World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:12, No:06, 2018

# Energy Loss Reduction in Oil Refineries through Flare Gas Recovery Approaches

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**Abstract :** For the last few years, release of burned undesirable by-products has become a challenging issue in oil industries. Flaring, as one of the main sources of air contamination, involves detrimental and long-lasting effects on human health and is considered a substantial reason for energy losses worldwide. This research involves studying the implications of two main flare gas recovery methods at three oil refineries, all in Iran as the case I, case II, and case III in which the production capacities are increasing respectively. In the proposed methods, flare gases are converted into more valuable products, before combustion by the flare networks. The first approach involves collecting, compressing and converting the flare gas to smokeless fuel which can be used in the fuel gas system of the refineries. The other scenario includes utilizing the flare gas as a feed into liquefied petroleum gas (LPG) production unit already established in the refineries. The processes of these scenarios are simulated, and the capital investment is calculated for each procedure. The cumulative profits of the scenarios are evaluated using Net Present Value method. Furthermore, the sensitivity analysis based on total propane and butane mole fraction is carried out to make a rational comparison for LPG production approach, and the results are illustrated for different mole fractions of propane and butane. As the mole fraction of propane and butane contained in LPG differs in summer and winter seasons, the results corresponding to LPG scenario are demonstrated for each season. The results of the simulations show that cumulative profit in fuel gas production scenario and LPG production rate increase with the capacity of the refineries. Moreover, the investment return time in LPG production method experiences a decline, followed by a rising trend with an increase in C<sub>3</sub> and C<sub>4</sub> content. The minimum value of time return occurs at propane and butane sum concentration values of 0.7, 0.6, and 0.7 in case I, II, and III, respectively. Based on comparison of the time of investment return and cumulative profit, fuel gas production is the superior scenario for three case studies.

**Keywords :** flare gas reduction, liquefied petroleum gas, fuel gas, net present value method, sensitivity analysis
**Conference Title :** ICSEMEP 2018 : International Conference on Sustainable Energy Management and Environmental Policy
**Conference Location :** Copenhagen, Denmark
**Conference Dates :** June 11-12, 2018