

OIL & GAS METHANE REDUCTION PROJECT OPPORTUNITY

Substitution of Wet Seals with Dry Seals in Gas Compressors

PEMEX Gas and Basic Petrochemicals

Poza Rica and Nuevo Pemex, Mexico

OVERVIEW OF OIL & GAS PROJECT OPPORTUNITY:

Pemex Gas y Petroquímica Básica (PEMEX Gas and Basic Petrochemicals, hereafter known as PGPB), the Project host, is dedicated to processing, transporting and commercializing natural gas, liquid hydrocarbons (such as LPG and gas condensates) and basic petrochemical products like ethane, natural gasoline and sulfur. PGPB is a subsidiary of Petróleos Mexicanos (or PEMEX). PEMEX subsidiaries engage in the production, refining, distribution, and commercialization of petroleum products, (i.e. oil derived products, natural gas and its liquids), as well as a wide range of petrochemical products.

The project opportunity aims to reduce methane emissions at gas processing plants through the substitution of wet seals with dry seals in 15 centrifugal gas compressors. The Project activity will be implemented by PGPB at the Gas Processing Centers located in Nuevo Pemex, in the State of Tabasco; and Poza Rica, in the State of Veracruz, Mexico. This project could be replicated at other major PGPB facilities which have similar equipment. The decision to go ahead with its implementation was strongly influenced by previous joint PGPB-M2M measurement surveys at the Ciudad Pemex Gas Processing Complex, both before and after a dry seal implementation. The measured results showed a 95% reduction in overall real methane emissions from this source and helped in the determination of typical CH₄ emission factors and project emission reduction potential.

ESTIMATED ANNUAL AVERAGE EMISSION REDUCTIONS: 6.03 MILLION CUBIC METERS METHANE/ 90,728 MTCO₂E

PROJECT DETAILS

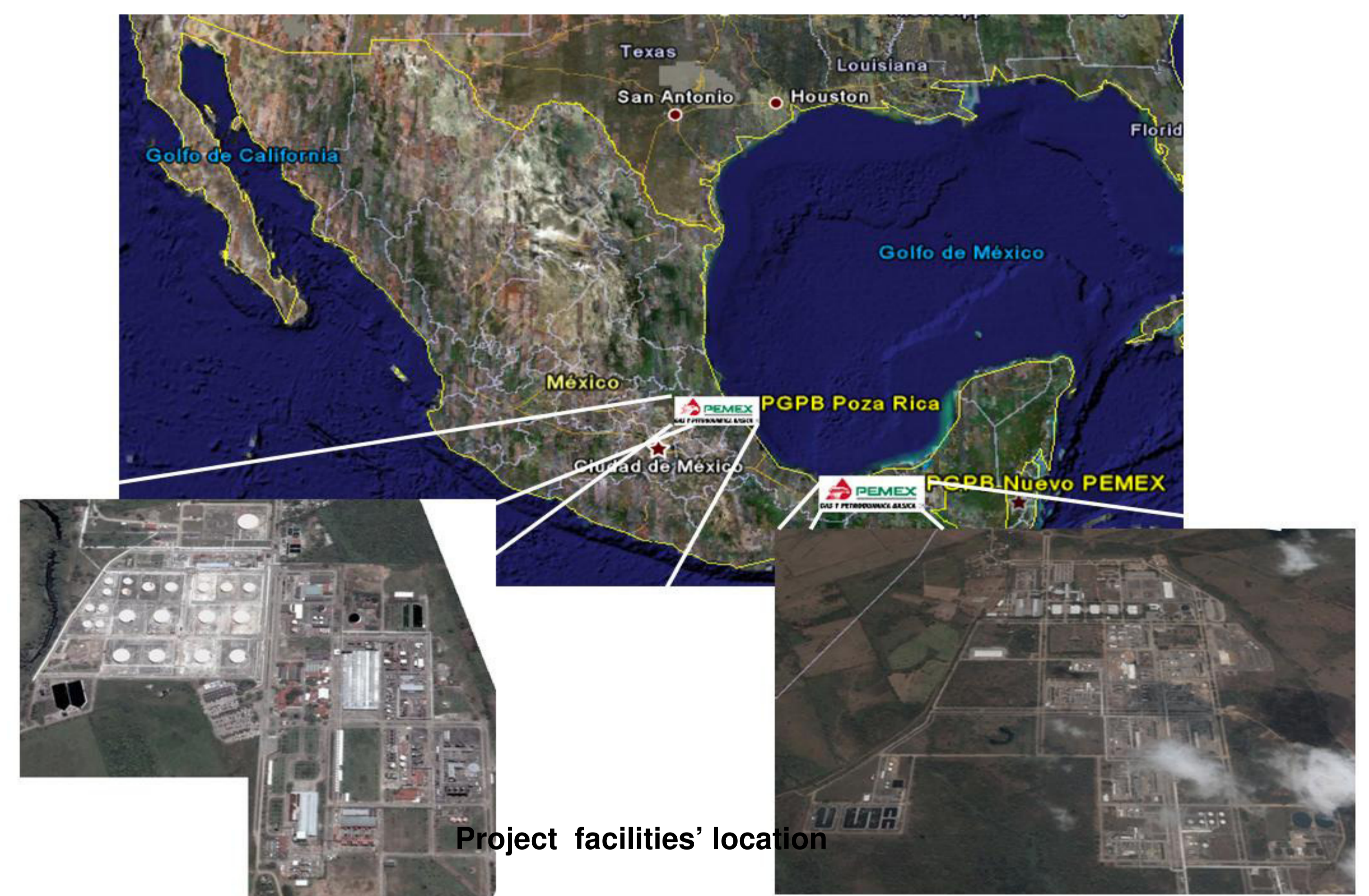
The project activity aims to significantly reduce vented methane emissions that occur in gas processing plants and gas compressor stations using wet seals by replacing them with dry seals.

Technology of substituting dry seals for wet seals in compressors

Seals in centrifugal compressors prevent high pressure natural gas from escaping the compressor casing. Traditionally, these seals use oil at high pressure as a liquid barrier. Most emissions from wet seals occur when absorbed gas in the high pressure side of the seal is released by flashing it from the circulating oil. Recovered methane is commonly vented to the atmosphere. Since a mechanical dry seal system does not use a circulating seal oil, this venting of methane is avoided. Replacing wet seals with dry seals has been found to reduce operational and maintenance costs as well as methane emissions.

Dry seals operate mechanically under the opposing force created by hydrodynamic grooves and static pressure. Hydrodynamic grooves are etched into the surface of the rotating ring affixed to the compressor shaft. When the compressor is not rotating, the stationary ring in the seal housing is pressed against the rotating ring by springs. When compressor shaft rotates at high speed, compressed gas has only one pathway in which to leak down the shaft—between the rotating and stationary rings. This gas is pumped between the rings by grooves in the rotating ring.

The opposing force of high-pressure gas pumped between rings and the springs that push the rings together creates a very thin gap between the rings. While the compressor is operating, the rings are not in contact with each other, and therefore, do not wear or need lubrication. O-rings seal the stationary rings in the seal case.



PROJECT DETAILS (CONTINUED)

Leak screening and measurement technology

An initial, or baseline, survey using the hi-flow sampler identified and accurately measured methane emissions from representative PGPB compressors. These survey results will serve as a point of reference. All methane emissions identified were tagged, entered into a database, and monitored by re-screening the methane vented once the seal substitution has taken place, using IR imaging, and hi-flo sampler / bagging techniques to determine methane emissions levels over time. Long term, re-screening results will be used to ensure emissions remain at acceptable levels according to dry seal manufacturer specifications. Expected reduction levels are well over 90% from those found in the baseline survey.

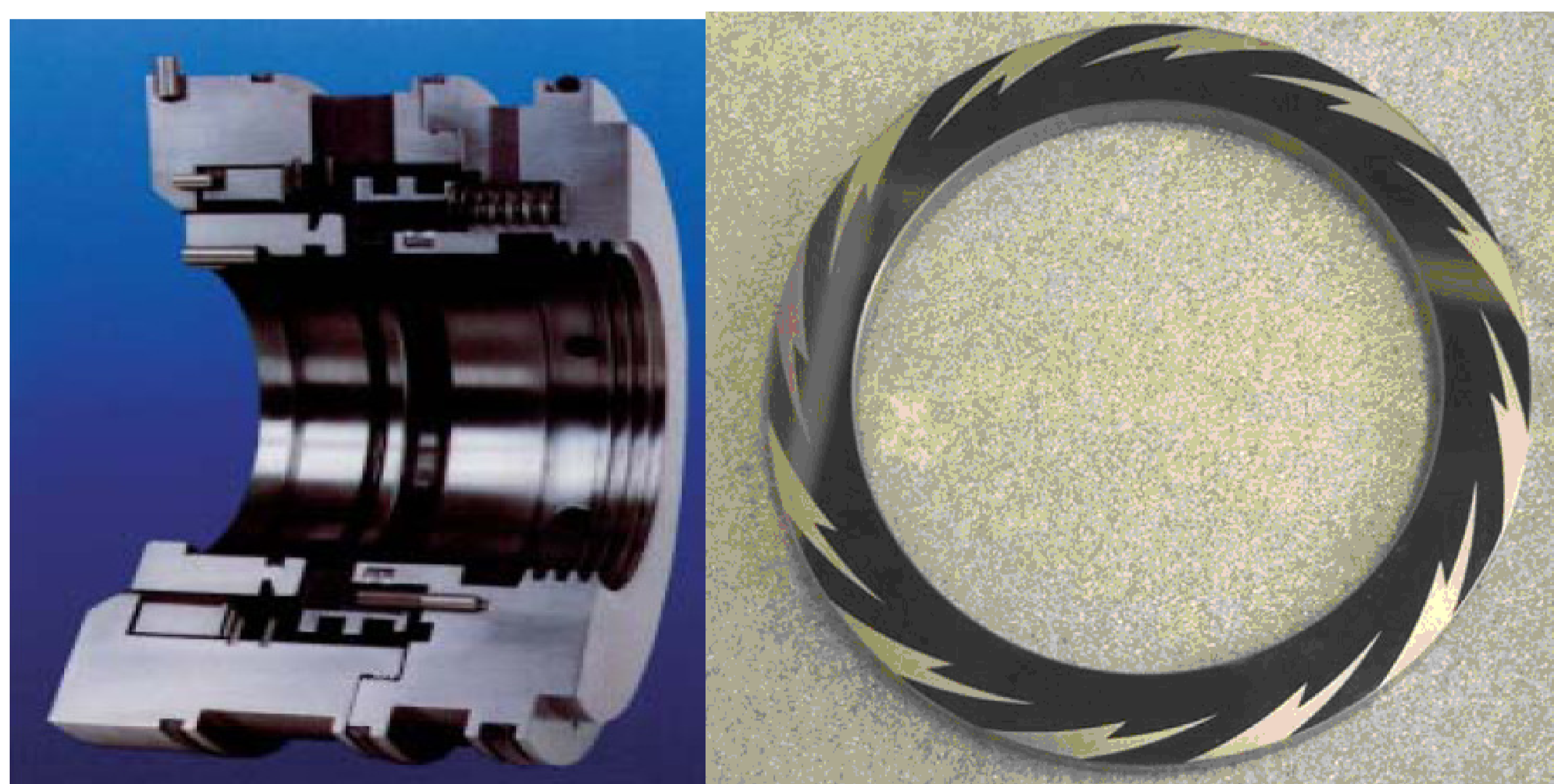
PROJECT DEVELOPMENT PLAN

The project is scheduled to be implemented during 2010, for 11 compressors operating at the 3 Nuevo Pemex Gas Processing Center Cryogenic Plants and 4 more compressors in the Poza Rica Gas Processing Center

Estimated Amount of Emission Reductions Over a Ten Year Period

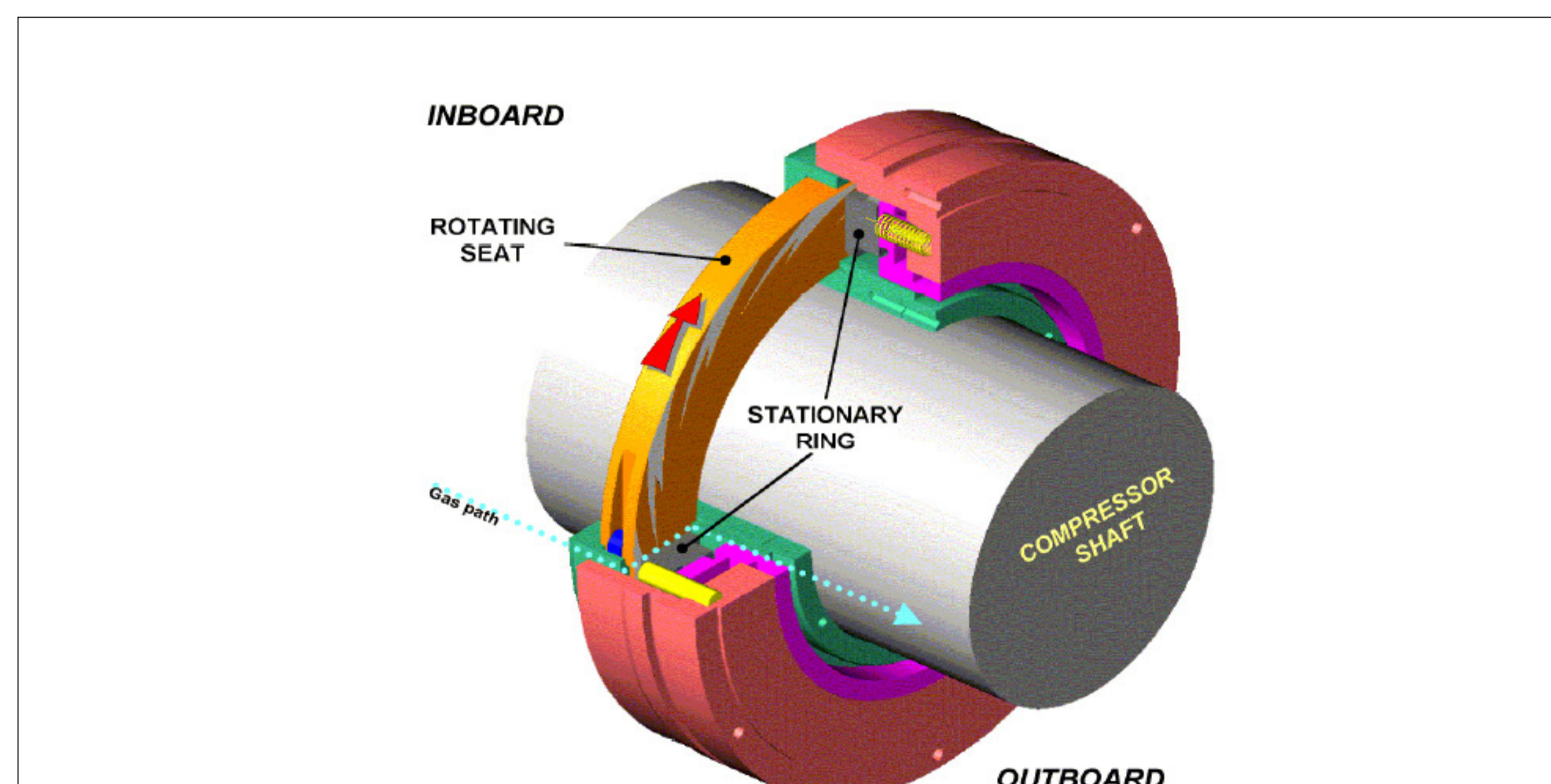
Year	Annual Estimation of Emission Reduction in tonnes of CO ₂ e
2009	9,942
2010	71,843
2011	129,601
2012	129,601
2013	126,760
2014	109,480
2015	95,041
2016	90,851
2017	66,280
2018	49,000
2019	28,879
Total estimated reductions (tonnes of CO₂e)	907,278
Annual average over a 10-year period of estimated reductions (tonnes of CO₂e)	90,728

PROPOSED TECHNOLOGIES



Dry seal housing w/
stationary ring

Dry seal rotating disk



Dry seal operation scheme

PROJECT CHALLENGES

There are no legal and/or regulatory frameworks enforced per Mexican Law about the substitution of dry seals for wet seals in Mexico, nor for leak detection and measurement techniques. The project must compete for scarce funds in PEMEX. In addition, implementation costs are substantially higher than those encountered in other countries, due to overheads and pricing policy toward PEMEX, making it less profitable than in other applications.

ECONOMIC BENEFITS

Potential annual gas savings: US\$ 1,359,000 in commercial gas value at the time of the study.

Desktop analysis indicates that the project activity will have an approximate 11 percent rate of return and a nearly 20 percent rate of return with the sale of emissions reduction credits (a CDM application has been submitted). Other project benefits include:

- Environmental benefits obtained from the reduction of the CH₄ currently vented to the atmosphere through technology improvement.
- Improved safety for the operators and the facilities involved in the project.
- Enhanced standing in terms of the company's corporate sustainability and environmental stewardship.

TYPE OF ASSISTANCE SOUGHT

There is no plan for funding outside of PEMEX to be involved in this project activity. The project is intended to be implemented as a Clean Development Mechanism under Kyoto Protocol rules. It is estimated that there are at least 20 more compressors with the same possible application throughout the PGPB system.

PROJECT FINANCES

- Projected capital costs: US \$ 7,500,000
- Projected additional operation and maintenance costs for fully implemented project: No additional costs are to be incurred. Savings from reduced O&M are to be expected, although they were not considered for financial analysis purposes.

FOR MORE INFORMATION

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