



GHG MITIGATION OPPORTUNITIES IN THE OIL REFINERY SECTOR

Workshop on Sectoral studies and Approaches for mitigation
of greenhouse gases in Mexico
September 2008

OIL INDUSTRY in Mexico



Pemex Refining (PREF)

Transforms crude oil into fuel for general use which trades and distributes throughout the country

Pemex Exploration and Production (PEP)

It conducts exploration and exploitation of oil and natural gas

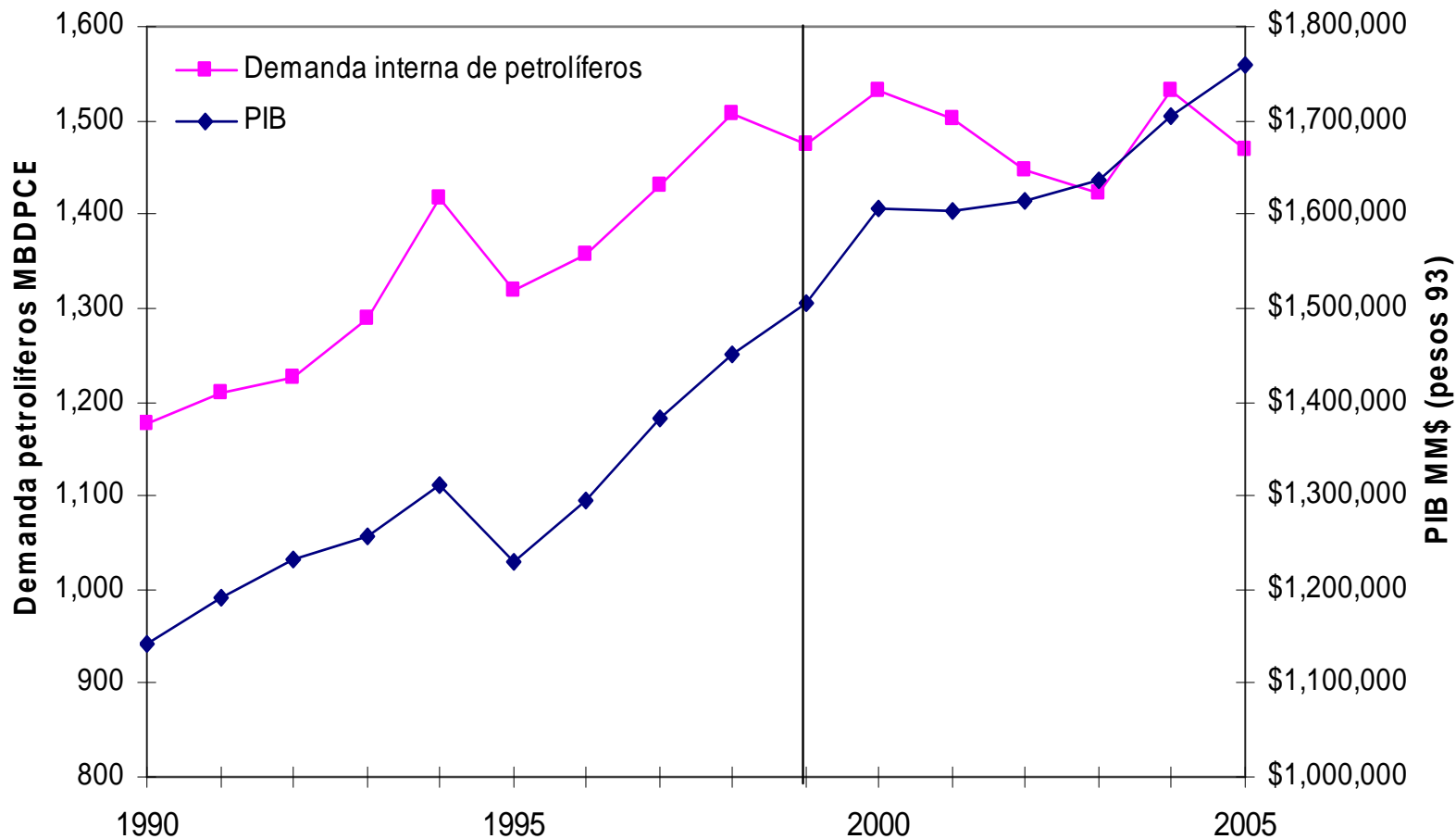
PEMEX Gas and Basic Petrochemical (PGPB)

Processes natural gas and produces commodity petrochemicals and liquefied gas, transports and sells such products

Pemex Petrochemical (PPQ)

Develops and trades a variety of raw materials for chemical and petrochemical industries in the country (including derivatives of methane and ethane)

National GDP and domestic demand for oil products



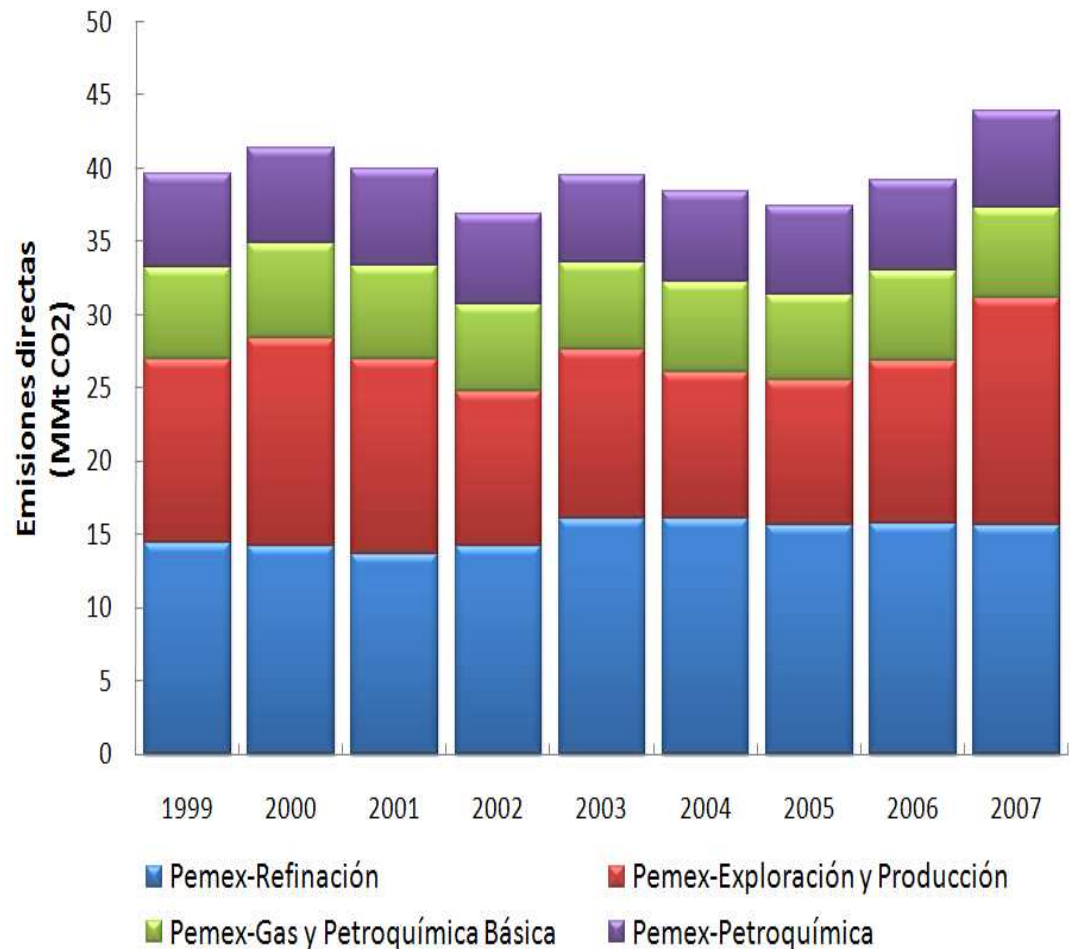
Source: CMM 2007, con datos de SENER

CO₂ historical emissions (2001-2007)

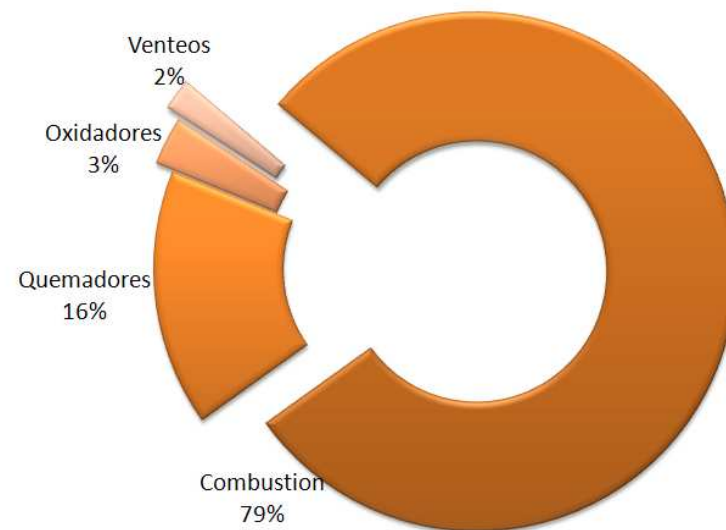
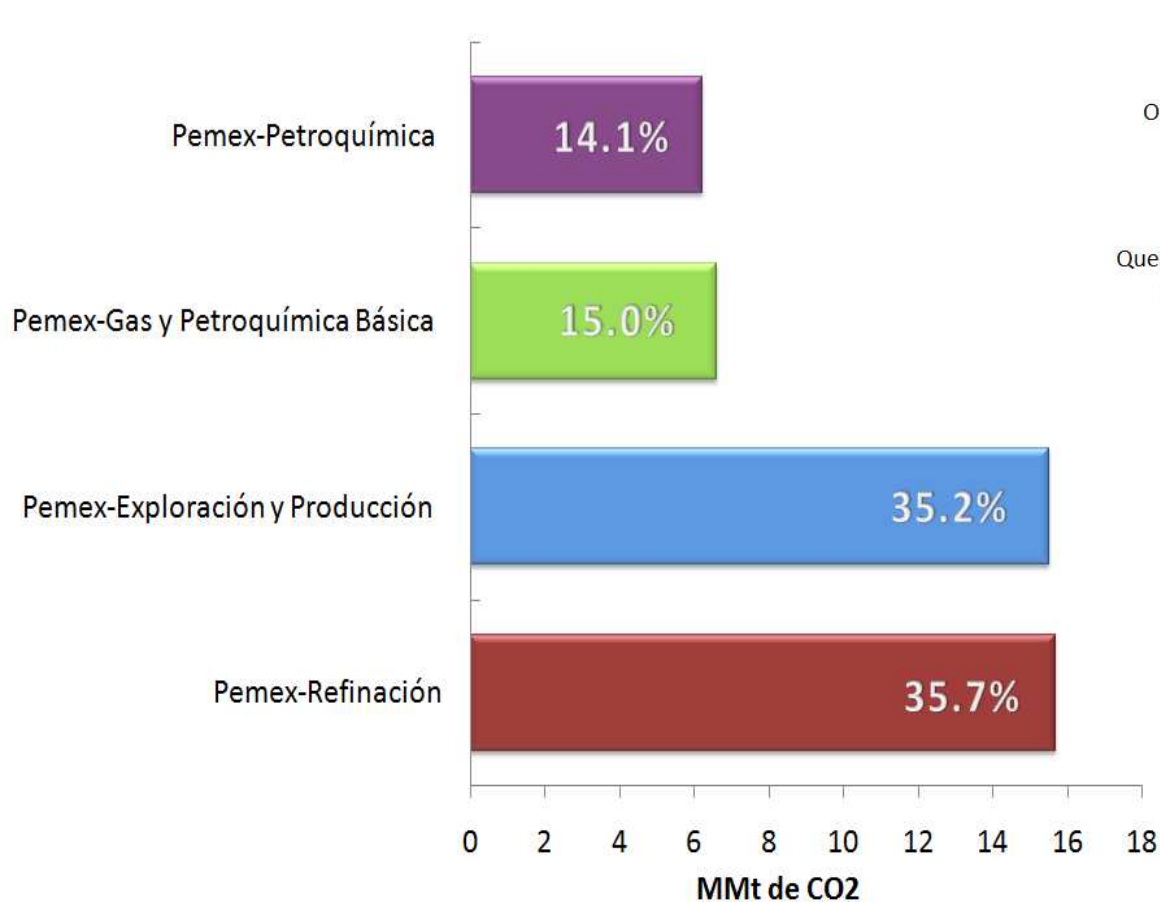


PEMEX generates near 6% of the emissions of GHG in Mexico.

In 2007 their emissions increased in 12% with regard to the previous year, mainly due to the liberation of bitter gas with high nitrogen content.

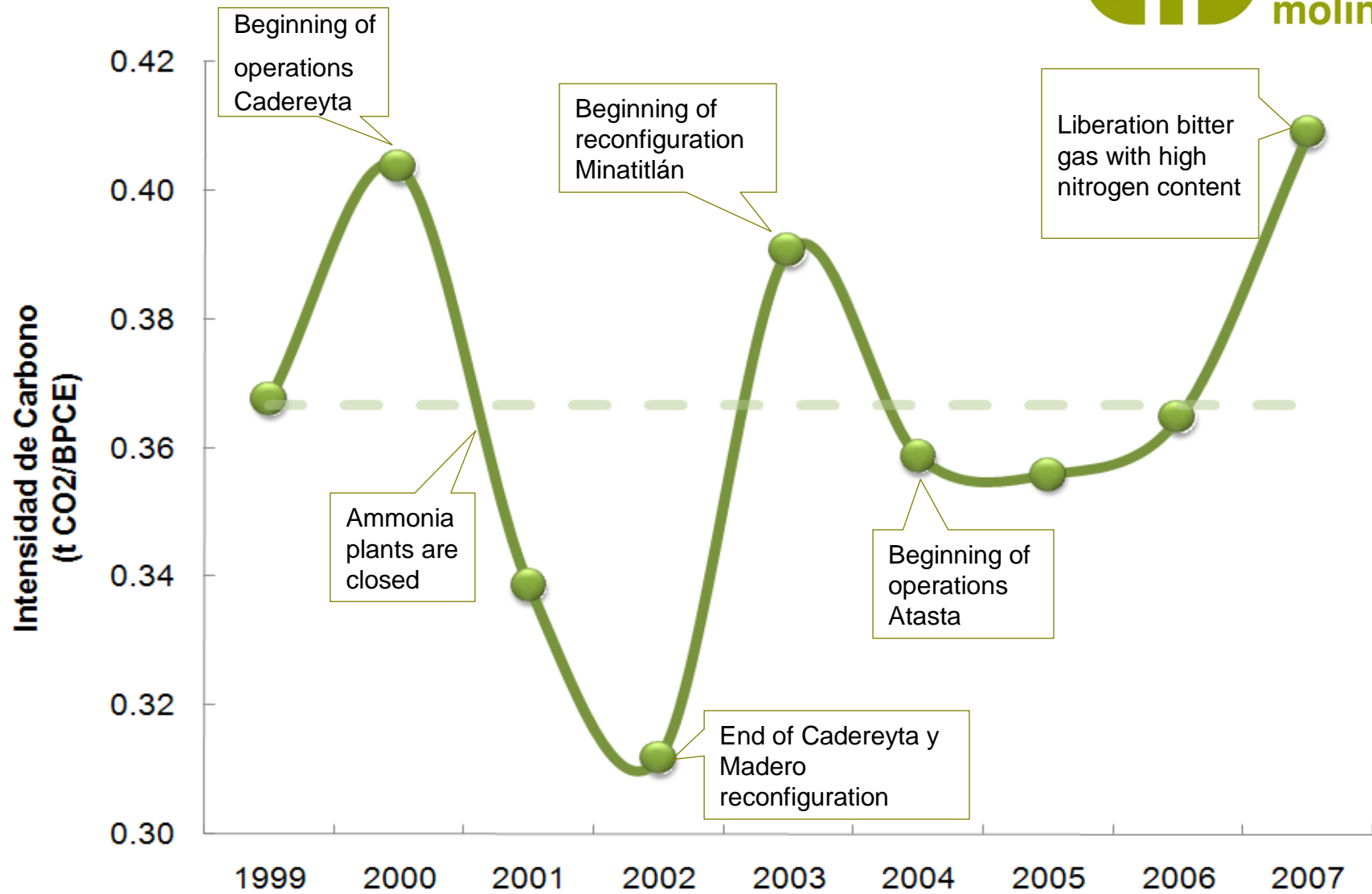


GHG emissions 2007



43.8 million tons of CO₂

CO₂ INTENSITY



Source: Informes de Desarrollo Sustentable. 1999 a 2006. PEMEX

Potential projects to develop identified in PEMEX



About 66 potential projects for reducing GHG emissions have been quantified in PEMEX in cogeneration, energy efficiency and methane recovery, of which 19 are in the process of documentation for registration with the CDM Executive Board.

Subsidiaria	Proyectos*	Reducción de emisiones* (Mt CO2e/año)	Inversión requerida (millones de USD)
PEP	12	1.2	\$428
PREF	13	1.5	\$130
PGPB	9	1.3	\$440
PPQ	32	2.1	\$366
TOTAL	66	6.1	\$1,363

Summary of the main mitigation actions for the oil sector included in the PECC



Generación de energía	Metas en el período		Implicaciones económicas, inversión	Temporalidad y otras observaciones
	Acción	Acumulado 2008-2012 (MtCO ₂ e)	Reducciones alcanzadas en 2012 (MtCO ₂ e/año)	
Eficiencia térmica en PEMEX	7.5	2.5	\$715	Proyectos en etapa de promoción
Eficiencia eléctrica en PEMEX	1.7	1.7	\$172	Proyectos en etapa de promoción
Cogeneración en PEMEX	3.2	1.6	\$472	Proyectos en etapa de promoción
Reducción de emisiones fugitivas de metano	1.2	0.3	\$5	Proyectos en etapa de promoción
Total	13.6	6.1	\$1,363	



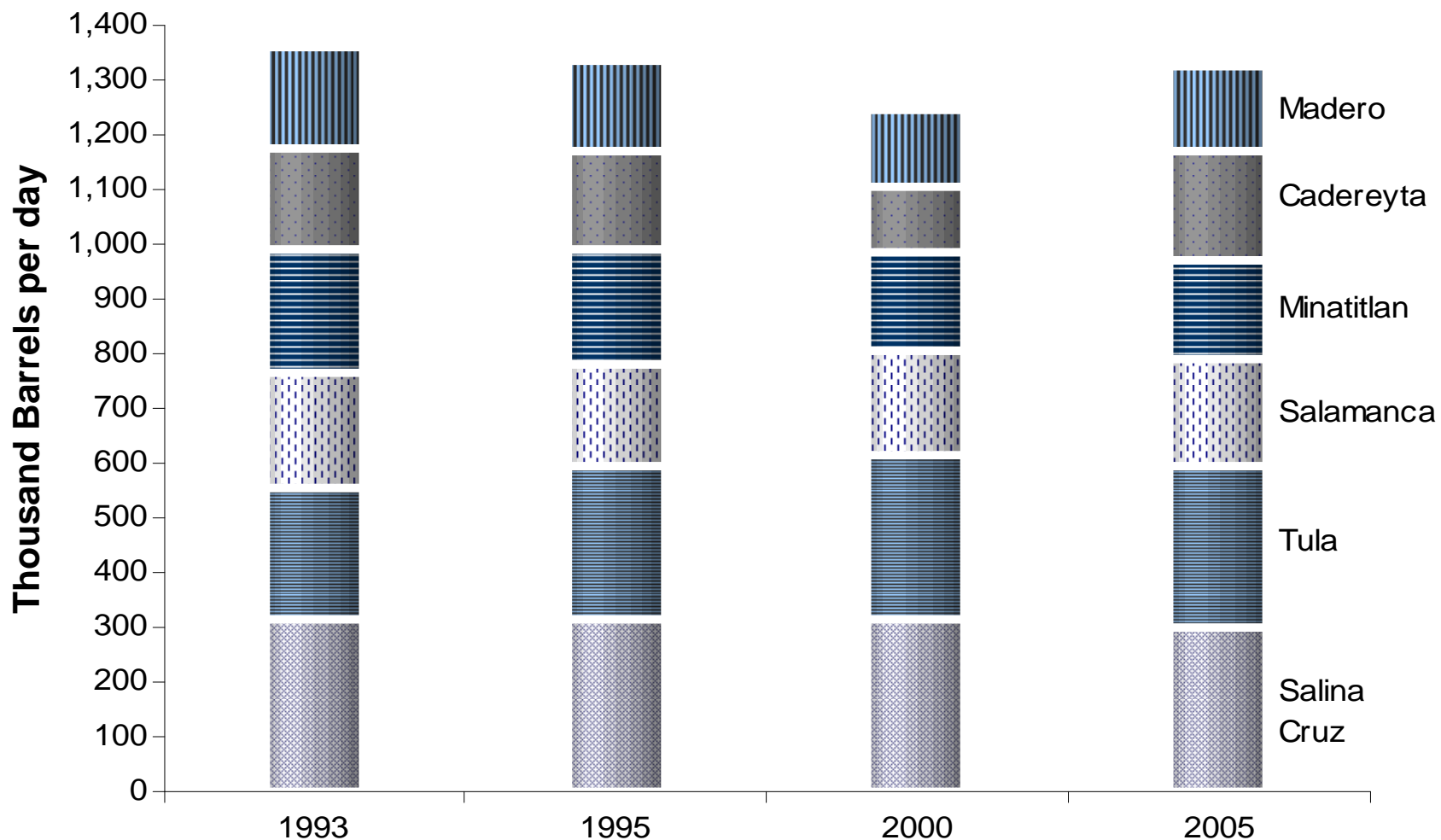
PEMEX REFINERY

START DATES OF OPERATION OF THE SNR



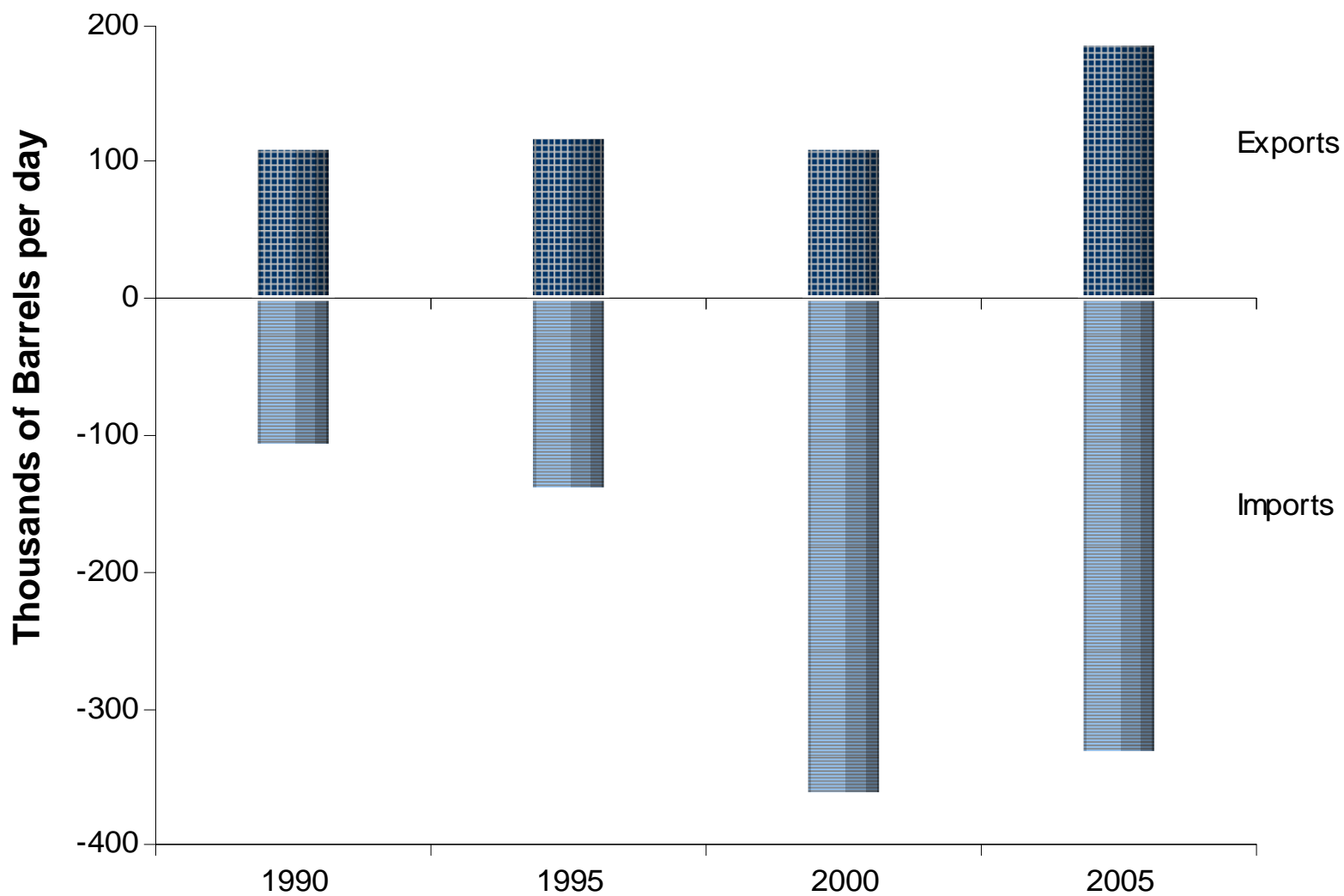
Source: PEMEX

PRODUCTION BY REFINERY 1993-2005



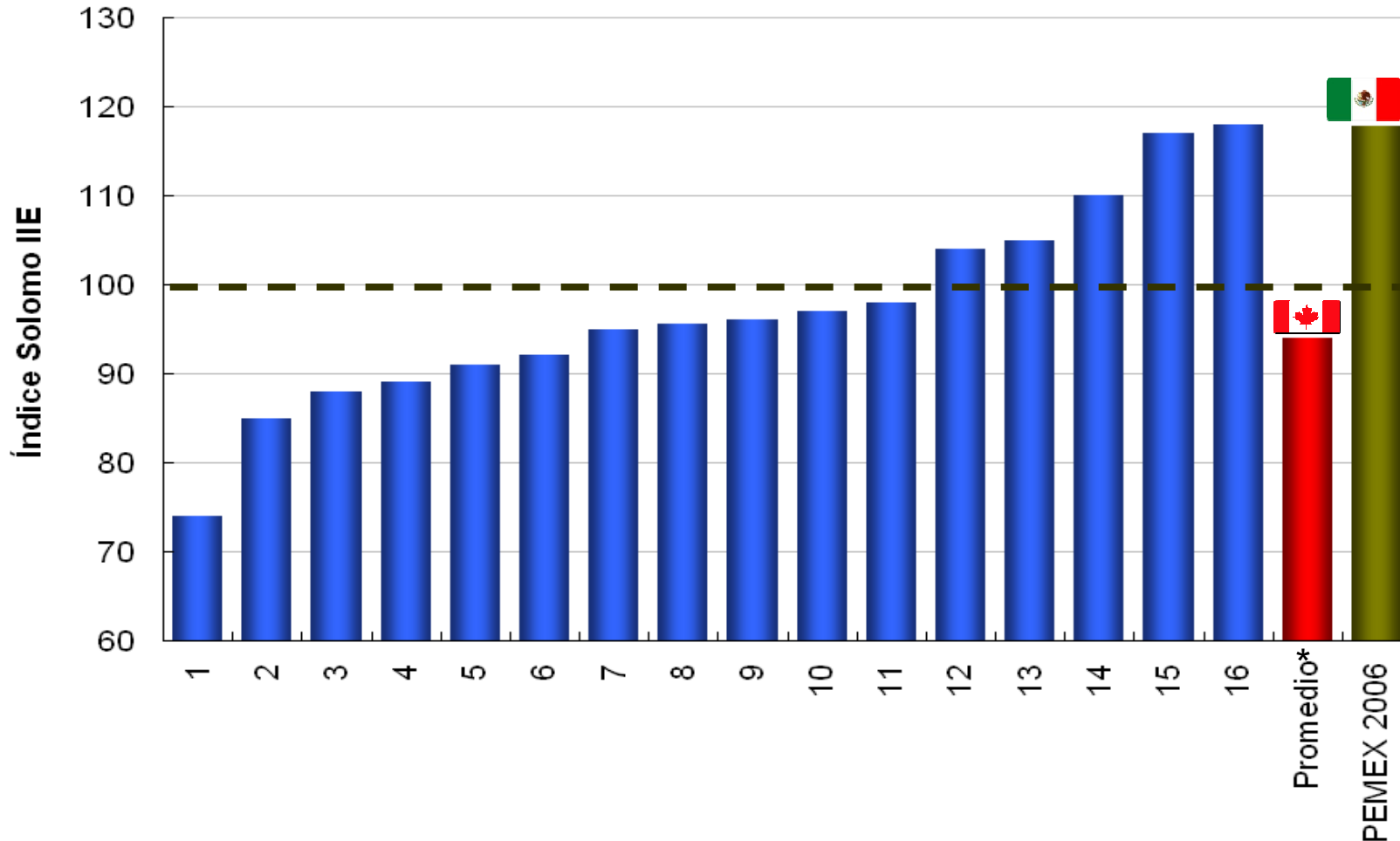
Source: CMM 2007, con información del SIE, 2006.

EXPORTS AND IMPORTS



Source: CMM 2007, con información del SIE, 2006.

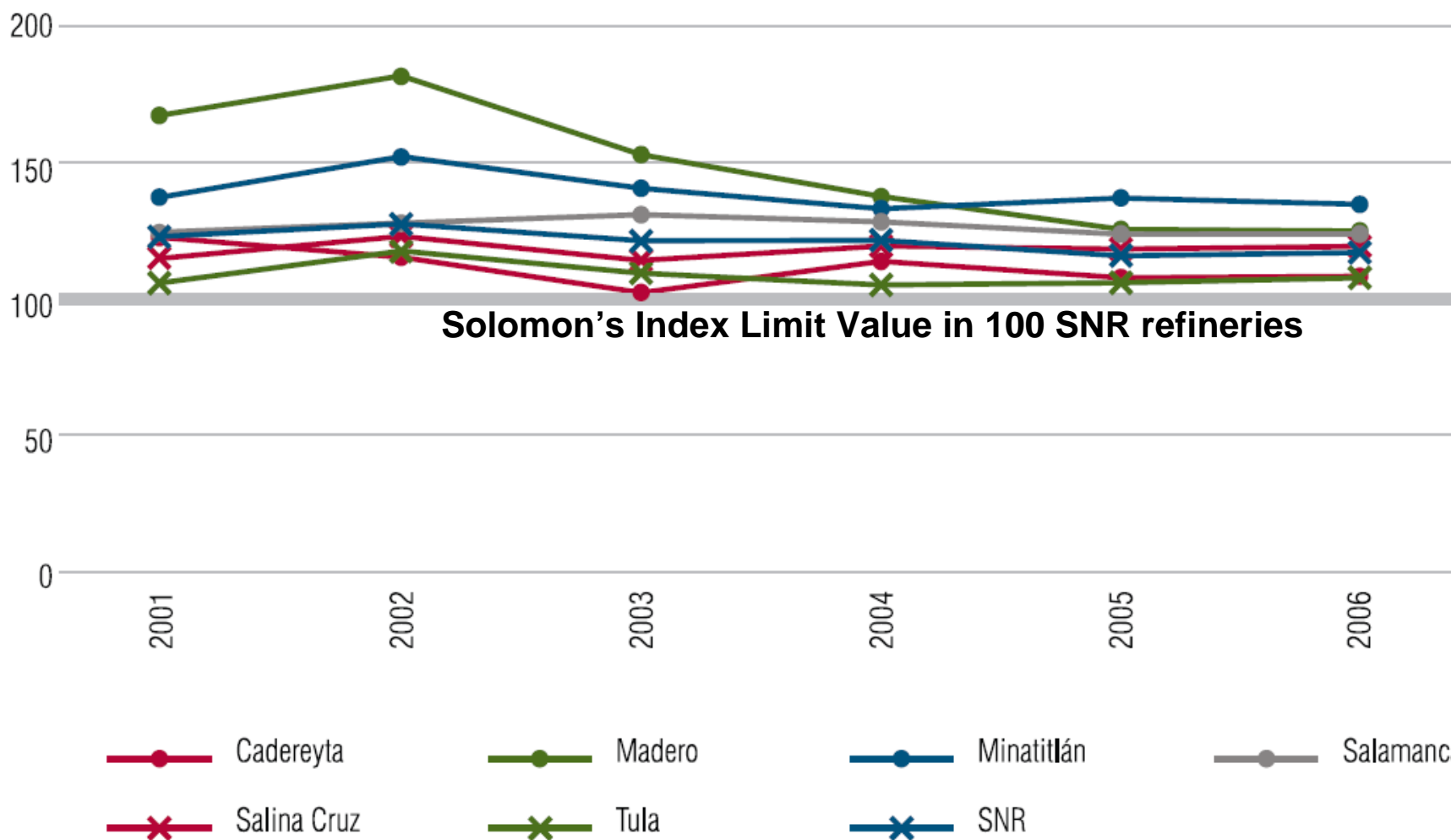
PEMEX-REFINERY SOLOMON INDEX in comparison with Canadian refineries



*estimation of the averages praised, the real Canadian average is considered confidential

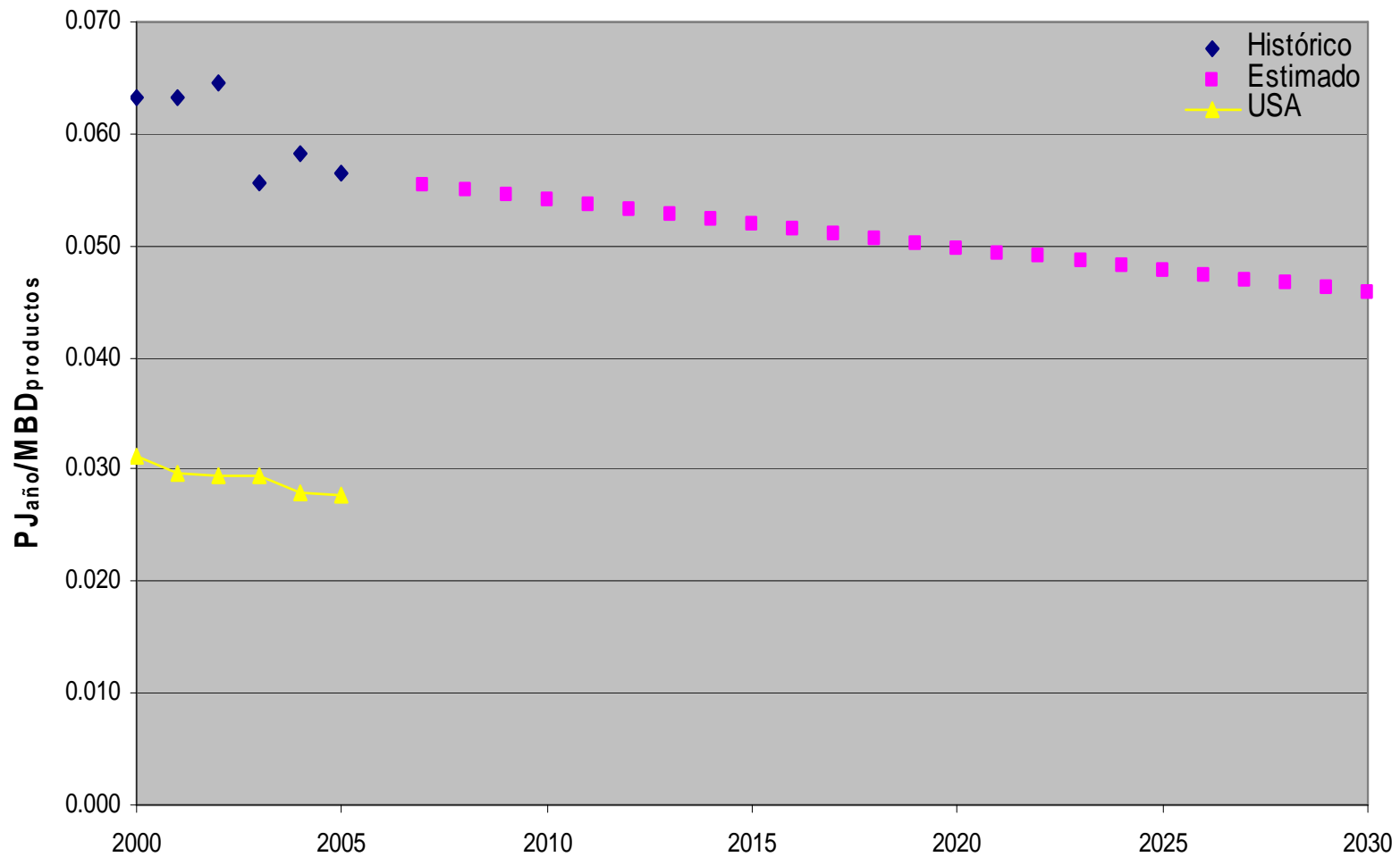
Source: Elaborated with data from Energy Consumption Benchmark Guide Conventional Petroleum Refining in Canada, Canadá (2002) e Informe de Rendición de Cuentas de la Administración Pública Federal 2000-2006, Etapa 3: PEMEX-Refinación, México (2006)

ENERGY INTENSITY LEVEL PER REFINERY



Source: INFORME ANUAL 2006.PEMEX.

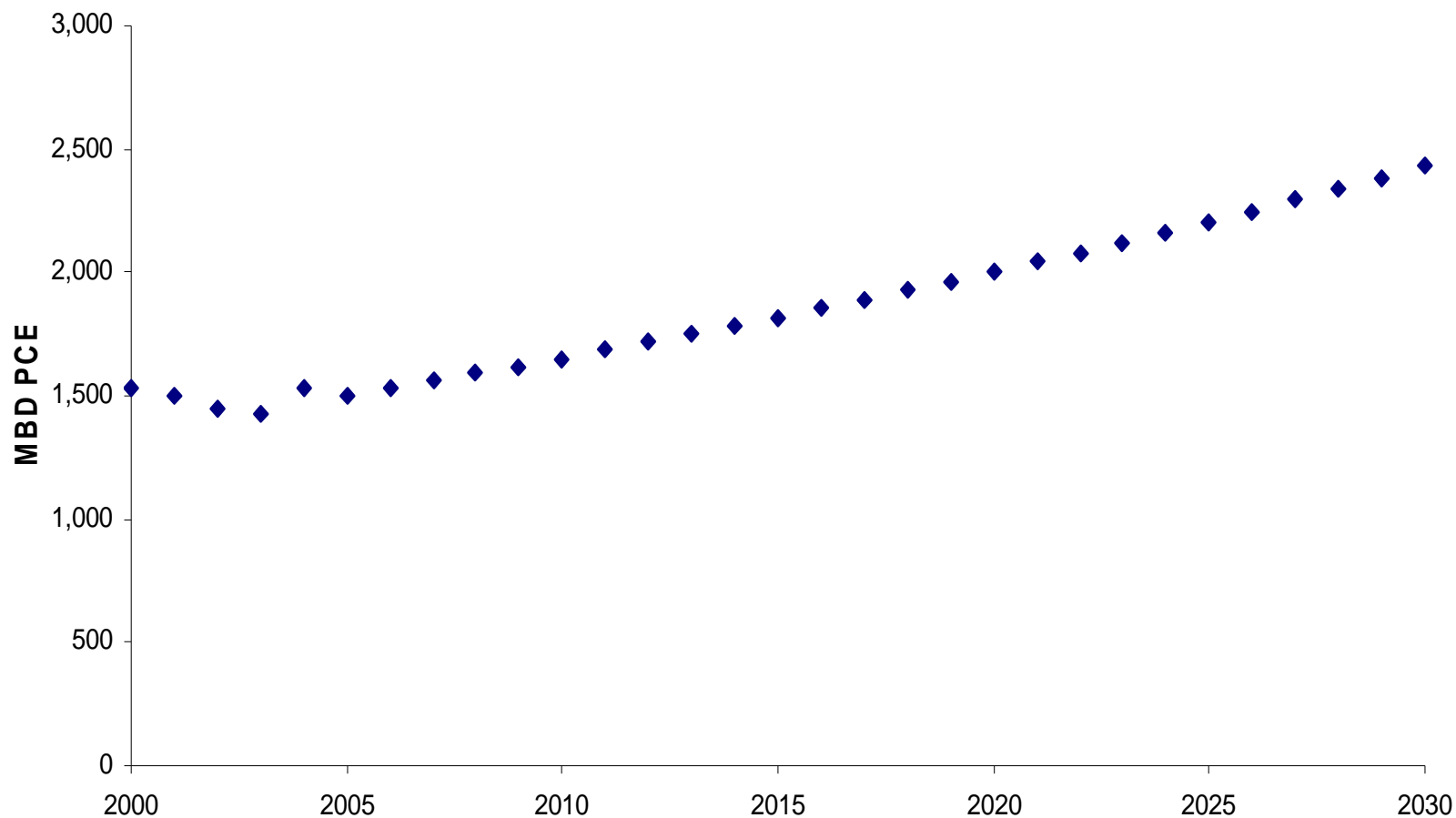
ESTIMATE OF THE ENERGY-INTENSITY LEVEL FOR PEMEX REFINERY 2030



Source: CMM con datos de SENER, DOE y CMM

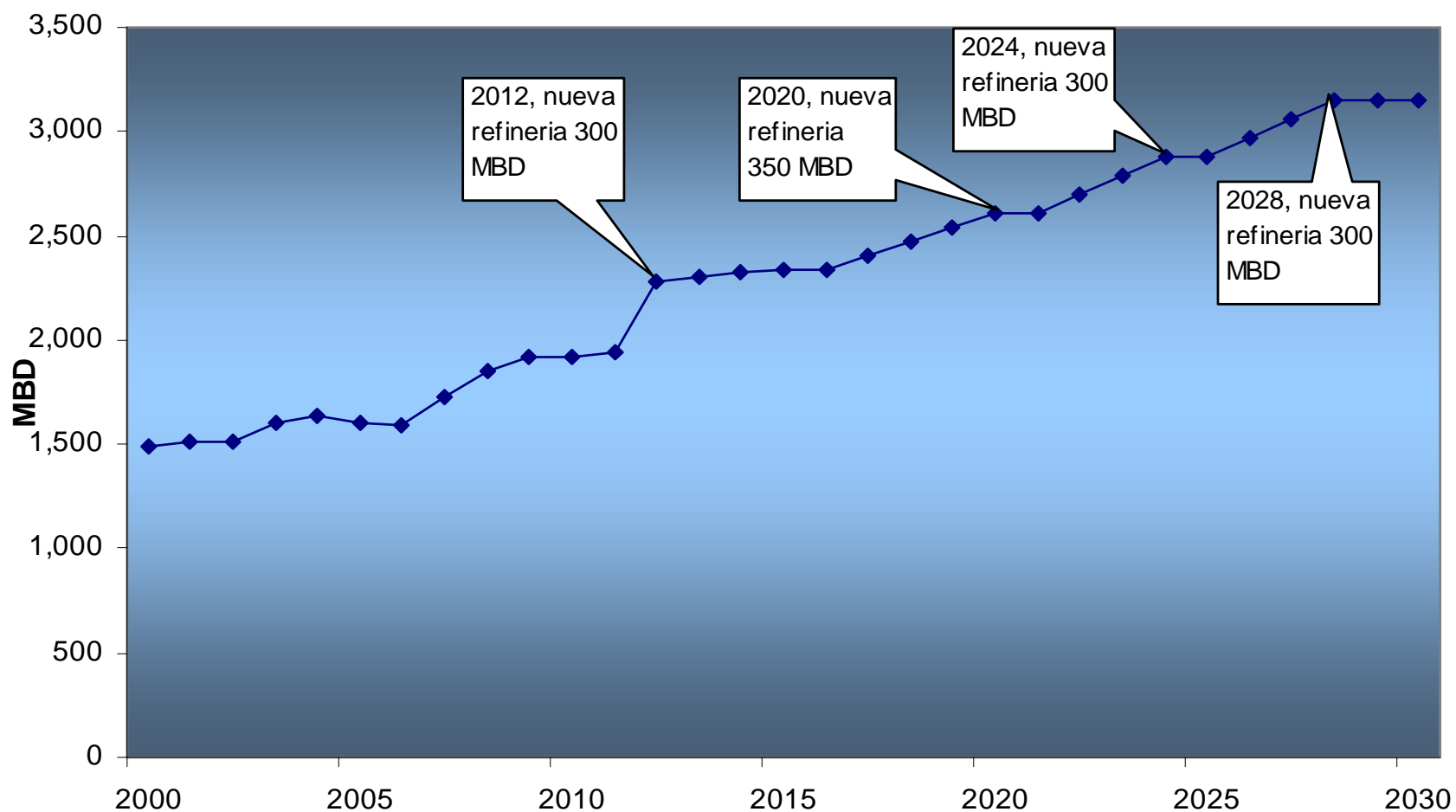
Scenario BEFORE-2006

tmca $GDP_{05-30}=3.25$



Source: CMM con datos de SENER y estimaciones propias

Projection for new refineries



Source: CMM with data from SENER and own estimates

MITIGATION OPTIONS



There are four main strategies for reducing CO₂ emissions in the oil industry in Mexico:

- Cogeneration
- Energy efficiency
- Abatement of fire and venting of hydrocarbons
- Geological carbon sequestration

1 Cogeneration

a Cogeneration with combined cycle based fuel:

PEMEX will reduce gradually its production of oil, which is preferable to use it in place with new co-generation power plants.

b CHP gasification (IGCC) from petroleum coke:

Currently, the coke produced is being fully exploited by the cement companies, which import significant volumes of additional material, to the extent that the completion of coking projects can be provided with additional volumes withdrawn for a clean cogeneration.

CMM OPTIONS in the SNR



1 Cogeneration

C Cogeneration with gaseification, CO₂ capture and sequestrations

This technology is evolving rapidly, it is considered that when there is availability of coke will be possible to obtain technology to make the most of this option.

CMM OPTIONS in the SNR



2 Energy Efficiency Programs

a PEMEX-CONAE Energy Development Program:

Implemented since 1990 have succeeded in reducing the rate of energy consumption per barrel processed in refineries, this trend is already implicit in the projections to 2030.

Example: Savings achieved in the Tula refinery with the implementation of recommendations in three cooling towers:

Electric energy	1.45 GWh-month
Water	66,000 m ³ -month
Savings	\$600,00

CMM OPTIONS in the SNR



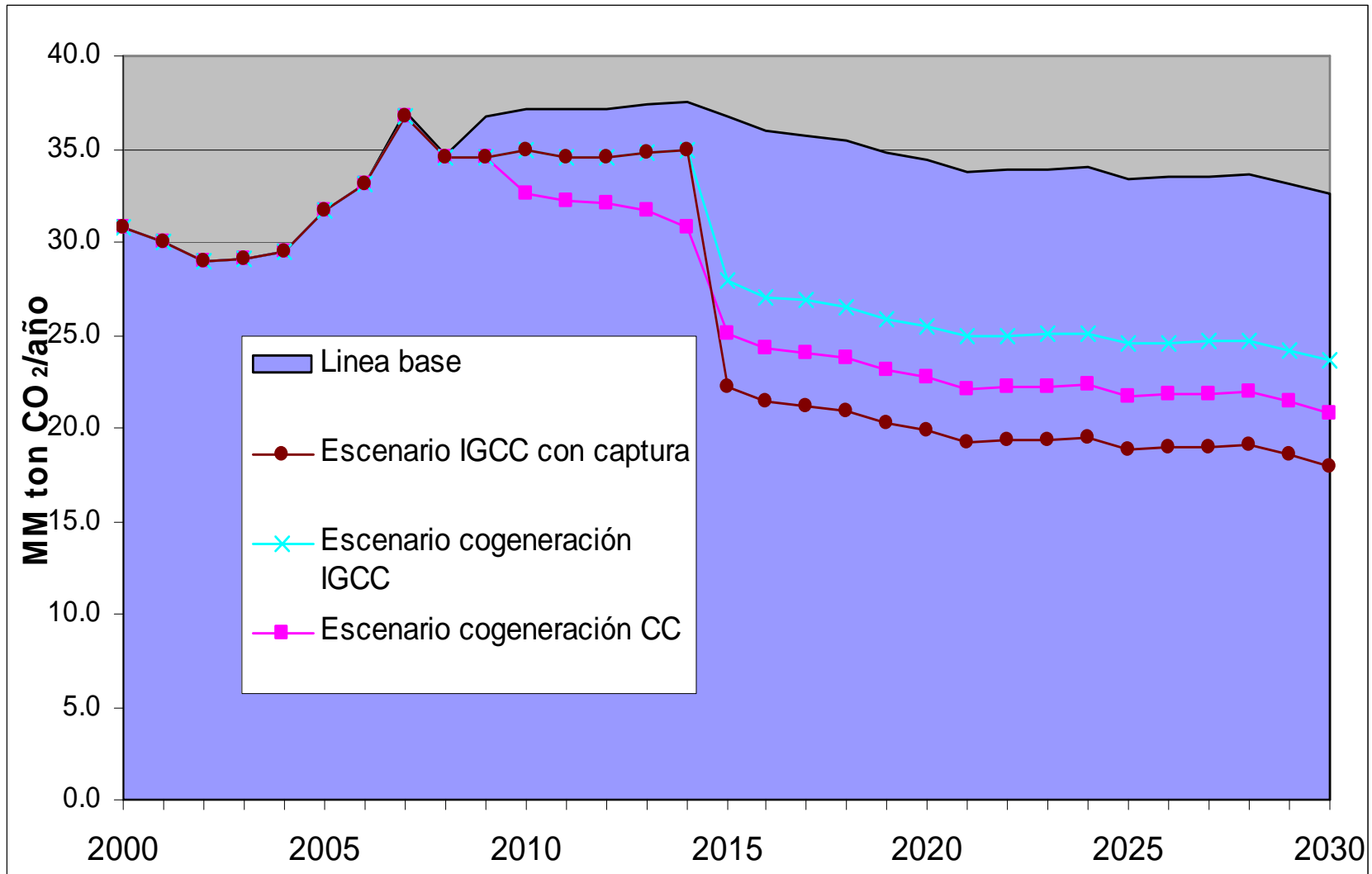
2 Energy Efficiency Programs:

b Energy integration:

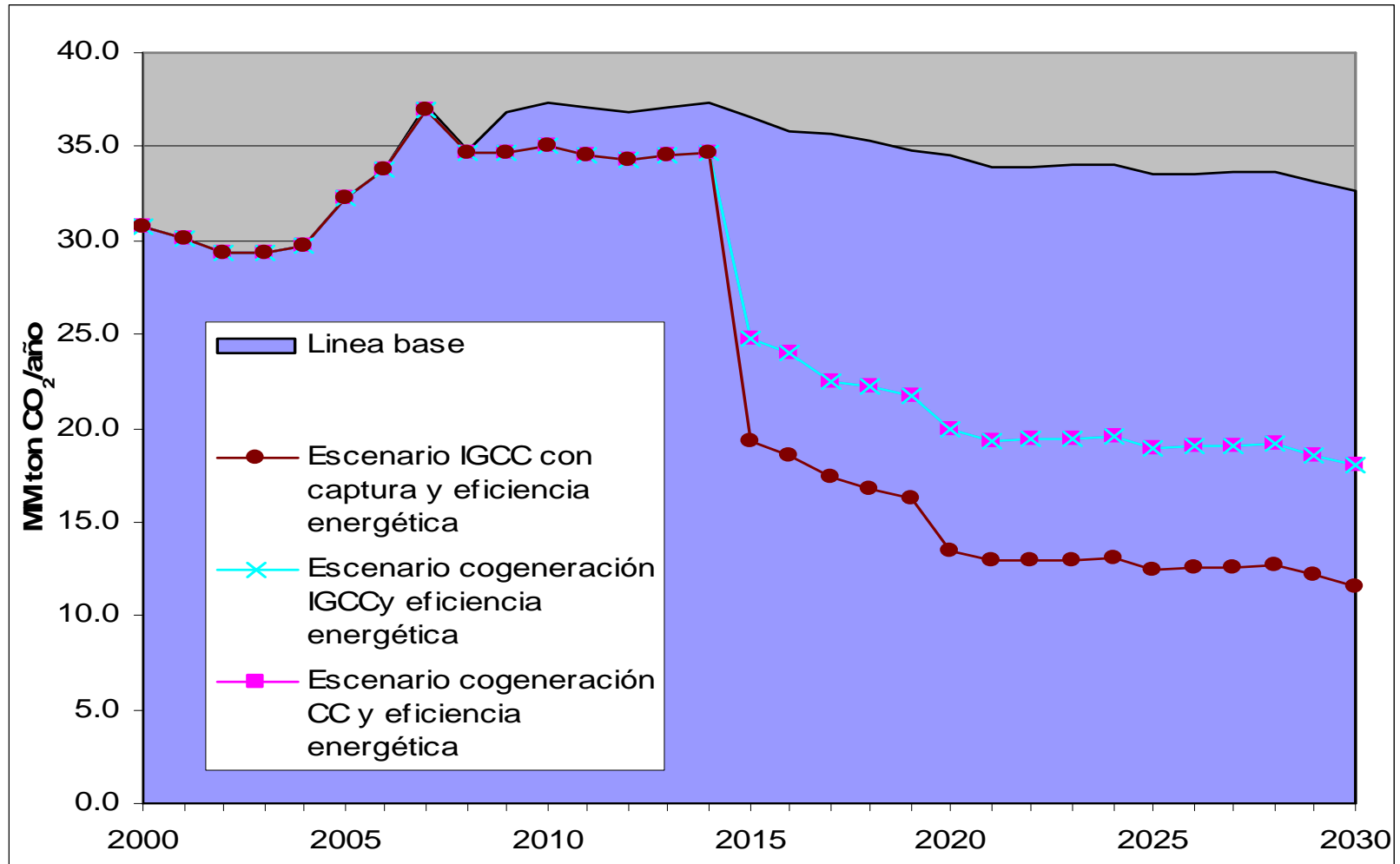
Energy consumption per barrel in the PEMEX refineries is nearly double that of the U.S. for what is being proposed as a mitigation option energy integration, this option can reduce power consumption by up to 30%.

It is proposed to reduce by 23% to 2030 the rate of energy consumption from 0045 PJ / MBD to 0035 PJ / MBD. The average cost is estimated at one third of the construction of a new refinery.

RESULTS

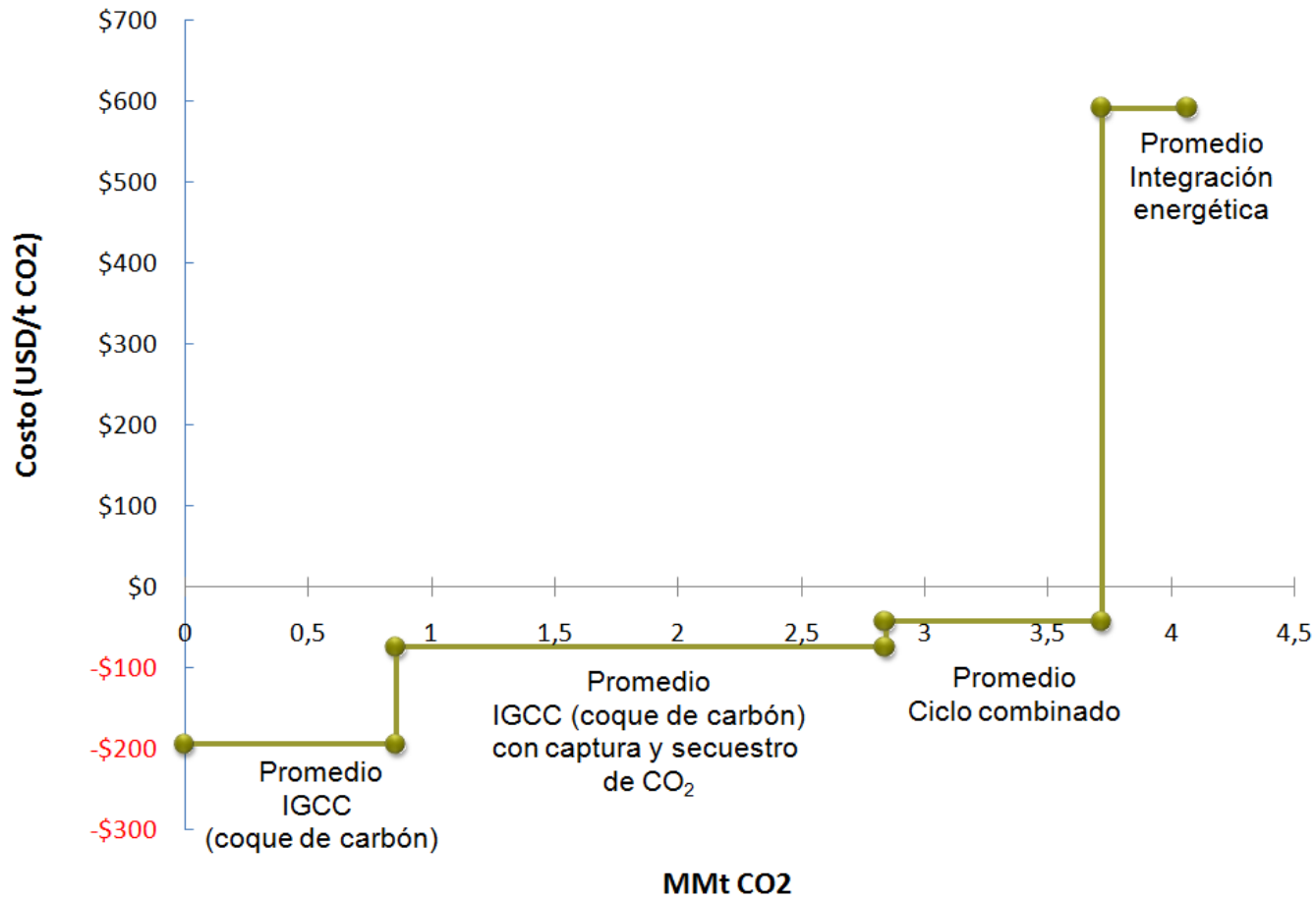


RESULTS



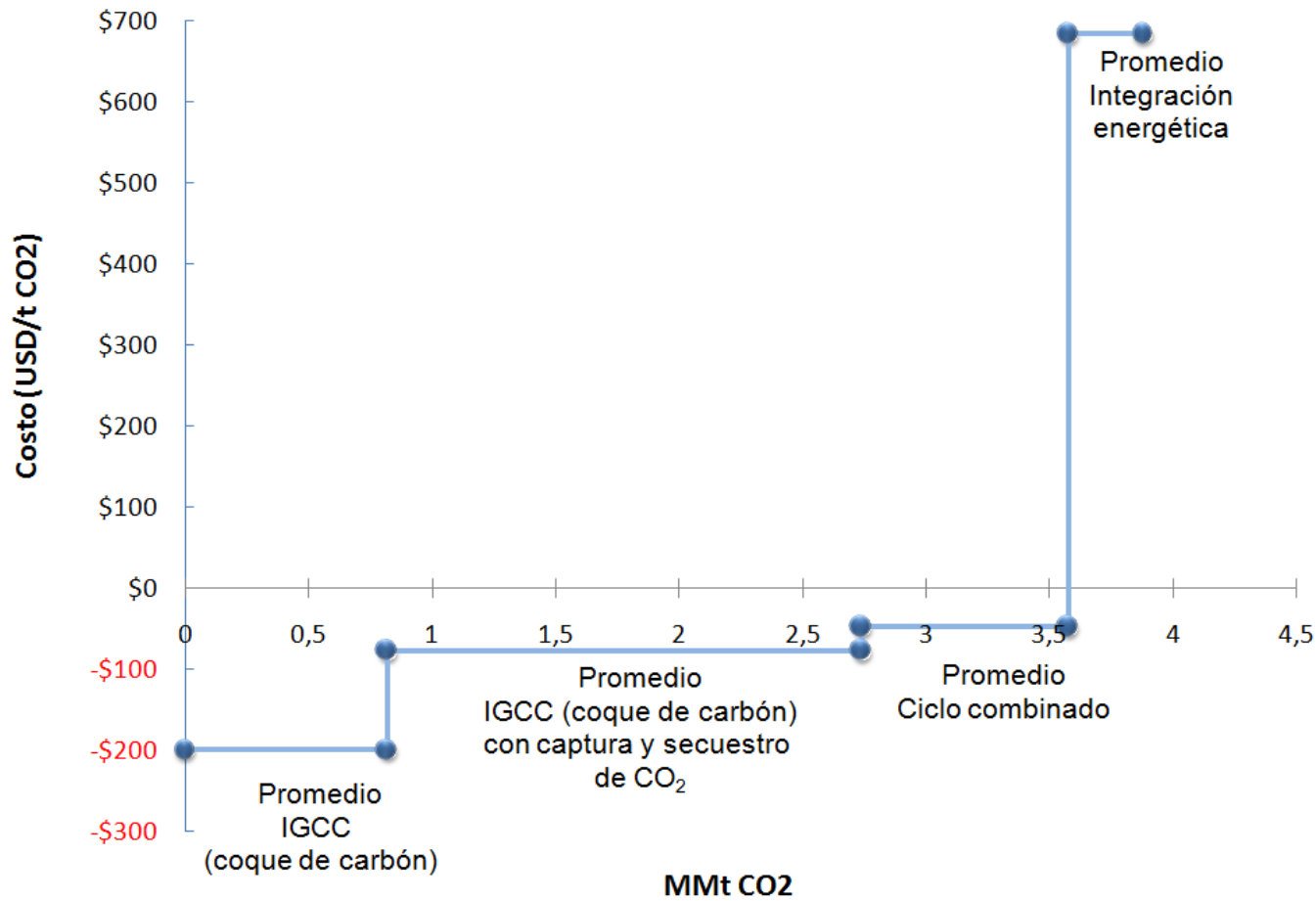
RESULTS

Average cost-benefit curve, 2015



RESULTS

Average cost-benefit curve, 2020



Source: CMM

There are basically three barriers to include co-generation in PEMEX

- 1 . Legal Framework - PEMEX had limitations in their legal framework for cogeneration.
- 2 . CFE Framework - there is a maximum price of the acquisition of CFE.
- 3 . Budget - PEMEX has always budgetary constraints and the resources allocated to the primary production of oil and gas primarily in second instance

The recent amendments to the 6th article of the Law Regulating Article 27 of the Constitution, and the 3rd of the Organic Law of PEMEX, will entitle PEMEX for cogenerate and sell surplus electricity to CFE.

Are working on the second barrier to CFE can buy a different price.

In the case of PGPB is the foundation for public tender in August, for which investments are made by third parties

In June 2008 PEMEX made its Integrated Program in the Electric Field, which considers the cogeneration, among the projects under consideration:

- Nvo PEMEX (PGPB) by 300 MW, with 40 MW for local consumption and for the rest of PEMEX facilities, thereby reducing the consumption of natural gas in 70 MMpcd
- Salamanca (PR) 550 MW natural gas is seen as energy, but has not ruled out the coke
- Tula (PR) por 350 MW
- Salina Cruz (PR) por 350 MW
- Madero (PR) por 350 MW
- Cadereyta (PR) por 350 MW



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