Gas Flaring in Petroleos Mexicanos

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EXTRACTIVE INDUSTRIES WEEK
The World Bank

March 3-5, Washington, D.C.
Agenda

Introduction

Pemex’s brief description

Diagnosis

Energy Legal Reform and Pemex’s Vision

Case study: Gas flaring reduction in Cantarell

Conclusions

Next steps
Introduction
Introduction

• The Federal Government of Mexico considers energy efficiency and climate change as two crucial issues for the global society.

• The Global Gas Flaring Reduction Partnership (GGFR) was launched in August 2002 at the World Summit on Sustainable Development.

• The purpose of GGFR is to support governments, development agencies, and the oil and gas industry in their efforts to reduce the environmentally impact flaring and venting of gas associated with the extraction of crude oil.

• Through the Ministry of Energy of Mexico (SENER), Petróleos Mexicanos (Pemex) has been convoked to join the Global Gas Flaring Reduction Partnership (GGFR) of the World Bank.

• It is relevant for Pemex becoming a member of GGFR considering the coincidence of the objectives of both organizations, aimed at increasing the utilization of natural gas and abating GHG emission in the oil and gas industry.
• In supporting the Mexican Federal Government's energy strategy and contributing to reduce green house gas emissions in oil and gas industry, besides GGFR, Pemex participates in some of the main global initiatives:

- United Nations Organization's Kyoto Protocol
- US EPA´s Methane to Markets Partnership, in which Pemex co-chairs the Oil and Gas Industry Subcommittee
- ARPEL´s. Pemex chairs the Energy Efficiency and Climate Change Committee.
- EITI. Member of the Governing Group

• To foster and become more productive in the efforts put into practice by the oil and gas sector, it seems opportune to find synergy among these initiatives.
The Pemex´s targets at the Extractive Industries Week are as follows:

1. Show the company's strategy to increase the gas utilization in the Pemex´s up-stream from the corporate perspective in both, the short and the long terms.

2. Evaluate the possibility of developing an Action Plan among SENER, Pemex and the GGFR partnership including, among others, the following issues:

   - Technical assistance and capacity building on regulatory best practices
   - Shared operational best practices
   - Support in seeking carbon finance for flare reduction and natural gas infrastructure projects
Pemex’s brief description
Pemex is an integrated State-own oil and gas company; it’s the main corporation of Mexico and one of the biggest in Latin America.

In 2008 produced 2.8 million barrels per day of crude oil and 6,919 million cubic feet per day of natural gas (2,363,986 MMCF/Y).

At this point of the time, Mexico occupies the 18th. place among the 20 major gas flaring countries. It is expected to drastically reduce gas flaring at the end of 2009.

Its GHG emissions during that year amounted near 50 million ton of CO2e, equivalent to near 10% of the GHG México’s emissions.

To run the oil and gas business in Mexico, Pemex is integrated by a Corporate level and four Subsidiaries:

- Pemex Exploration and Production
- Pemex Gas
- Pemex Refining
- Pemex Petrochemicals

www.pemex.com
Pemex’s Organization

The up-stream sector of Pemex is operated by Pemex Exploration and Production (PEP) and Pemex Gas (PGPB).

Pemex up-stream

- Pemex Exploration and Production
- Pemex Gas
- PMI International

Research & Development

- Gasoline, diesel
- Lubricants and asphalts
- Oil gas and coke

Pemex Refining

- Natural Gasoline

Pemex Petrochemicals

- Ammonia, Polyethylene, Aromatics
- Petrochemicals
- Gas natural, LPG, Sulphur
- Dry Gas

Corporate

Natural Gas and condensates

Crude oil
Main infrastructure

USA

- 344 Production fields
- 6,247 Production wells
- 225 Off-shore Platforms
- 11 Gas processing complexes

MEXICO

- 6 Refineries
- 8 Petrochemical Complexes
- 77 Distillates products Storage and Distribution Terminals
- 21 LPG Distribution Terminals

64,000 Km Pipelines (crude oil, gas and distillates)

www.pemex.com
Diagnosis
Before 2000 Pemex made huge investments in compression capacity to reduce gas flaring in offshore platforms, reaching 97% of gas utilization in 2004.

Nevertheless, an unexpected behavior due to the complexity of the Cantarell field, and the contamination with Nitrogen injected for hydrocarbons recovery, Pemex had to flare sour gas again.

Therefore, in 2008 the gas flaring reached 461,748 MMCFY* (near 17% out of the total gas production)

To reduce gas flaring in Cantarell and about 6.9 MM ton of CO₂ emissions, PEP is currently executing a EOR project by re-injecting sour gas with high concentration of Nitrogen.

Source: SISPA Preliminary data
PGPB. Does not include gas’ liquids
Gas flaring in Pemex Exploración y Producción by Regions. 2001 - 2008

- Consequently, the Northeast Marine Region (RMNE), where is located Cantarell, is the main source of gas flaring of Pemex Exploration and Production.

- This image compares the RMNE’s gas flaring and the North Region.

Source: SISPA.

*Preliminary

Cantarell is located in the Northeast Marine Region (RMNE) of PEP.

www.pemex.com
Gas Flaring and CO\textsubscript{2} Emissions in Pemex Gas

Gas processing is the second most important gas flaring source in Pemex’s up-stream. Its behavior will depend on Cantarell’s performance.

- During the period 2001-2004 the gas flaring reduction was due to the operation of new Sulphur recovery plants in the main gas processing centers.

- During the period 2005-2008, gas flaring in Pemex Gas increased rapidly because operational troubles in the gas processing complexes and the natural gas rejection due to high Nitrogen concentration.

Source: SISPA.
*Preliminary
Once Cantarell quits gas flaring at the end of 2009, Pemex will utilize up to 97% out of the total production, 2% should remain venting and flaring for safety and operational requirements, and the rest (1%) will be the area for potential opportunities to reduce flaring.
• The Comisión Nacional de Hidrocarburos (National Hydrocarbons Commission) was created in the recent Pemex’s legal reform approved by the Mexican Congress in November 2008.

• As a part of the Ministry of Energy (SENER), this Commission will direct the activities related to the exploration, production, processing, transportation and storage of hydrocarbons in Mexico.

• The Law on National Hydrocarbons states for Pemex the following responsibilities:

  • “To reduce venting and flaring of natural gas at the minimum level in the exploration and production projects of Pemex.

  • “To promote the sustainability of the natural resources, as well as the industrial safety and the environmental protection”

*Artículo 3. Ley de la Comisión Nacional de Hidrocarburos
Pemex´s priorities

From the corporate perspective, Pemex will focus on addressing the gas flaring in two steps:

1. At the end of 2009, PEP will reduce the gas flaring in Cantarell, consequently it will allow to reach 97% of the gas utilization, to reach again the percentage of the year 2004.

2. In the long term, the PEMEX´s up-stream must reach and sustain the best gas utilization standards in the world's oil and gas industry, to contribute to the efficiency and competitiveness of the company as a whole.
Case study: Gas flaring reduction in Cantarell
• Cantarell is located on the continental shelf and slope of the Gulf of Mexico, at 80 km northwest of Ciudad del Carmen, Campeche, between the isobaths of 40-50 meters below sea level

• The producing formations are the Kimmeridgian and Oxfordian of Upper Jurassic, Lower, Middle and Upper Cretaceous, and Paleocene-Eocene

• This important asset produces is the first producer of oil in the country with 1,016 mbd and 1,626 mmcf/d (end 2008) of heavy oil de 19° to 22° API. The cumulative production up today is 13,248 millions of barrels

The main fields that integrate the asset are Akal, Ixtoc, Nohoch, Takin and Sihil.
After 25 years of increasing production, Cantarell production decline started in 2004. Therefore, a new strategy was defined to maximize the oil recovery factor including EOR techniques.

- First field discovered in 1976 well Chac-1
- Akal field in 1977
- First production in 1979
- Target: production platform of 1 mmbd

1997-2004: “Maximize the recovery of production”
- Strong investment
- Nitrogen injection to sustain pressure
- Target increase production up to 2,124 mbd.

2005-2008: “Decline administration”
- Beginning decline
- Reduce the production decline through maintain the recovery factor
Current situation on gas flaring

The goal for 2009 is 97% in accordance with the new Pemex law approved in November 2008 establishes the legal mandate to reduce gas flaring.

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<th>Year</th>
<th>Percentage</th>
<th>Compliance</th>
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<td>2007</td>
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<td>2008</td>
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</table>

The goal for 2009 is 97% in accordance with the new Pemex law approved in November 2008 establishes the legal mandate to reduce gas flaring.
The production of natural gas from the transition zone has increased derived from the advance in the gas-oil contact in Cantarell.

To address this situation, Pemex has begun the construction of additional infrastructure, including a nitrogen recovery unit (NRU) where nitrogen is separated from the natural gas stream, and various compression modules in order to inject natural gas and nitrogen into the reservoir, which started to operate in April 2008.
Actions to reduce flaring

Operative actions

- The nitrogen recovery unit (NRU) started operations in April 2007, and now operates at full capacity
- Maintain sour gas injection at levels of 300 million cubic feet per day
- Increase the volume of treat sour gas in Akal C8 platform
- Separate streams with high nitrogen content

Additional compressor capacity in Akal-B, Akal-C y Akal-G platforms

- Two turbo compressors to process additional gas volumes
- Five turbo compressors to inject natural gas into the reservoir
- Construction of additional infrastructure to inject natural gas into the reservoir.
## Advances gas flaring reduction plan

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<th>Actions and works to reduce the gas sent to the atmosphere</th>
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<td>3 Keep the injection of sour gas to the reservoir 350 mmcfd</td>
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<td>4 Enhance the capacity of injection of sour gas to the reservoir (350 to 1,230 mmcfd)</td>
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<td>Conversion to dry seals T60 TC’s in SLM’s Akal-C (2 - 210 mmcfd)</td>
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<td>Installation of a compressor injection Akal-C (180 mmcfd)</td>
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## Handling and process of gas flaring

### Actions and works to reduce the gas sent to the atmosphere

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<td><strong>5 Ciudad Pemex NRU facilities</strong></td>
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<td>Management Gas (Process) at Akal-B (70 mmpcd)</td>
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<td><strong>Installing Turbocharger Booster # 1 in T60 SLM AKJ</strong></td>
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<td><strong>Rehabilitation of the 3rd Turbocharger for PB-S-Ku</strong></td>
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<td><strong>Progress: 1% (Development of Basic Engineering)</strong></td>
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**Notes:**
- **P** - Planned
- **R** - Realized

**Event:**
- 1st June, 2009 is going to be shipped from Houston, Tx

**Progress:**
- Progress 63% in turbo-machinery
- Progress 62% in turbo-machinery

**Schedule:**
- Scheduled January 21, 2009
- Scheduled 21-Ene'09
- Scheduled 38% to January 21, 2009

**Areas:**
- Turbo-machinery
- Management Gas
- Process
Initiatives for natural gas usage:

- Increase and maintain the injection in Cantarell of 800 million of cubic feet per day of sour gas
- Separate natural gas streams with high nitrogen content
- Installation of turbo compressors to process additional volumes of gas
- Construction of additional infrastructure to inject natural gas into the reservoir
  - Building three additional NRU

At August 2009, Pemex expects to achieve an use rate of 97%
Conclusions
• The recent Pemex’s reform approved by the Congress of Mexico emphasizes to reduce venting and flaring of natural gas at the minimum level in the exploration and production operations, as well as to promote the sustainability of the natural resources, the industrial safety and the environmental protection.

• Gas flaring reduction is considered an effective route to improve the economic and environmental performance of the company and to face the global warming as well, through a better use of the hydrocarbons.

• Pemex has established a goal of 97% Natural Gas usage at the end of 2009 through a continuous process of operational improvements, mainly in Canatarell.

• In the long term, PEMEX will reach and sustain the best gas flaring standards in the world's oil and gas industry in PEP and Pemex Gas.

• It is convenient for Pemex to be member of GGFR Partnership, and aim to create synergies with other global initiatives in the oil and gas industry oriented to the energy efficiency, GHG emissions reduction and climate change issues.
Next steps
Next steps

• Finalize the assessment of México's joining GGFR and establish the Action Plan to be developed.

• Execute pilot projects to put into practice technical assistance and capacity building on regulatory best practices, share operational best practices, and seeking carbon finance for flare reduction and natural gas infrastructure projects

• It is opportune to create synergies with other global initiatives, as the US EPA’s Methane to Markets, ARPEL and carbon markets, for integrating efforts to increase gas utilization and mitigate GHG emissions in the oil and gas industry.
Gas Flaring in Petroleos Mexicanos

- Guillermo Camacho. Deputy Director of Operational Discipline, Safety, Health and Environmental Protection

- Miguel Angel Maciel. Strategic Planning, Manager. Pemex Exploration and Production

EXTRACTIVE INDUSTRIES WEEK
The World Bank

March 5, Washington, D.C.