Methane emissions from a declining marginal oil field as a clean energy source: identification, quantification and pre-feasibility assessment

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ABSTRACT

This document describes the work conducted by the authors and their colleagues in the project "Activities that advance methane recovery and use as a clean energy source in the oil and gas industry of Ecuador" funded by the US Environmental Protection Agency-USEPA within the Methane to Markets program. An assessment of the methane emissions from wells of a marginal declining oil field was conducted and a pre-feasibility analysis was performed for the use of the gas as a domestic energy source for a small community nearby a section of the field, to replace the use of the currently heavily subsidized LPG. It was found that the use of the gas is unfeasible even when including the income from the sales of carbon credits.

1. INTRODUCTION

Methane is a powerful GHG. The oil and gas industry is one important source of emissions. The USEPA, under its Methane to Markets program, sponsors projects that enhance the capacity of countries to reduce the emission of this GHG and at the same time identify the potential for use of the gas as a clean energy source. The Escuela Superior Politécnica del Litoral-ESPOL was given a grant for activities leading to the identification, quantification and the assessment of the potential for use of methane emissions from one marginal declining oil field it ran under a concession contract with the Ecuadorian goverment. The project fell within the spirit of the contract as the oil field was to be used for academic research and trainning, as well as for extension activities.

2. PROJECT OBJECTIVES

(1) Perform measurements to determine the quantity and quality of the gas being emitted in the oil field, with emphasis on the emissions from the wells.
(2) Develop a GIS to assist in the selection of options to recover and use for the gas.
(3) Identify options for the recovery and for the use of the gas.

(4) Identify the barriers, legal, economic, social and environmental, for the capture and use of the gas emitted.
(5) Complete a pre-feasibility analysis for the use of the recovered methane.
(6) Conduct training and dissemination activities.

2.1 MEASUREMENTS

Prior to conducting the measurements of methane emissions, information on the oil field operations were gathered and the field was visited several times to gain familiarity with them. Information on the type of wells, their distribution and number, age, production and the way the oil was extracted was gathered. In parallel, equipment for methane gas leak detection and quntification was identified and bought.

A High –Flow sampler from Bacharach was chosen for measuring the gas flow from the wells. A Heath RMLD was acquired for leak detection. The project team was also trained in the use of the VLIR GasFinder infrarred camera with the assistance of the local representative and the Ecuadorian Petroleum company, Petroecuador, at the Esmeraldas Petroleum Refinery.

Information on the plans of the operator to use gas was also requested. A GIS with the distribution of the wells in the field was made available to the project and was used to select the sample of wells to be tested. A total of 100 wells were measured using the High-Flow sampler. The sample included productive wells, wells temporarily suspended from production and abandoned wells.

2.2 OPTIONS FOR RECOVERY AND USE OF THE GAS

The distribution of the wells, the amount of measured gas and the identification of the services available in the potential using communities led to the analysis of using the gas for domestic applications in a community located near to one area were an important number of wells were located.

The locality that was chosen as potential beneficiary of a project that would collect methane, store under pressure in a storage tank and distribute it to the town homes, currently uses heavily subsidized LPG 15 kg bottles at an estimated rate of 1 bottle per family of 5 per month. The cost of the bottle is around 15 dollars to the government, but it is bought by users in up to 2 dollars the bottle.

The community has 600 families and their consumption is estimated at a total of 540 m3 of methane per day.

Two options for collection of the gas from neighboring wells were designed and analyzed. A single design for storage and distribution of the gas by pipes to the homes was chosen.

2.3 PRE-FEASIBILITY ANALYSIS

Costs for the two recovery options were estimated. The costs for the storage tank and distribution of the gas to the homes were also calculated. The pre-feasibility analysis included as benefits the income from the sale of the gas to the families, the avoided cost of the subsidy and the sales of methane emissions reduction using the average sale price of the metric ton of CO2 equivalent at the Chicago Climate Exchange.

The recovery and use of the methane emissions is not economically feasible and only a political decision of using locally available fuel sources to reduce the need to import LPG, would allow it. The option of capping the wells was then analyzed. A proposal for the capping of the wells is currently being prepared for the consideration of the government.

3. CONCLUSIONS

The pre-feasibility of the recovery and use of methane emissions from wells of a marginal, declining oil field was analyzed for the case of supply of gas to a 600 family community in the vicinity of a cluster of wells. The analysis included all costs and the revenues coming from the sale of the gas to the families, the elimination of the cost associated to the LPG subsidy, and the revenue coming from the sale of emission reduction measured as metric tons of CO2 equivalent.

It was found that the recovery and use of the gas for such a case was unfeasible. Capping the wells is the only option considered feasible and a proposal for consideration of the government is currently being developed.

4. BIBLIOGRAPHY

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