UNIVERSITI TEKNOLOGI MARA

CASE STUDY: THE EFFECT OF VAPOR BLOWBY TO THE DEBUTANIZER COLUMN PRESSURE RELIEF VALVE (PRV) SIZING

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ABSTRACT

Gas or vapor blowby is a dynamic scenario whereby the vapor is being discharged via liquid outlet from the process component due to the multiple process failures such as control valve fail-open or blocked liquid outlet provided that the design pressure of downstream equipment is lower than the upstream pressure. The degree of fatality caused by failure to properly address a vapor blowby event, which is significant for a distillation column relief valve sizing may affects the plant performance, creates casualty and in worst case scenario loss of life. Therefore, this work was carried out in order to study the effect of vapor blowby to a distillation unit profile which are temperature, pressure and flow rate from its upstream column and its importance for a column relief device sizing. The work was simulated using Aspen HYSYS software focusing on debutanizer column under four different cases. From the result, it is confirmed that in order to adequately size a relief device and also cater for the possibility of a vapor blowby event, the relief valve should be sized for a two - phase flow condition.

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INTRODUCTION

1.1 RESEARCH BACKGROUND

Refinery products such as liquefied natural gas (LNG) and gas has been and always been on increasing demand. The growth is increasing definitely. According to BP Energy Outlook 2017 (Figure 1.1), it is estimated the supply and demand of the LNG worldwide will keep increasing until 2035. The products are valuable both as a source of energy as well as chemical feedstock and it involves numerous processing before it reaches to the final production such as removal of liquid hydrocarbons, water and trace components. Each step is critical in order to recover more valuable components from the raw gas and also to ensure its stability before the gas can be transported over a long distance. In typical gas processing plant, various components of LNG are separated from the natural gas stream by employing a series of distillation columns.

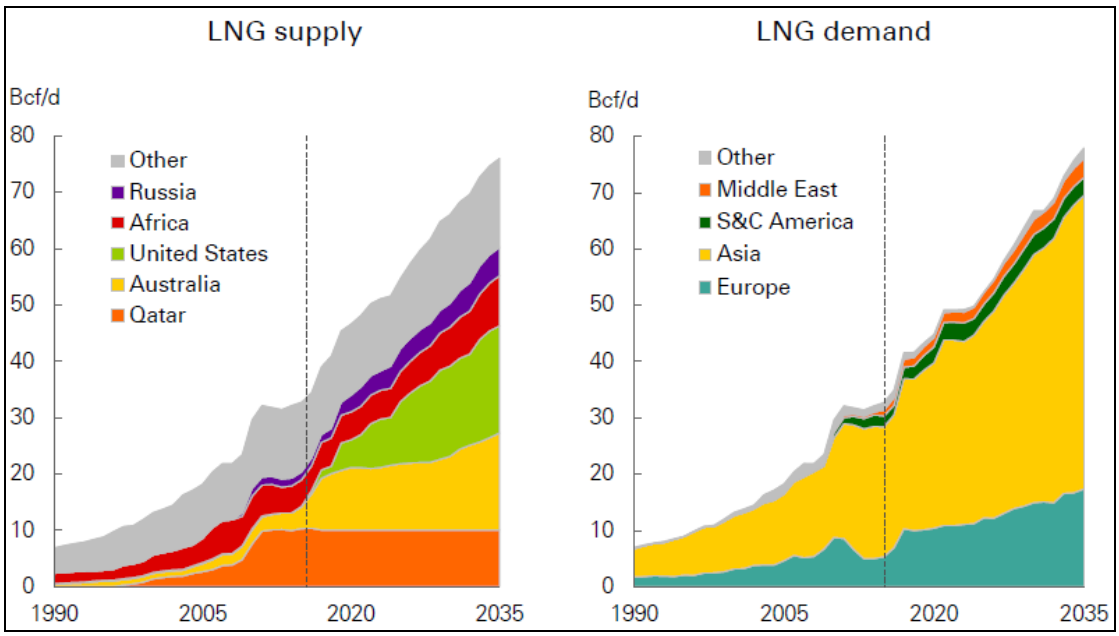

Figure 1.1: The supply and demand of Liquefied Natural Gas (LNG) worldwide, 1990 – 2035 (unit: billion cubic feet per day) (BP Energy Outlook 2017 Edition, 2017)

The distillation columns are commonly used for distillation, stripping, absorption and extraction processes. It is used in every process industry such as