Assessing the Environmental Impact of a Flare Minimization Approach using CO2 Emissions and Wobbe Index Calculator – An Ethylene Process Case Study

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Flaring is a common practice in industrial process for various reasons such as safety, maintenance and during emergency process situations. It is a high-temperature oxidation process that is used to burn combustible components, mostly hydrocarbons of waste gases from industrial operations[1]. Flare emissions contribute to more than 50% of the annual Certified Emissions Reductions (624 million tons) according to Kyoto's Clean Development Mechanisms[2]. Emissions due to flaring activities led to high impact on the climate and environment that cannot be ignored by researchers, environmentalists and policy makers. Hence a number of environmental policies and international standards such as Kyoto protocol and The United Nations Environment Programme (UNEP) have been and are currently being implemented in developed and developing countries around the globe. GHG calculators are created and used by different industries to report CO2 and other GHGs emissions to comply with governing authorities. Therefore, a standard and acceptable GHG calculator is important to quantify those emissions, which led us to develop one. The calculator is developed as part of an ongoing project that proposes mitigation methods for flare reduction during abnormal process operations, also known as process upsets. The aim of this work is to propose an effective mass balance based methodology for tracking CO2 emissions from fuel combustion and process flare during both normal and abnormal operation. It is based on the EU commission guideline for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council[3]. An Ethylene process base case is presented in this paper to highlight the usefulness of this tool. The case assesses the impacts of using a stand by cogeneration system for utilizing flare streams during upsets and minimizing the overall process CO2 emissions. The merits of the GHG calculator are that it has the ability to estimate the emissions at different upset scenarios while each scenario has multiple flare sources; it has the flexibility of estimating the wasted energy of process flare streams using international accredited standards from the EU commission such as Deutsches Institut für Normung standards . In addition, the calculator is able to estimate the carbon tax and credit using the latest carbon tax rates at various focal countries around the globe. Finally, in this work we will show the potentiality of COGEN system as an alternate solution to reduce GHG emissions and to recover the energy content from the flare streams which was emitted previously. Initial results showed that for our case study, both the cost of fuel and the cost of CO_2 tax can be reduced through the utilization of flare streams from abnormal situations. Therefore, COGEN system is economically and environmentally viable option for abnormal situations management.

[1] Industrial Flares - US Environmental Protection Agency
http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s05.pdf

[2] The world bank - Russia, Kazakhstan Lead Way to Reduce Gas Flaring and Lower Emissions
http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSDNET/0,,contentMDK:22949562~menuPK:64885113~pagePK:7278667~piPK:64911824~theSitePK:5929282,00.html

[3] Official Journal of the European Union L 229/1
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2007:229:TOC