ABSTRACT

A pilot test of CBM well was successfully conducted. Normally, the methane production rate in CBM decreases after it reaches the maximum rate. To minimize the declining production in a CBM well, we need a secondary recovery to sweep the gas that is left in the matrix. The methane production from a coal beds can be enhanced with an injection either from carbondioxide or nitrogen. The injected CO$_2$ will displace methane and accelerate methane production at sustained or increased pressures. Coal has a capacity to hold considerably more CO$_2$ than methane in the adsorbed state. Furthermore, CO$_2$ injection in ECBM can potentially be a CO$_2$ storage in coalseams, and become a promising technology to decrease anthropogenic greenhouse gas emission.

In recent days, the simulation technology cannot be separated from oil and gas reservoir development program. Reservoir simulation is a powerful tool to design field development and predict reservoir behavior. In this work we will simulate the ECBM – CO$_2$ based on injection pattern. The correlation between type of injection pattern and the result of injection will be presented on this paper.

Keywords: CBM, ECBM-CO$_2$, Secondary Recovery

INTRODUCTION

Coal Bed Methane (CBM) have been the new source of energy. Recently, this new kind of energy have been explored and exploited. Primary recovery factor for CBM operation with its natural energy ranges between 40% – 65% (Massarotto et.al., 2005). This value is very low compare to natural gas recovery factor which can range between 70% – 80% (IEA, 2005). To increase the recovery of CBM, many technologies have been developed. Among them, Enhanced Coal Bed Methane (ECBM) is a process by which gas is injected into the coalbed to recover the remaining hydrocarbon gases from the reservoir that may otherwise be stranded. One of this way is injecting CO$_2$ to CBM reservoir. Many works/researchs in associate with CO$_2$ injection to CBM reservoir have been done (Mazumder, 2008). There are two main advantages of injecting CO$_2$ to CBM reservoir i.e. to increase CBM recovery factor, and the other one is as a CO$_2$ sequestration. Recently, many ways have been done to reduce CO$_2$ production due to Kyoto Protocol of Green House Gases. This work, injecting CO$_2$ to reservoir, can be a solution to it. Most of this injection process have been done in a certain injection pattern like 5-spot pattern or inverted 5-spot pattern (Reeves, 2003/2004).

ECBM is the process by which gas is injected into the coal bed in order to recover the remaining hydrocarbon gases from the reservoir that may be stranded. Nitrogen (N$_2$) and CO$_2$ injection have been the subject of ECBM research in recent years and have been shown to have substantially different recovery processes. The ECBM process works off the coal seam’s relative affinity for the injected gas, which is best illustrated by the pure component isotherms for CO$_2$, methane (CH$_4$) and N$_2$ (See Figure 1). It is clear that at any given pressure, a particular coal seam is capable of storing more CO$_2$ than CH$_4$ and more CH$_4$ than N$_2$. This is an important concept which controls how the respective processes move forward. Coal has the highest affinity for CO$_2$ compared to CH$_4$ (see Figure 1). This phenomenon causes preferential adsorption of CO$_2$ onto the coal surface and releases CH$_4$ into the cleat system. This process could be termed as a classic “displacement” mechanism. (Koperna, 2009).

The mechanism by which CO$_2$ (or N$_2$) can enhance the CBM recovery and CO$_2$ sequestration is a