



PEMEX

GAS Y PETROQUIMICA BASICA



PEMEX®

Methane Emissions Mitigation Actions in PEMEX Gas

Production Department (Subdirección de Producción)

January 2009

1. Introduction
2. Collaboration M2M – PEMEX Gas
3. Success stories in PEMEX Gas
4. Methane emissions inventory and energy efficiency
5. Next steps
6. Conclusions



PEMEX Organizational Structure

PEMEX operates a corporate office and four subsidiaries:

Exploration and Production (PEP)



Gas Production

- 
- Refining
 - Export

Refining (PR)



- Clients
- Export

Refining of Products

PEMEX Gas and Basic Petrochemicals



- 
- PPQ, PEP
 - Clients
 - Export

- Sweetening
- Liquids Recovery
- Fractionation

Petrochemicals (PPQ)



- Clients
- Export

- Methane, ethane derivatives
- Propane derivatives
- Aromatics and other derivatives

PEMEX Gas and Basic Petrochemicals



PEMEX Gas occupies a strategic position in the value chain of oil and gas, with the responsibility of processing natural gas and its liquids, as well as transport, storage and commercialization of its products.

PEMEX Gas is one of the principal gas processing companies internationally, with a throughput of close to 4 billion cubic feet per day (bcfd) in 2004. It is the second largest producer of natural gas liquids, with 451 thousand barrels per day (Mbd) in its 11 gas processing centers. It has an extensive pipeline system of more than 12,000 km, through which it transports 3.6 bcf of natural gas, making it the 10th largest gas transport company in North America.

In Mexico, PEMEX Gas is among the 10 largest companies, with income of US\$ 16.3 billion in 2004, with assets close to US\$ 9 billion. PEMEX Gas is an important source of jobs, employing approximately 12,000 workers.

Processing Installations of the PEMEX Gas Production Department

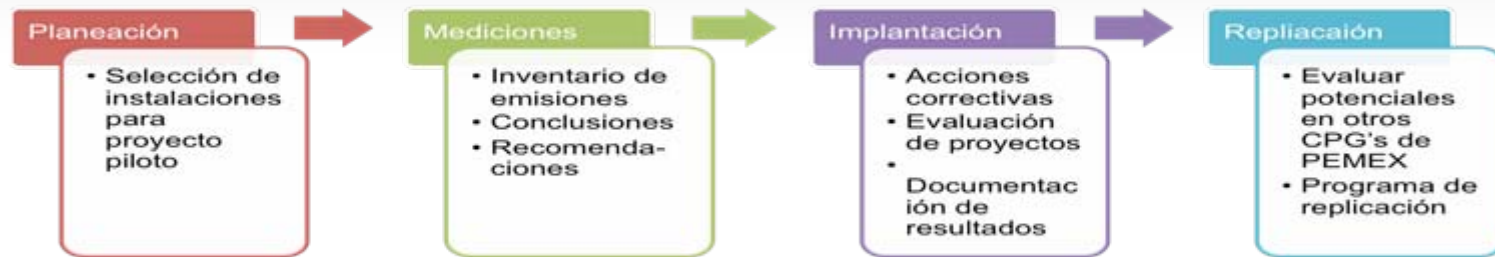
- The main activity of the Production Department is natural gas processing and liquids recovery.
- There are 9 Gas Processing Centers: three in the northern region of Mexico, one in the central region, and five in the southeast region.



- Methane to Markets (M2M) is an international partnership supported by the US Environmental Protection Agency (USEPA), and including 28 countries that represent nearly 70% of worldwide methane emissions. Mexico has an active role in this partnership. PEMEX, in representation of SEMARNAT, the Ministry of Environment and Natural Resources) co-presides with Russia and Canada, the International Oil and Gas Subcommittee.
- PEMEX needs emissions inventories and diagnostics of its energy consumption in order to improve its environmental performance, reduce operating risks and improve safety, protect natural resources and generate cost savings.
- Within the framework of M2M collaboration, the Production Department of PEMEX Gas has carried out emissions measurement and quantification campaigns in several gas processing centers in order to identify opportunities for emissions reduction and energy efficiency improvement



Methodology of Methane Emissions Mitigation



1.- Planning

The operating centers provide their data to the consultant to estimate methane emissions and propose emissions reduction opportunities.

The consultant prepares a work plan for on-site measurements and prepares a list of requirements from the operating center to facilitate this task.

2.- Measurement

The consultant provides equipment for the identification and measurement of the emissions. On-site inspection provides detection of venting and fugitive emissions, and provides basic data for the development of proposed projects.

3.- Implementation

Using the results of the measurements and the resulting emissions inventory, the consultant and operating staff review the project opportunities and prioritize them based on environmental and cost savings considerations. The consultant provides detailed technical and economic information for this purpose.

4.- Replication

PEMEX Gas analyzes the feasibility of replicating the measures or opportunities in its other operating centers.

¿What kind of equipment should be used?

Leak detection was carried out according to Method 21 of the USEPA (EPA, 1997), which allows the use of digital infrared cameras (for example, a Sherlock VOC), or portable hydrogen gas detectors (for example, Bascom-Turner Gas Sentry CGI-201, CGI-211 or GMI Gas Surveyor3).

The work described here used the Remote Methane Leak Detector, which operates by laser spectroscopy specifically tuned to methane gas.

Each of the components found to be leaking was tagged, then the leak flow was measured. Each tag included a reference number, leak flow, date detected, and other information. All information was organized into a central database.



Quantifying the Leak Flows

The quantification of the leaks was performed consistent with methodologies approved under the Kyoto Protocol, which allow the use of the High Flow Sampler, which measures the leak flow.

In this work, we used the Heath Gasurveyor 6-500, which performs a bagged measurement using the flow induced by the device, rather than requiring a physical bagging of the leak.

The sample concentration in the induced flow is determined through a series of thermal conductivity and catalytic oxidation sensors.

For leaks greater than the measurement capacity ($14 \text{ m}^3/\text{hr}$), or for open vents or lines, physical bagging or direct measurement techniques were applied.



Measuring Techniques



Measuring Techniques



Measuring Techniques



First stage of measurement studies (Heath Consultants):

- [August 2006 – Ciudad PEMEX Gas Processing Complex.](#) Baseline fugitive emissions in compressors
- [August 2006 – Cactus, Ciudad PEMEX and Nuevo PEMEX Gas Processing Complexes.](#) Identification and quantification of process component fugitive emissions
- [February 2007.](#) Preliminary estimate of methane emissions in PEMEX
- [October 2007 – Ciudad PEMEX Gas Processing Complex.](#) Post dry-seal implementation measurements of compressor emissions
- [October 2007 – Cactus, Ciudad PEMEX and Nuevo PEMEX Gas Processing Complexes.](#) Leak measurements after repair and valve rehabilitation.



Quantification of Emissions in Gas Processing Complexes of PEMEX Gas

- In August 2006, with the support of USAID and M2M, the detection and quantification measurements of methane emissions were carried out in the Cactus, Nuevo Pemex and Ciudad Pemex Gas Processing Complexes.
- The components with the greatest leaks were attended to immediately, and in October 2007 Heath Consultants carried out a new series of measurements to monitor the follow-up of the leaks. According to the measured results, emissions were reduced by 98.38%. About 75% of the total reduction was due to replacement of compressor wet seals, while the remaining 25% was from the repair of component leaks.



Second stage of studies: (Clearstone Engineering)

- [October 2007 – Nuevo PEMEX Gas Processing Complex.](#) Integrated methane emissions measurements in the complex.
- [February 2008 – Poza Rica Gas Processing Complex.](#) Integrated methane emissions measurements in the complex.
- [October 2008 – Pipelines.](#) Fugitive emissions measurements in the Mendoza Sector pumping stations and the Los Ramones compressor station.
- [December 2008 – Burgos Gas Processing Complex.](#) Integrated methane emissions measurements in the complex.



Energy Diagnostics in Gas Processing Complexes

- In October 2007 and February and December 2008, measurement campaigns were performed in the Nuevo PEMEX, Poza Rica and Burgos Gas Processing Complexes, respectively, to develop an integrated inventory of greenhouse gas emissions, and to propose mitigation actions through :
 - Best practices in processes and operations
 - Energy efficiency improvements
- The measurement campaigns included:
 - Census of components with leaks, process venting, and gas flows to flare
 - Determination of operating efficiency of process gas heaters



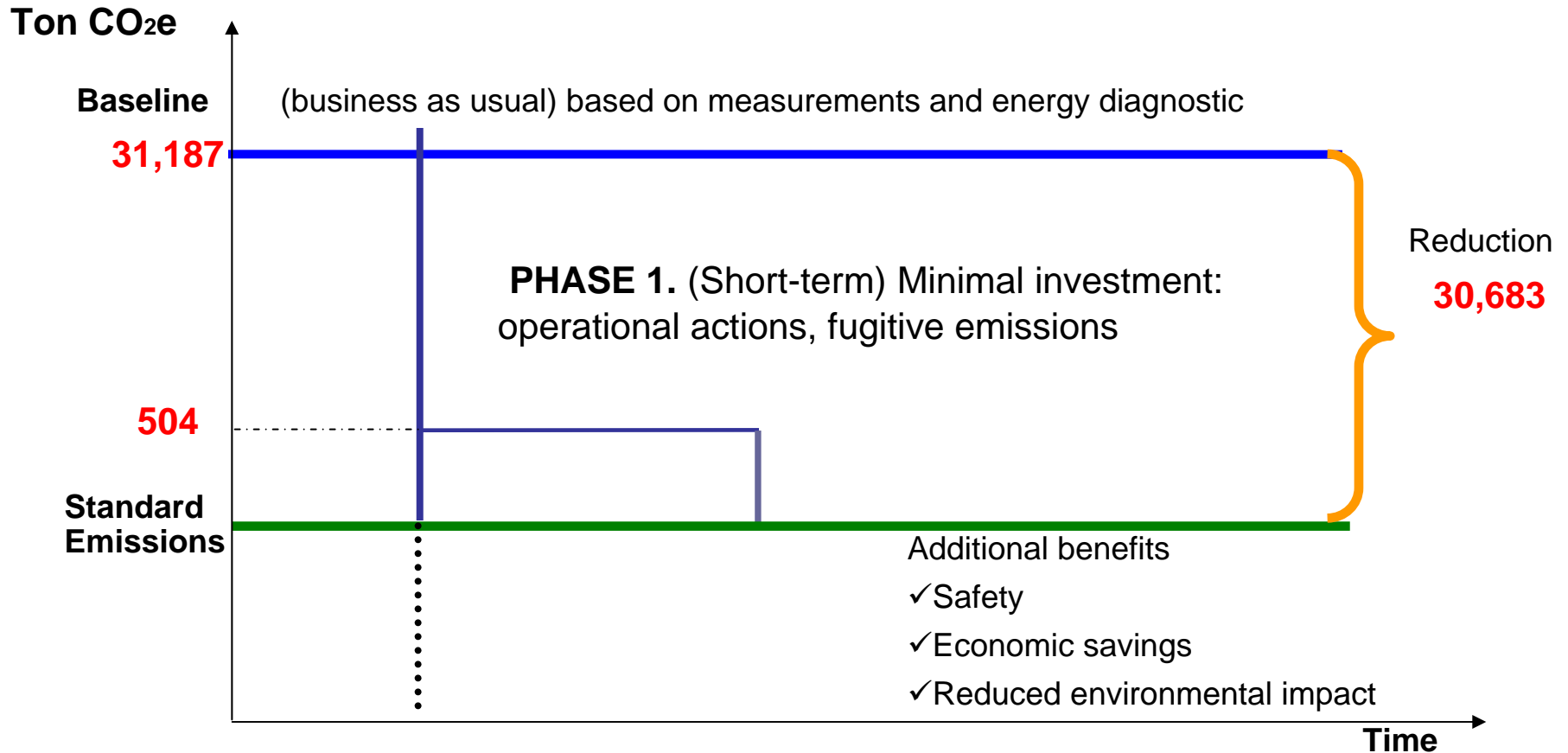
Energy Diagnostics in Gas Processing Complexes

- In addition, specific emissions reduction opportunities were identified, with a cost-benefit evaluation of the measures.
- The companies which carried out the measurement and evaluation work were PA Consulting of the U.S. and Clearstone Engineering of Canada, with support from M2M, without cost to the company.
- The results obtained will be integrated into action plans to take preventive and corrective actions for energy optimization in the processes and for reduction of methane and carbon dioxide emissions.

Methane to Markets

Potential CO₂e emissions reductions

Gas Processing Complexes: Nuevo Pemex, Poza Rica and Burgos*



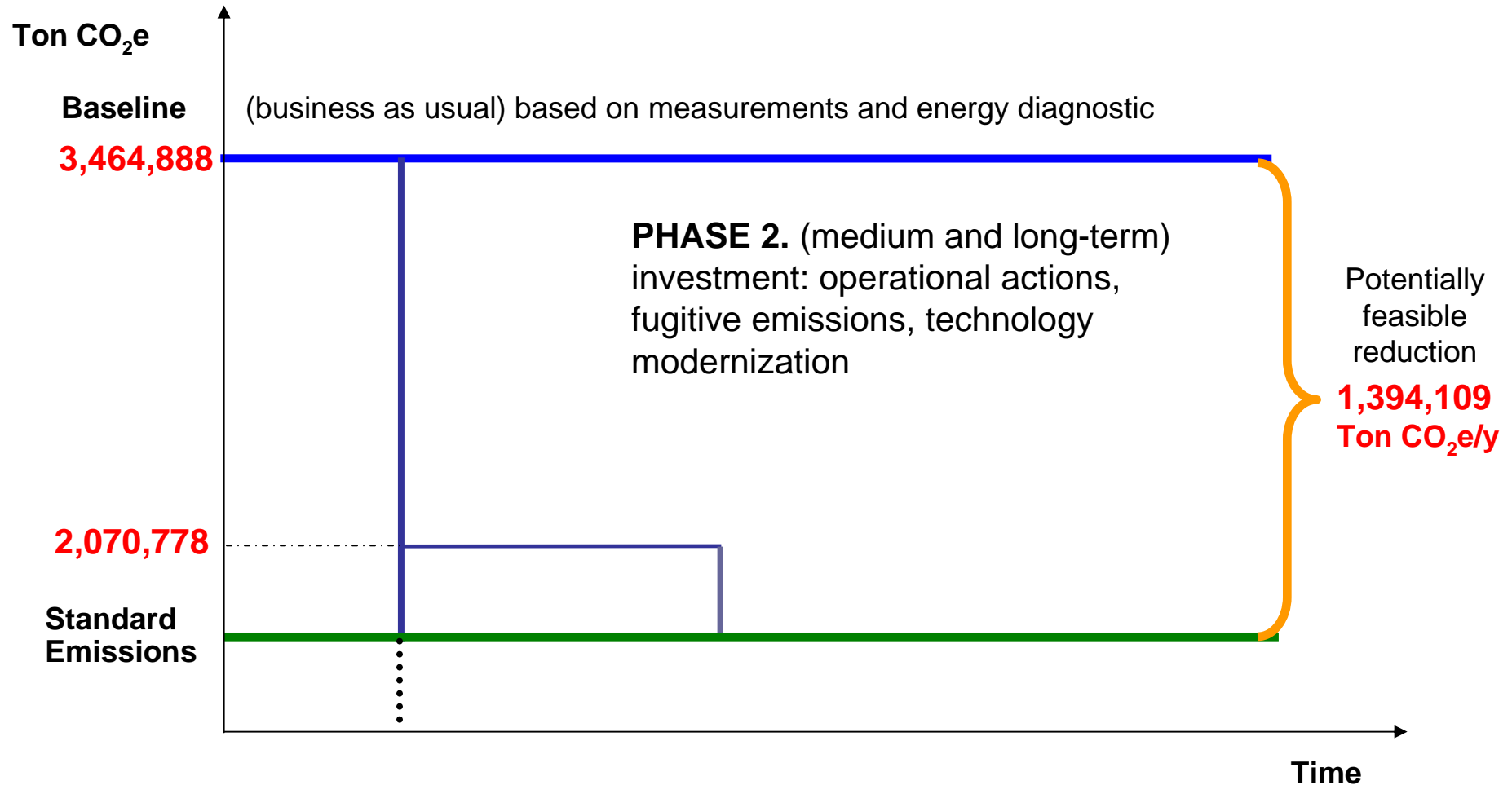
* This analysis is limited to specific areas in the Gas Processing Complexes Cactus, Nuevo PEMEX and Ciudad PEMEX.

The potential overall emissions reduction in the Production Department is much greater, considering the 10 Centers that it includes.

Methane to Markets

Potential CO₂e emissions reductions

Gas Processing Complexes: Nuevo Pemex, Poza Rica and Burgos*



* This analysis includes the methane emissions inventory and energy efficiency opportunities in the 3 gas processing complexes.

- Preparation of action plans and programs to take advantage of the areas of opportunity identified in the studies carried out with M2M support.
- Analysis of the conclusions of the studies to propose viable projects to be included in the Clean Development Mechanism to commercialize the carbon credits which they generate.
- Continuation of the PEMEX Gas – M2M collaboration, in which PEMEX Gas plans to implement, among other actions, the following:
 - Specialized training and equipment for the detection and repair of fugitive emissions from in-service valves.
 - Integrated studies of methane emissions in the Cactus and Ciudad PEMEX gas processing complexes.
 - Development of staff resources for the detection and measurement/quantification of methane emissions.

Methane emissions reduction is attractive, because of:

- The sales value of methane and other hydrocarbons recovered
- Reduced costs when installing latest generation equipment:
 - Operation and maintenance
 - Fuel savings
 - Investment/replacement
- Potential value in the carbon market

PEMEX plans to continue collaboration with sustainable development initiatives such as M2M that offer no-cost assistance to help companies in partner countries to benefit from technical assistance in:

- Identification of applicable technologies and practices
- Project feasibility studies
- Methane emissions inventories
- Technical assistance and training



PEMEX should incorporate these types of emissions measurements and energy diagnostics into our regular operation practices at the different PEMEX Gas installations, formalizing them into operating protocols and providing the different facilities with training and CH₄ and CO₂ emissions detection and measuring equipment.



These initiatives will promote the development of CDM projects based on the results of the diagnostics, and will allow a permanent program of activities to make these practices sustainable and replicable throughout PEMEX Gas.