



Identification, Measurement and Development of Fugitive Emissions Reduction Projects at the Gas Processing Complex CPG Nuevo Pemex

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1. Collaboration M2M – PEMEX
2. Activities in Pemex Gas
3. CPG Nuevo Pemex: Description of work completed
4. Conclusions



- Since 2006, Pemex has collaborated with the international Methane to Markets Partnership (M2M), to detect and measure methane emissions in the company facilities. This collaboration has been coordinated by the Pemex Corporate Directorate of Operations.
- Based on its production processes and its institutional objectives, Pemex Gas and Basic Petrochemicals (Pemex Gas) has played a key role in this collaboration.
- Working closely with the Production Department of Pemex Gas, M2M has carried out various activities focused on the reduction of methane emissions in Pemex Gas installations.



- **As part of its operational activities and its commitment to sustainable development, the Production Department of Pemex Gas has undertaken various optimization initiatives, including projects that focus on reducing greenhouse gas (GHG) emissions.**
- **This work has been accomplished using both existing capacity in Pemex Gas, as well as utilizing available external resources.**
- **The work with the Methane to Markets Partnership is a good example. Thanks to a close cooperation, it has been possible to carry out various activities, among them the detection of opportunities for reduction of emissions of methane and other GHGs at the gas processing complex CPG Nuevo PEMEX.**



Installed capacity in the process plants

Process	Quantity	Capacity
Gas sweetening	2	880 MMcfd
Sulfur recovery	2	800 t/d
Criogenics	3	1550 MMcfd
Fractionation	2	208 Mbd
Liquids sweetening	4	96 Mbd

Measurement campaign:

- Inventory of process components with fugitive emissions and vents
- Quantification of methane emissions levels at the sources identified
- Determination of the opportunities for reducing emissions of other greenhouse gases

- Process flow diagrams
- Mass and energy balances
- Layouts of principal installations
- Control room process monitors
- Manufacturers' data for principal components and equipment
- Drawings and data sheets for principal components and equipment
- Additional technical information available in the plant

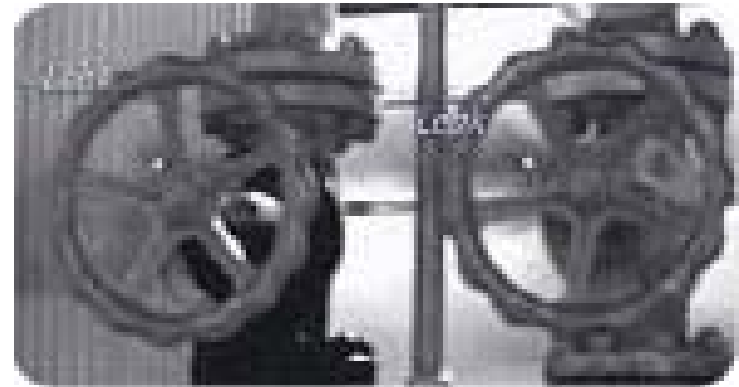
Fugitive Emissions:

- Complete measurements at Planta Criogénica I
- Partial measurements at Planta Criogénica III

Process venting:

- Measurement of vents from seals and lube oil tanks of compressors in Planta Criogénica I
- Measurement of vents from seals and lube oil tanks of compressors in Planta Criogénica III

Fugitive emissions, vents:
Detection by IR camera



Fugitive Emissions:

Quantification measurements by Hi Flow Sampler



Findings: fugitive emissions

- Methane emissions in components: 6,073 tCO₂e/y
- Potential cost-effective reduction: 80%
- Measurements in the rest of the facility will likely increase these values and the reduction potential

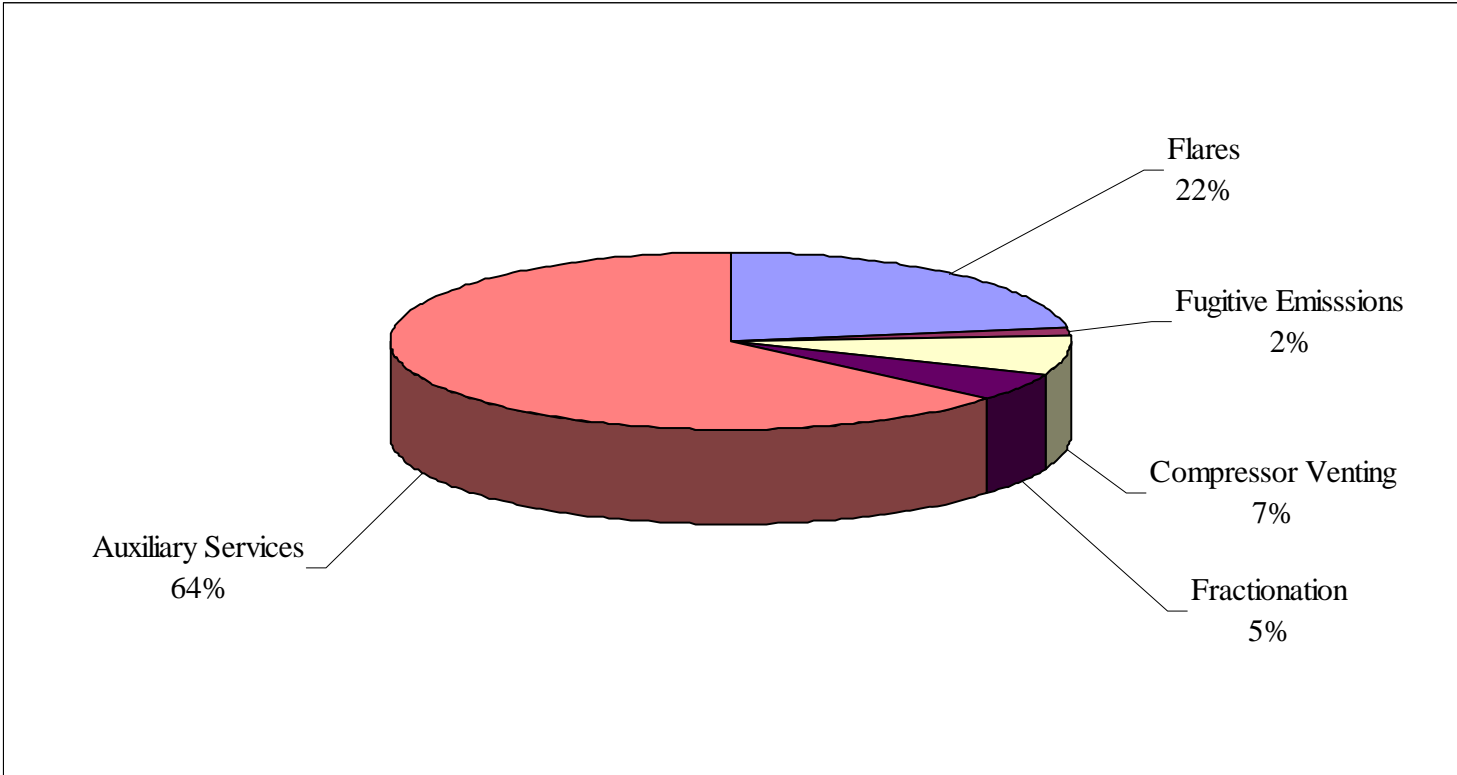
Excerpt from summary of emissions from economic-to-repair leaking components at Cryogenix Plant I										
Tag	Process Unit	Description	THC Emissions (10 ³ m ³ /y)	CH ₄ (10 ³ m ³ /y)	CO ₂ (10 ³ m ³ /y)	CO ₂ e (t/y) ²	Value of Emissions (\$/y)	Repair Cost (\$)	NPV of Repair ¹ (\$)	Payout Period (y)
HT14	PV-2103A	Control valve stem - 6"	63.06	54.32	0.00	773.92	\$12,421	\$282	\$21,494	0.0
HT13	EA-2101	Gate valve stem - 16"	27.99	24.11	0.00	343.57	\$5,514	\$920	\$16,846	0.2
10945	DA-2102B	Control valve stem - 10"	21.84	18.81	0.00	268.08	\$4,302	\$459	\$7,084	0.1
HT17	VOP-125	Control valve stem - 6"	20.63	17.77	0.00	253.22	\$4,064	\$282	\$6,843	0.1
HT15	Next to PV-2155	Gate valve stem - 8"	20.53	17.69	0.00	252.03	\$4,045	\$350	\$12,683	0.1
10941	DA-2102B	Regulator - 0.5"	19.75	17.01	0.00	242.39	\$3,890	\$175	\$14,859	0.0
HT16	Next to PV-2155	Gate valve stem - 8"	16.27	14.02	0.00	199.72	\$3,205	\$350	\$9,978	0.1
10934	FV-2139-B	Gate valve stem - 8"	14.85	12.79	0.00	182.23	\$2,925	\$350	\$9,074	0.1
10934	FV-2139-B	Gate valve stem - 8"	14.58	12.56	0.00	178.97	\$2,872	\$350	\$9,074	0.1

- Methane emissions in components: 24,432 tCO₂e/y
- Detected only in the oil seals of the centrifugal compressors
- Potential cost-effective reduction: 95% (US\$ 430,000/y)
- As a result of the detection techniques applied (IR camera), propane emissions from the compressor seals were also detected. These were estimated to have a value of US\$ 1,000,000 per year, with a potential cost-effective reduction of 95% as above.

- In addition, based on the measurements, it was estimated that emissions of methane due to incomplete combustion in heating equipment reach 200,000 tCO₂e/y.
- This is due to the large volume of fuel gas consumed, and the particular characteristics of the combustion equipment.
- As a result, an additional methane emissions reduction opportunity is associated with with a potential efficiency improvement in the combustion equipment. This is estimated at approximately 10% (20,000 tCO₂e/y).

Areas of opportunity, CPG Nuevo Pemex

Results of the measurements: methane emissions



These values are based on gas volumes vented, fugitive emissions in equipment and components, and inefficiency in combustion equipment measured during the field work.

13,574 ton CH₄/y
(285,054 ton CO₂/y)

Other measurements and findings

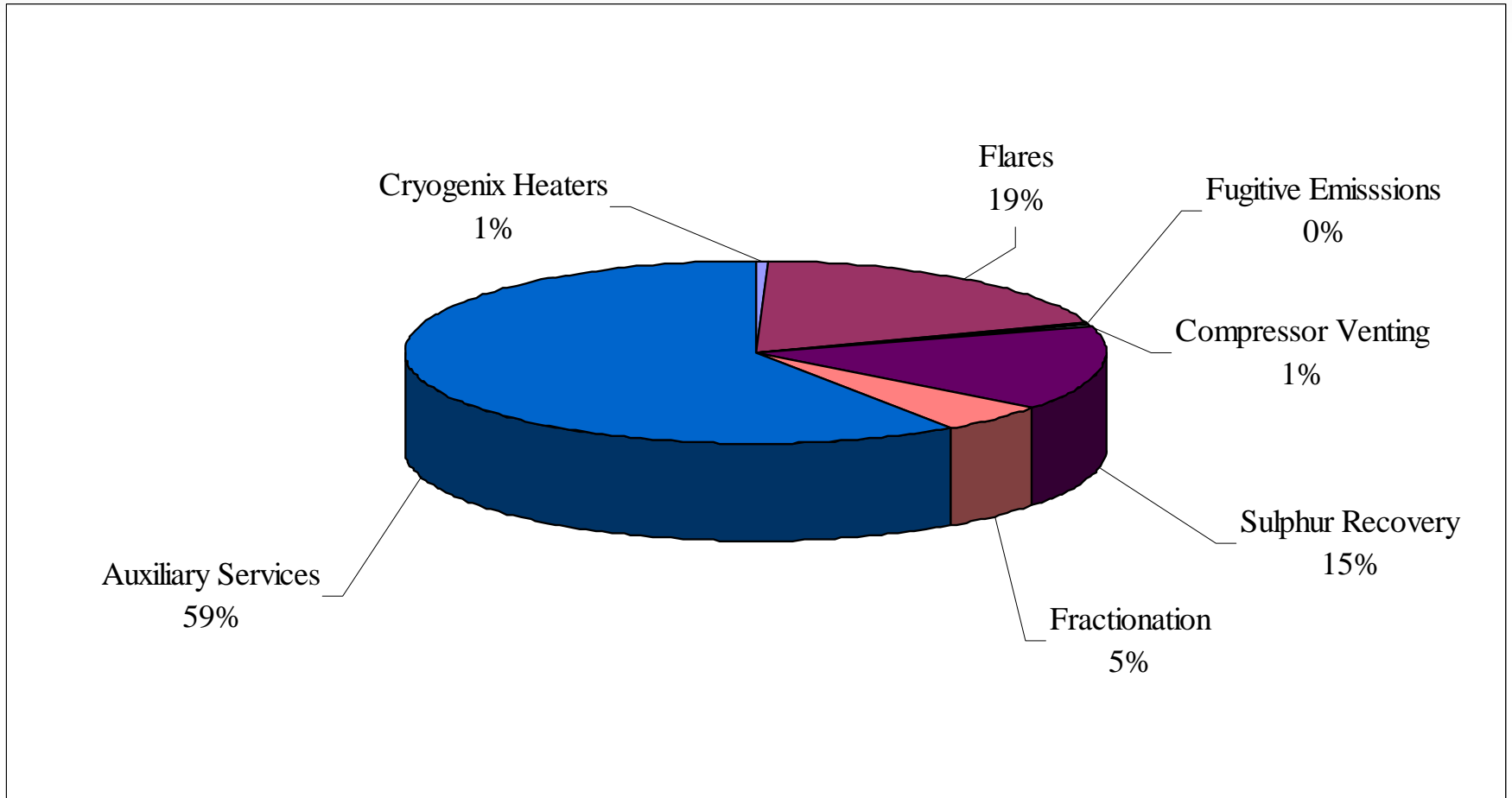
In order to estimate CH₄ emissions due to incomplete combustion, the team used gas analysis measurements and information on the fuel gas analysis.

The optical comparison technique was used to estimate the fuel flow to the burners, based on the shape and size of the flame (API 521).

It was estimated that the CO₂ emissions resulting from fuel combustion could be reduced by 150,000 - 200,000 tCO₂/y, but would require high levels of investment. The detailed investment estimates were beyond the scope of this study.

Pemex Gas has had an ongoing program of activities to increase the efficiencies of fired equipment in its gas processing complexes, and has added new activities.

Total Emisiones CO₂e/y, CPG Nuevo Pemex



Total Plant Emissions = **2,875,000** Ton CO₂e/y

There are good opportunities for methane emissions reductions at CPG Nuevo Pemex.

The emissions reductions are cost-effective in the majority of cases.

It would be appropriate to extend the activities of this study to the sections of the plant which were not covered, due to operating restrictions and limitations to M2M services.

This will certainly increase the opportunities for cost-effective emissions reduction.

The integral approach is very useful, since it allows a broader result, incorporating additional findings, such as energy efficiency, and, in this case, recovery of propane gas.

Energy diagnostic in the Nuevo PEMEX Gas Processing Complex: Summary

- In October 2007, a measurement campaign was performed in the Nuevo PEMEX Gas Processing Complex, to develop an integrated inventory of greenhouse gas emissions, and to propose mitigation actions through:
 - Control of methane emissions
 - Improvements in energy efficiency
- The measurement campaign included:
 - An inventory of components and detection of leaks, process venting and gas flows to flare
 - Determination of the efficiency of the process heaters
- In addition, specific opportunities for emissions reductions were identified, along with cost-benefit analyses for their implementation.
- The companies supporting the measurement and evaluation work were PA Consulting of the U.S. and Clearstone Engineering of Canada, under technical support from the M2M program and logistic support from Pemex.
- With the results obtained, action plans will be prepared in order to take preventive and corrective actions for process energy optimization and reduction of methane and carbon dioxide emissions.

