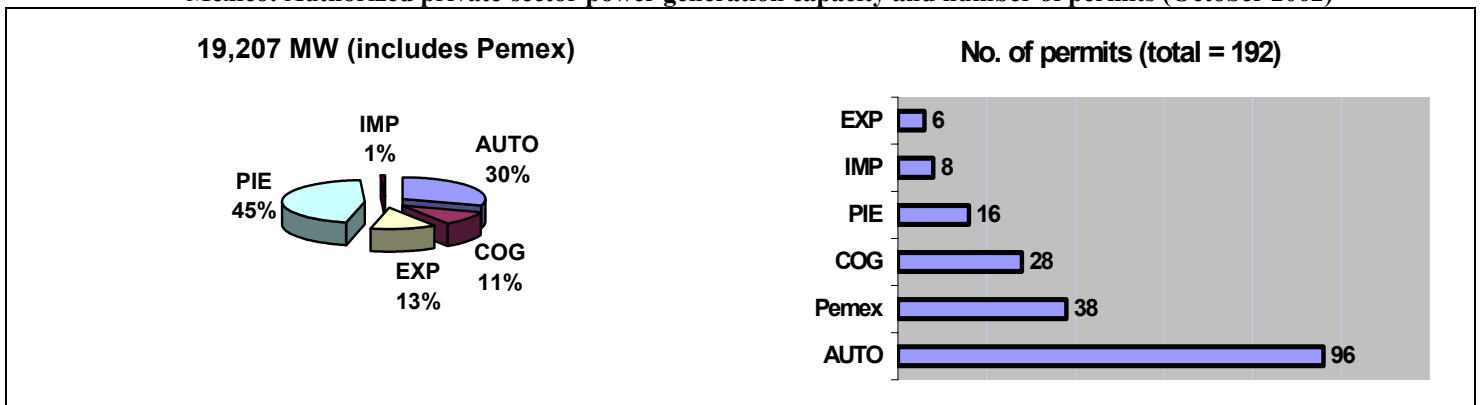
Authorized Permits and Generation Capacity

As of October 2002² there were 192 “permitholders” authorized to generate (or market, in the case of importers) electricity in Mexico within the various modes allowed by the current legal framework. The additional installed generation capacity represented by all the permitholders is 19,207 MW. Of this capacity, 8,759 MW corresponds to independent power generators (*productores independientes de energía*—PIE); 5,781 to entities generating electricity for their own consumption (AUTO); 2,429 to exporters (EXP); 2,085 to cogeneration facilities (COG) and only 152 MW (less than 1%) to importers (IMP).

Of the total permits, 38 are held by Pemex (1,236 installed MW) and 8 by importers. This leaves 146 permitholders for which private capital plays a dominant role in the development of generation capacity, including 96 AUTO, 28 COG, 6 EXP and 16 PIE (Figure 1).

Figure 1

Mexico: Authorized private-sector power generation capacity and number of permits (October 2002)



Source: CRE website, <http://www.cre.gob.mx/estadisticas/stat98/electr.html>

The data presented in Figure 1 provides a capsule portrait of the situation in the month of October 2002. However, it should be noted that the permits are at different stages of the process and in reality, only 149 permits representing 45 percent of the authorized capacity are *operating*. An additional 35 projects (9,390 MW) are *under*

¹ **Private investment in Mexico's electricity sector**, a report prepared for the North American Commission for Environmental Cooperation, Environment, Economy and Trade Program (project no. P.1.1.1.02.02) by Miguel G. Breceda Lapeyre, Mexico, August 2002.

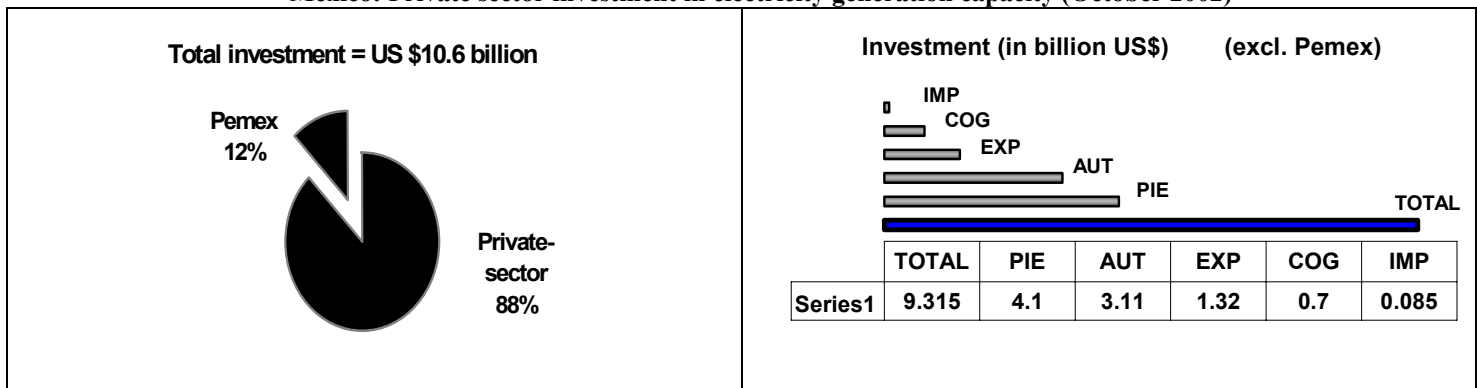
² Data from CRE website, <http://www.cre.gob.mx/permisionarios/perelec.html>

construction, representing 48 percent of the authorized capacity. The remainder consists of 6 “inactive” permits amounting to 402 MW. The CRE has also issued two permits “to begin work” on a capacity of 847 MW.

Generation Capacity and Investment

Total investment in the permits amounts to US \$10.6 billion, of which US \$1.3 billion (12%) corresponds to the 38 operating Pemex projects. The rest, or US \$9.315 billion, is the amount of private capital currently committed to electricity generation in Mexico. The available data indicates that the largest proportion of the investment is provided by the PIEs, which carry out larger-capacity projects on average. The PIE mode accounts for 44% of non-Pemex investment with only 16 authorized permits, AUTO contributes 33 percent with 96 permits, EXP 14 percent with 6 permits, and COG 8 percent with 28 permits. (Figure 2)

Figure 2
Mexico: Private sector investment in electricity generation capacity (October 2002)



Source: Based on CRE data, <http://www.cre.gob.mx/permisionarios/perelec.html>

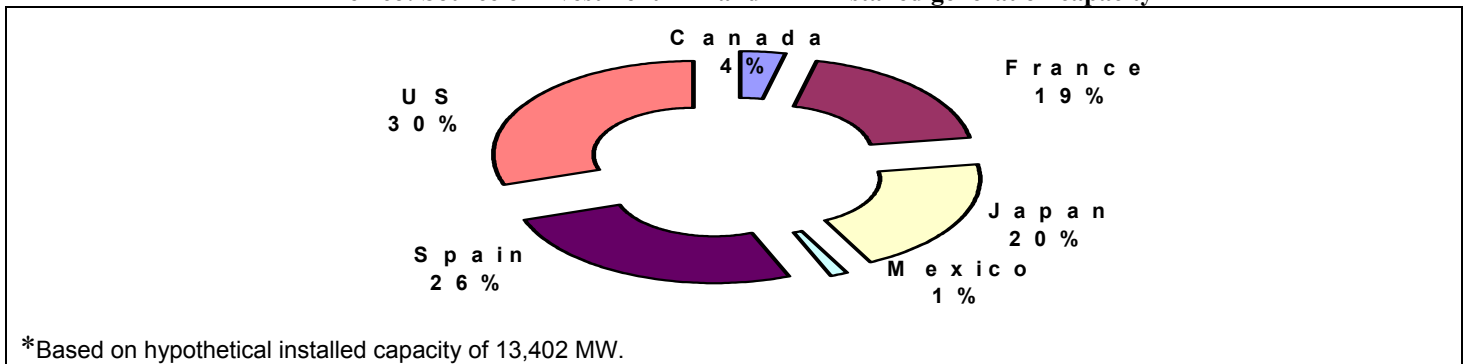
According to various sources, at least 90% of the total private capital invested in electricity generation derives from international sources of financing. From the analysis of generation permits issued by the CRE, it is impossible to determine the national origin of the capital, since many of the permitholders are legally incorporated as Mexican corporations. The CRE permits do not specify the source of the capital invested in the generation project even when the amount is indicated. The PIE and EXP modes in particular, representing together nearly 60 percent of the total authorized generation capacity, rely almost entirely on foreign capital. Domestic capital tends to be more prominent in the COG and AUTO modes (Pemex and several other domestic companies). It should also be realized that many of the permits classified as “under construction” are progressing very slowly and, in fact, some of these projects are essentially at a standstill.³

Appendix 2 of a recent report by the **Commission for Environmental Cooperation** on private investment in Mexico’s electricity sector⁴ contains a list of 32 PIE projects in Mexico published by the California Energy Commission which, incidentally, does not coincide with the CRE’s official list. But since the former list provides some information about domestic entities carrying out projects in their countries of origin, it is useful in making some inferences about the sources of capital invested in electricity generation in Mexico for domestic and export purposes, corresponding to nearly 60 percent of total private generation (44% PIE and 13% EXP; see Figure 1). It should be reiterated that this data is approximate; it provides a partial vision that should be taken with reserves (Figure 3).

³ Arturo Whaley, a Mexican expert on the development of private power generation projects in Mexico and the holder of an active permit for a wind project in Oaxaca (180 MW), told us in a personal interview that the official version of the status of the permits is somewhat optimistic. Whaley said that a good number of the permits considered to be “under construction” are at a virtual standstill at this time.

⁴ See **Private investment in Mexico’s electricity sector**.

Figure 3
Mexico: Source of investment PIE and EXP installed generation capacity*



Source: California Energy Commission, Contract 500-00-015, **Mexico Energy Project Financing**, 2 January 2002, p. 8.

In the case of permit holders classified as AUTO and COG, it may be inferred that the capital comes from more diverse sources. It is generally determined by the national origin of the company itself or has a larger proportion of domestic capital. In this fragmented universe of generators, there is capital from countries not appearing in Figure 3, such as Belgium through Tractebel and Switzerland through Apasco, a cement company.

Generation Technology, Capacity, Fuel and Investment

The Mexican regulatory authorities have defined 11 basic technologies among permit holders. In the aggregate, for 50 of the 192 permit holders, steam turbine (ST) technology is the principal source, followed by gas turbine (GT) and internal combustion (IC). Only 18 permits indicate the use of renewable energy (RE) technologies (hydro and wind power), representing only 4 percent of authorized capacity to date. In terms of generation capacity, the dominant technology (70 percent of authorized capacity) is combined cycle (CC), accounting for 6 of every 10 dollars invested in generation (Table 1 and Figure 4).

The primary fuels or energy sources indicated in the CRE permit list are the following: **renewable** (wind, water, sugar cane bagasse, biogas); **petroleum** (fuel oil, diesel, and petroleum coke); **coal and coke**; **natural gas (NG)**; **natural gas with other** (dual plants) and **other** (various combinations of energy sources other than NG in dual or hybrid plants). Most of the permit holders selected NG as their preferred fuel. As regards installed capacity, the dominant fuel is again NG, obviously due to the large scale of the PIE and EXP projects, almost every one of which uses NG (Table 2 and corresponding figures).

Table 1
Mexico: Authorized capacity and investment by generation technology (October 2002)

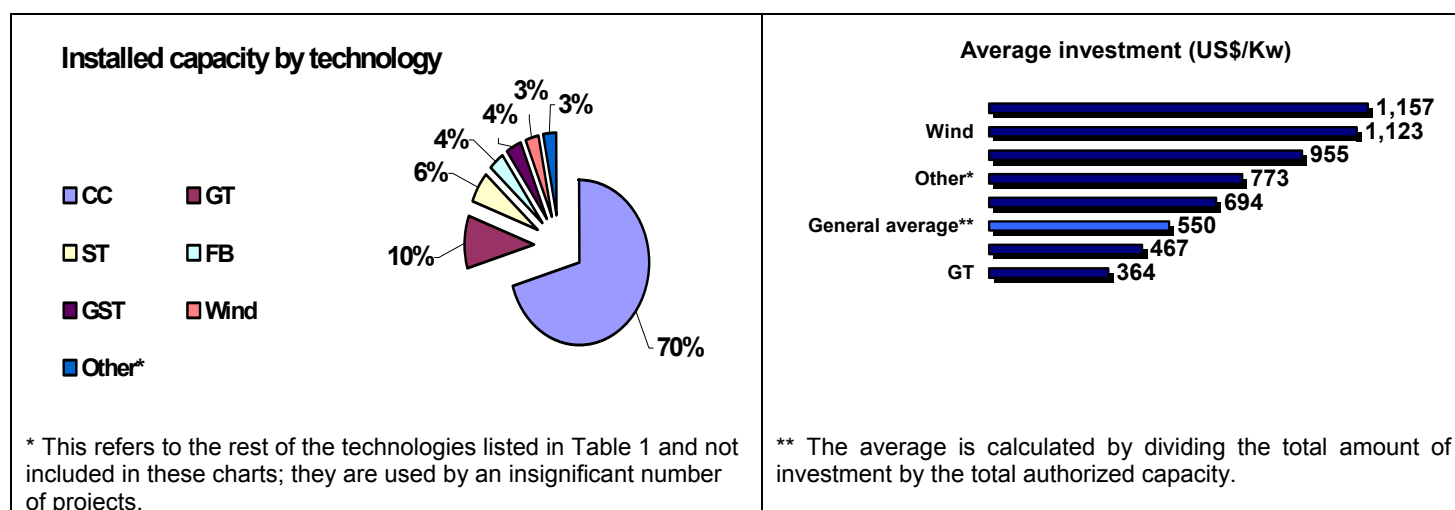
Technology	Number of permits	Authorized capacity		Investment	
		MW	%	Million \$	%
1. GAS AND DIESEL TURBINE (GDT)	1	7.8	0.04	3.0	0.03
2. STEAM TURBINE AND INTERNAL COMBUSTION (STIC)	1	4.4	0.02	5.0	0.05
3. HYDRAULIC AND STEAM TURBINE	2	19.0	0.10	23.6	0.22
4. FLUIDIZED BED (FB)	3	708.0	3.69	819.0	7.76
5. WIND	6	601.1	3.13	675.3	6.40

6. GAS AND STEAM TURBINE (GST)	7	683.0	3.56	473.7	4.49
7. HYDRAULIC TURBINE	12	169.3	0.88	172.9	1.64
8. COMBINED CYCLE (CC)	30	13,522.5	70.41	6,318.6	59.85
9. INTERNAL COMBUSTION (IC)	31	214.8	1.12	150.0	1.42
10. GAS TURBINE (GT)	41	1,952.9	10.17	711.7	6.74
11. STEAM TURBINE (ST)	50	1,171.5	6.10	1,119.3	10.60
IMPORTS	8	152.4	0.79	85.2	0.81
TOTAL	192	19,207	100	10,557	100

Source: Based on CRE data, <http://www.cre.gov.mx/permisionarios/perelec.html>

Figure 4 below shows that the predominant technologies chosen by the private sector are CC followed by GT, which together account for a little over 80% of authorized generation capacity. The right-hand chart shows the average per-kilowatt investment for each technology. It should be noted that CC and GT show lower “costs” than the general average and are, comparatively speaking, the technologies representing the lowest investment cost. This could explain the investors’ preference.

Figure 4
Mexico: Capacity and average investment by generation technology



Source: Table 1

Finally, Table 2 shows the amount of investment in different primary energy sources and combinations of these among the permits issued to date. Consistent with the predominant selection of CC technology, nearly 70 percent of the investment appears to be in NG. The remainder of the investment is in other fossil fuel (FF) technologies (slightly over 20 percent) and RE (only 9 percent). Moreover, it may be stated that FF is overwhelmingly the energy source of choice for private sector power generation in Mexico (96 percent), with RE marginal at 4 percent.

Table 2

Mexico: Private-sector investment and generation capacity by energy source

Energy source
Investment
Capacity

In million US\$
Authorized (MW)

RE
905
829

675
601

173
169

48
48

9
11

Petroleum
660
791

317
361

84
170

260
260

Coal
559
448

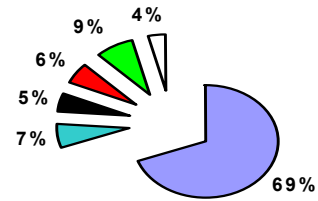
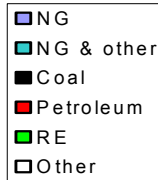
234
198

325
250

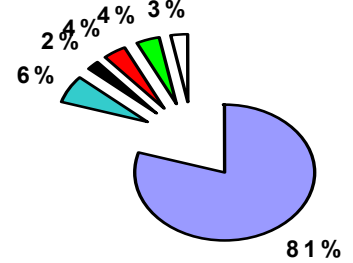
NG
7,297
15,320

NG and other
728
1,247

Investment



Authorized capacity



Wind

Hydro

Bagasse

Biogas

Fuel oil

Diesel

Coke/petroleum

Coal

Coke

Other
408
572
TOTAL
10,557
19,207

Source: Based on CRE data, <http://www.cre.gob.mx/permisionarios/perelec.html>

Conclusions

- A total of 19,207 MW of electricity generation capacity is authorized for the private sector in Mexico, half of this being currently “in operation.” Total committed investment for all authorized permits amounts to approximately US \$10.6 billion and it is estimated that more than 90 percent of this amount comes from international financing sources; therefore less than 10 percent of the capital committed to private sector generation in Mexico is of domestic origin.
- The proportion of foreign capital is even higher — nearly 100 percent — among permitholders classified as PIE or EXP, who represent almost 60 percent of the total authorized generation capacity to date. Based on unofficial information and a degree of speculation about this segment, it may be inferred that the origin of capital is as follows: United States (30%); Spain (26%); Japan (20%); France (19%); Canada (4%) and Mexico (1%). However, this data should be taken with reserves.
- Currently, eleven different technologies are used for power generation by the private sector in Mexico; some of these, such as GDT and STIC, are reported by only one permitholder each. The most common technology, as determined by number of permitholders, is ST (50 permitholders). However, the dominant technology in terms of installed capacity is CC, representing more than 70 percent of total capacity and 60 percent of investment.
- The average per-kilowatt investment by the private sector in Mexico is approximately US \$550, considering all the capital and the total authorized capacity. The CC and GT technologies are the “cheapest” at \$467/Kw and \$364/Kw, respectively; the “most expensive” technologies are FB (\$1,157/Kw) and wind (\$1,123/Kw).
- FF is the dominant energy source used to generate electricity by the private sector in Mexico: NG accounts for 81 percent, other FF 15 percent, and RE only 4 percent.

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Mexico City
Mexico, 15 November 2002

References

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2. Comisión Reguladora de Energía, www.cre.gob.mx/english/index.html
<http://www.cre.gob.mx/permisionarios/perelec.html>
3. North American Commission for Environmental Cooperation, www.cec.org
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