



**Methane Emission Detection, Quantification and Mitigation,
In-Plant Measurement Audit as a Foundation for a Methane Emissions
Reduction Program: the Poza Rica Gas Processing Complex**

Pemex Gas and Basic Petrochemicals
Division of Production

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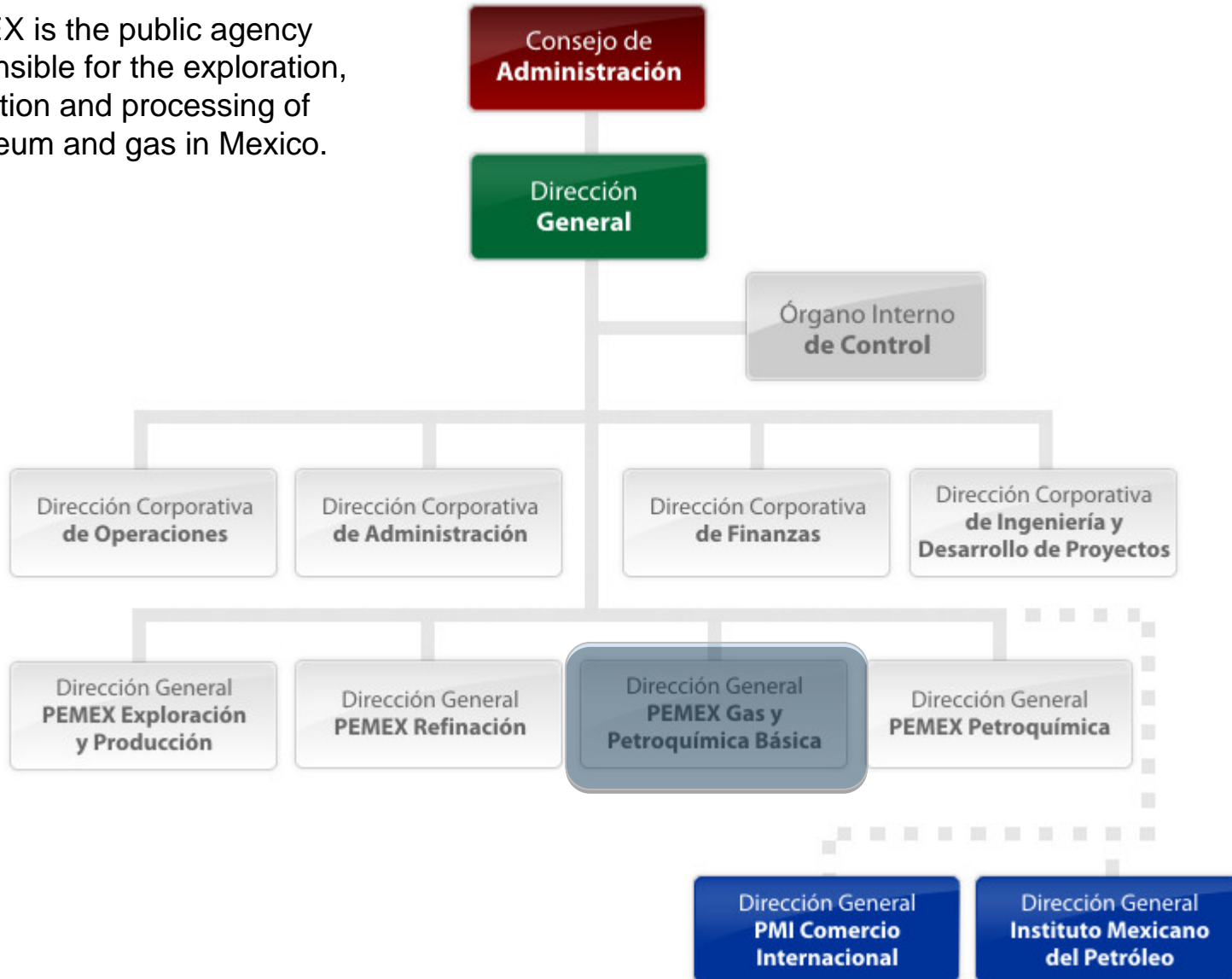
1. INTRODUCTION

- On March 24, 2006, the EPA, USAID (Agency of the United States for the International Development) and the Office of the Secretary of Environment and Natural Resources (SEMARNAT), signed a letter of cooperation to collaborate to set in motion projects of methane. Under the terms of this agreement, the two agencies work with the local government and the private sector in order to share and to bring to light the use of technologies for the capture and the use of methane, which commonly is sent to the atmosphere.
- In the framework of this agreement of cooperation, were established in Mexico four national subcommittees: Sanitary landfill, Farm Wastes, Coal Mines and Petroleum and Gas.
- SEMARNAT is the agency in charge of the M2M program in Mexico, and **PEMEX** co-presides the International M2M Oil and Gas Subcommittee with the Russian Federation and Canada.



PEMEX Organizational Structure

PEMEX is the public agency responsible for the exploration, extraction and processing of petroleum and gas in Mexico.



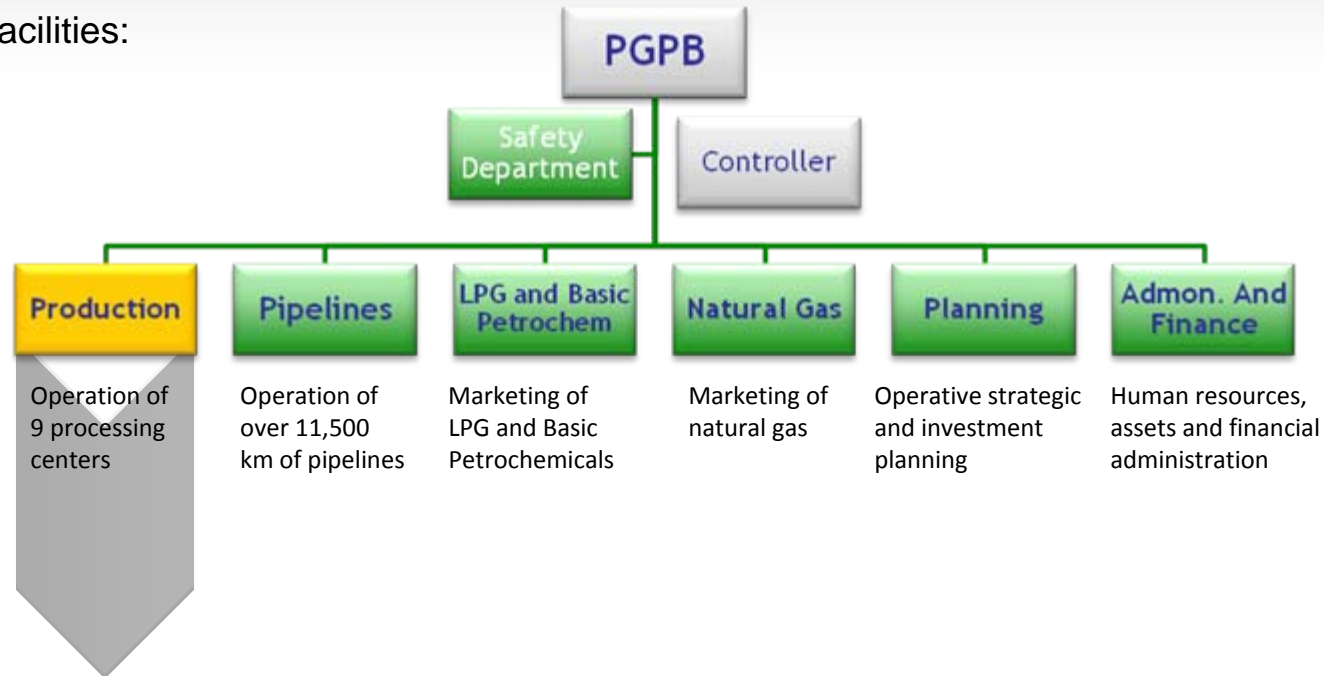
PGPB Infrastructure

Process	
Natural gas (MMpcd)	3,963
Condensates (Mbd)	107
Production	
Natural gas (MMpcd)	3,144
Liquids of gas (Mbd)	451
LPG (Mbd)	225
Sweetening Plants	20
Sour gas capacity (MMpcd)	4,503
Sour condensates capacity (Mbd)	144
Cryogenic Plants	17
Capacity (MMpcd)	4,992
LPG Distribution Stations	17
Pipelines (km)	
Natural gas	9,109
Products	3,181



PGPB Division of Production

PGPB Division of Production Facilities:



The main PGPB activities are processing natural gas and developing basic petrochemical products and liquefied gas in its nine Gas Processing Centers.

PGPB has installed nine Gas Processing Centers along the Coast Gulf of México: three located in the north of the country, one in the center and five in the southeast region.



2.- M2M SUPPORT

In close collaboration with the Methane to Markets Partnership, PEMEX has carried out on-site measurement studies in different gas processing complexes in order to identify methane and other GHG emissions reduction options, as well as energy efficiency opportunities.

The goals of the Partnership are to reduce global methane emissions to:

- Enhance economic growth
- Strengthen energy security
- Improve air quality and industrial safety
- Reduce emissions of greenhouse gases



Subcommittees in Mexico for M2M



Oil and Gas Systems



Coal Mines



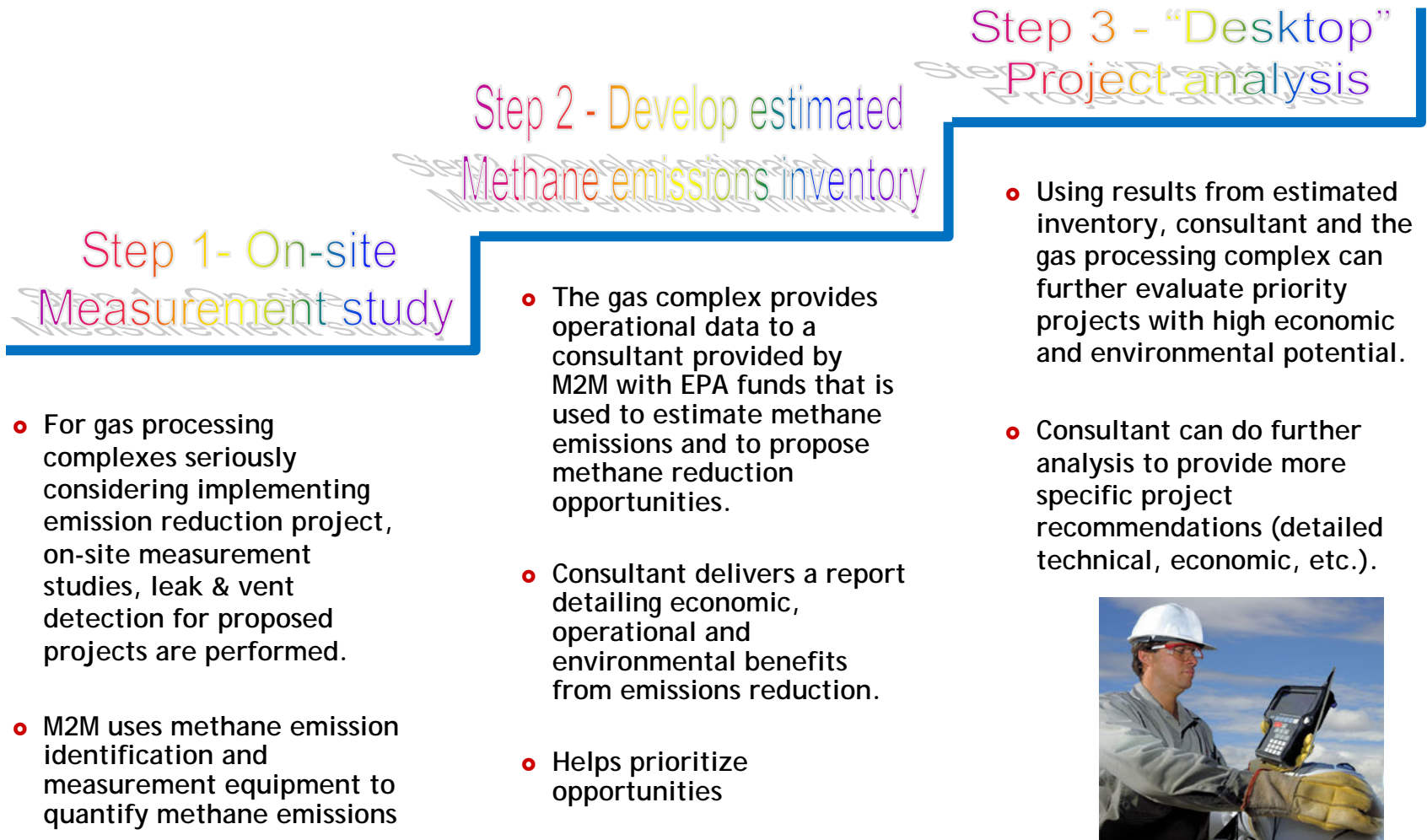
Landfills



Agricultural Waste

In the petroleum and gas sector, Petróleos Mexicanos (PEMEX) and M2M identified two pilot projects with a significant potential to reduce the emissions of methane. The objective of these projects is to bring the latest compressor technology used in gas processing and to demonstrate and evaluate the reduction of fugitive methane emissions from equipment and from petroleum storage tanks.

How does Methane to Markets support PEMEX Gas?

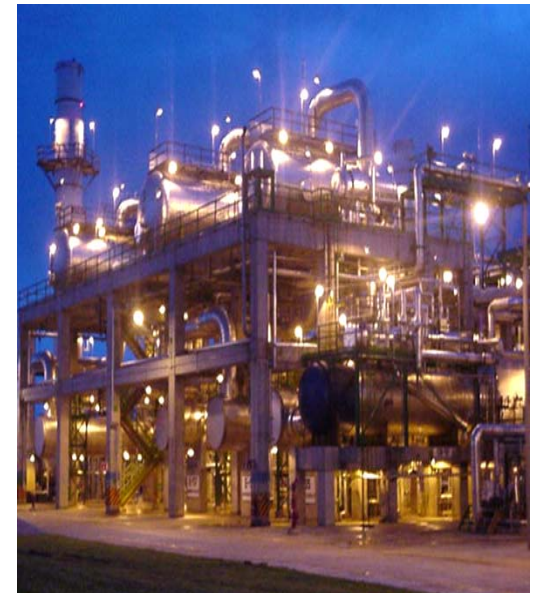


3.- DETECTION OF EMISSION REDUCTION OPORTUNITIES

Upon analyzing an installation in search of profitable opportunities of reduction of emissions of CH₄ and energy improvement, the maximum benefit is obtained by adopting a holistic focus, which considers all the natural gas loss reduction opportunities, of wastes and of unnecessary consumption. This focus allows maximum advantage to be derived from the a team of experts in different areas, and increases the economic impact and the benefit of this analysis.

Some of the key reasons so we have emissions reduction opportunities of CH₄ and of improvement in energy efficiency in gas and petroleum process installations are the following:

1. Progressive deterioration of installations.
2. Changes in conditions of operation compared to design values.
3. Previous designs based on low energy costs.
4. Not optimum technologies.
5. Lack of quantitative information that would allow establishment of the economic value of the emissions reduction opportunities of CH₄ and of improvements in energy efficiency.



Advantages of an integrated emissions and energy study

The main advantages to carry out a study integrated of emissions and energy are:

- 1.- Different perspectives complemented with experience and expert knowledge of the work team.
2. Greater probability of identification of profitable opportunities for reduction of CH₄ emissions through a complete analysis of the installation.
3. Potential synergies among several disciplines for an identification optimized of opportunities.
4. Utilization to the maximum of the experience of the technical team.
5. Independent verification of the performance of the installation.
6. Transparent decisions on the development of the emissions baseline and other data required to design carbon credits projects by a third party.
7. Opportunities of technology transfer and training of the staff of the installation.

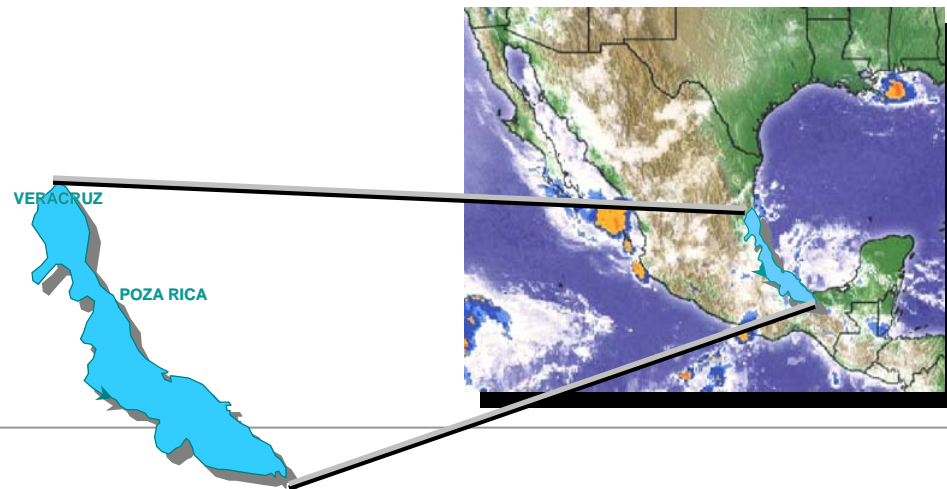


Additionally, the study provides the basis for monitoring the plant performance over the long term by comparing it against the baseline established with the first studies in the installation.

This process, or benchmarking, can be applied at the facility level or to individual process units.

4. - POZARICA GPC ENERGY DIAGNOSTIC

- On February 2008 Clearstone Engineering Ltd., and PA Government Services Inc., subsidiary of PA Consulting Group, funded by the M2M Program of United States Environmental Protection Agency (USEPA), conducted the study: Detection of Opportunities for Methane Emission Reduction and energy diagnostic in Poza Rica GPC, located in Poza Rica, Veracruz, México.
- This measurement campaign was conducted in order to generate a GHG emissions inventory and reduction opportunities by methane emissions control programs and energy efficiency improvement.
- Specific emissions control opportunities were identified, and an economic assessment for opportunities was prepared. The measurement campaign included: inventory of leaking components, process vents and flares, and gas process heater efficiency measurement.
- These results have been integrated into action plans to implement preventive and corrective actions of energy optimization in the processes in order to reduce methane and CO₂ emissions.



GPC Poza Rica Emissions Inventory

The measurement work resulted in the development of an inventory of annual total emissions based on the conditions observed, and utilizing process information to extrapolate the results to an annual base.

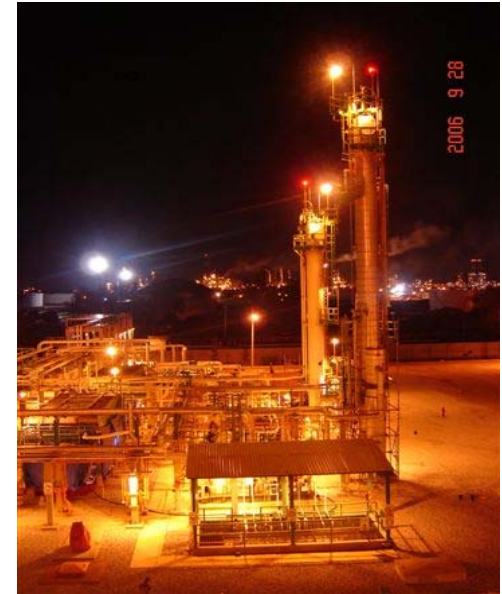
- It is estimated that the emissions of methane to the atmosphere are around of 13,200 ton/year, and the emissions of GEI total of the plant are near of 0,5 million equivalent tons of CO₂ (CO₂e). These values are based on consumption of fuel, volumes of vent gas and/or gas sent to flare, and fugitive emissions in equipment and components, which were identified and measured during the elaboration of the study.



- The flow to the flares was estimated at approximately the 0,78% of the gas that enters to the plant, or a 0,97% of the sales of total gas, with an annual value of \$2.2 million dollars.
- The vents of seals compressors including oil tanks were reviewed and quantified to include them in the total emissions of Hydrocarbons (THC's) with an annual value reckoned in US\$1.58 millions.
- In the case of the sulfur recovery units, a balance of mass of CH₄ and CO₂ was carried out and to determine the GHG emissions of the acid gas incinerator. The emissions of this unit is 92,265 ton CO₂e / year.

GPC Poza Rica Emissions Inventory

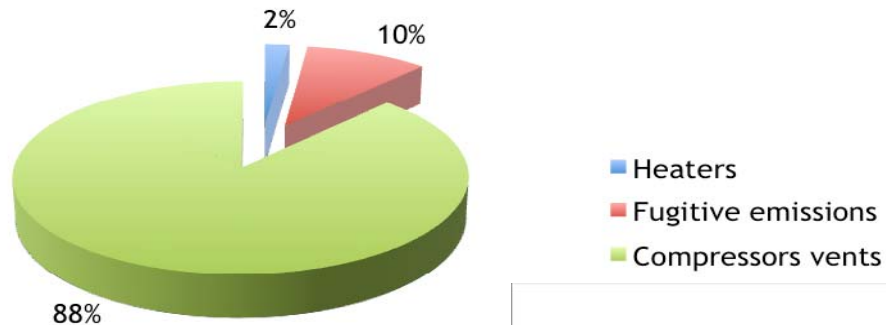
- The greatest source of GHG emissions is the combustion of gas, primarily in the boilers of Facility Services, that consume total of 374,000 m³/day of fuel gas, contributing annual GHG emissions of some 0.3 million tons of CO₂e.
- The emissions of the gases of combustion of the three gas heaters were also determined. It was found that the three heaters operate with unnecessarily high excess air, and with thermal efficiencies under the optimum values. The high excess air and the resulting unburned fuel imply losses by additional consumption of gas of some US \$750,200.
- Of the total of 187 components identified with leaks, it was found economically attractive to repair 131 of them. The implementation of the repair of these last components represents a net financial gain of US\$407,960; reducing the annual GHG emissions by 9,270 ton of CO₂e, and resulting in annual savings of US\$150,320, based on the value of the hydrocarbons lost.



5.- DETECTION OF PROJECT OPPORTUNITIES

Project opportunities¹ at Poza Rica GPC

Methane Emissions

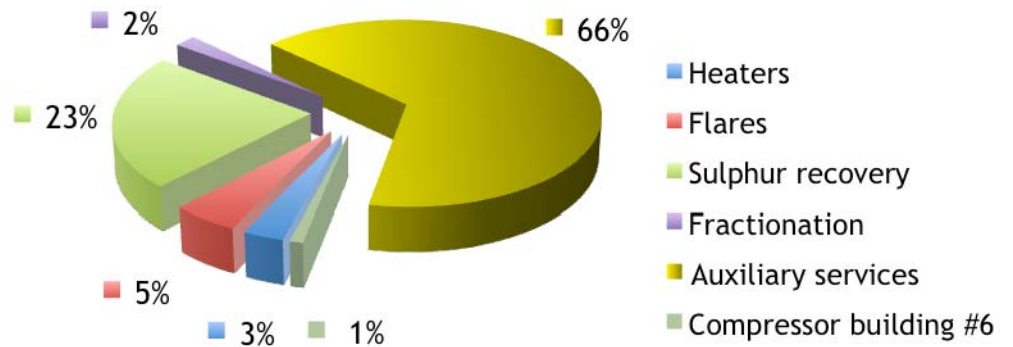


88%

4,704 tonCH₄/year

CO₂ Measurement results

CO₂ Emissions



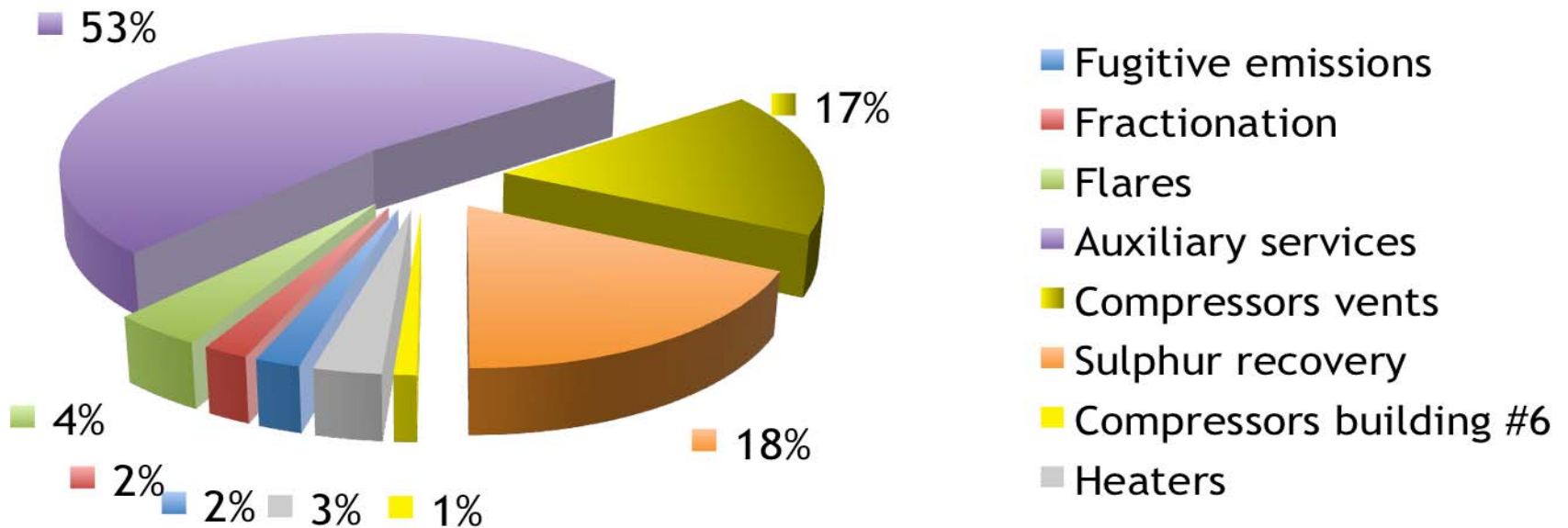
401,318 tonCO₂/year

¹ This figures are based on measurements performed during the inventory on fuel consumption, volumes of vented and/or burned gas, and fugitive emissions in components and equipment.

Summary GHG Inventory at GPC Poza Rica

Total CO₂e emissions at Poza Rica GPC

CO₂e Emissions



Total emissions = 500,100 ton CO₂e/year

Emissions reduction potential CO₂e at GPC Poza Rica

Source	Contribution %	Control Technology	Reduction Potential [%]
Heaters	4%	A/F management.	10-15
Flares	4%	Purge gas optimization and flare valve leak detection program or flare gas recovery system.	95
Fugitive Emissions	2%	DI&M program.	70-80
Compressor Venting	17%	Vapor recovery system.	95
Sulphur Recovery	18%	Review sweetening plant	95
Fractionation	2%	Regular inspection/tuning.	10-15
Auxiliary Services	53%	Regular inspection/tuning.	10-15
Total	100%	-	-

6.- IMPLEMENTING ACTION PLANS

- PGPB has developed detailed work plans for the GP Poza Rica, generated from the energy diagnostic performed by Clearstone Engineering and PA Consulting Group.



Complejo Procesador de Gas Poza Rica

Proposal of initiatives to integrate Clean Development Mechanism projects (MDL) from the M2M inventories

Activity	2008						2009												2010	
	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC		
1.- Reception of the technical report of energy diagnosis and reduction of emissions	P																			
	R																			
2.- Presentation and diffusion of the results	P																			
	R																			
3.- Verification by the CT of the data indicated in the technical reports	P																			
	R																			
4.- Analysis of results and programs elaboration	P																			
	R																			

PROGRAMA DE EJECUCION

Activity	2008						2009												2010	
	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC		
Eliminating the fugitive emissions detected in team of process of TF, Girbotol and Cryogenic, by order of magnitude, considering the replacement of components (to see note under observation)	P																			
	R																			
Replacing the components susceptible, identifying transmitters of repair rentablenota under observation)	P																			
	R																			
Improving the efficiency of combustion of the boilers, by means of adjust of the relation Air/Fuel	P																			
	R																			
Reducing I air of the seals and of the grasera of the compressors in the cryogenic plant	P																			
	R																			
Adjusting the combustion of heaters and ovens in the cryogenic plants, sulfur and fractioning	P																			
	R																			
Establishing a leaks detection program in the valves to QW ó to install a gases recovery system in QW.	P																			
	R																			
Optimizing the flow of purge to QW' s of flares, implementing their measurement	P																			
	R																			
Reducing vents of the units GB-602 TO/B/C	P																			
	R																			
Analysis causes-root of the losses of methane in the sweetening plant	P																			
	R																			

The proposals of improvement that require investment, will depend to the budgetary availability of PGPB.

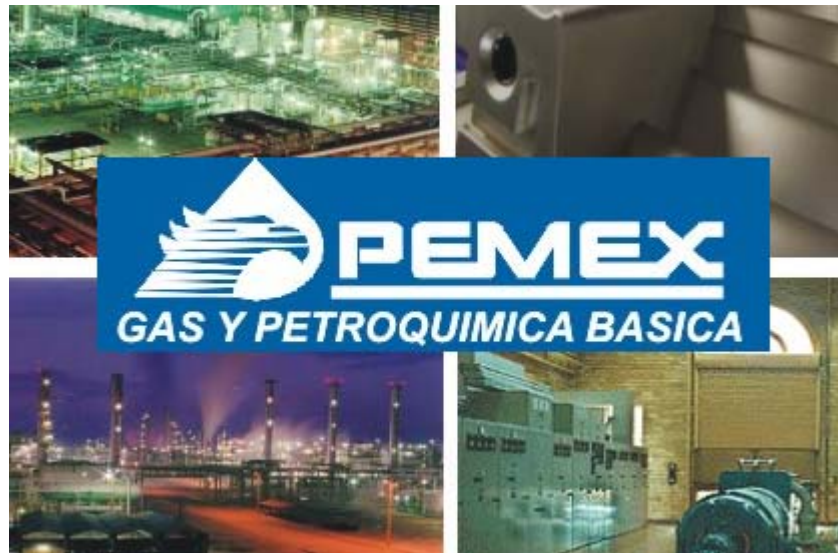
- Follow up on implementation of opportunities identified.
- Replicate the success cases in Pemex Facilities where it applies.
- Request M2M support for implement valve maintenance training at the GPCs.
- Propose feasible CDM projects and take advantage of the carbon market.
- Share experiences with other countries.



Oil & Gas Systems

7. CONCLUSIONS

At PEMEX Gas we are integrating these kinds of energy diagnostic measurements into our Operational Discipline at our gas processing complexes by buying detection and measurement equipment for methane and CO₂ equipment and training our personnel.



These diagnostics will not only promote the development of CDM projects, but also form the basis for a permanent program to sustain and replicate these actions throughout PEMEX Gas.

Pemex Gas and Basic Petrochemicals



Production Subdivision

¡ Thank-You!

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