# DESIGNING OF 50000 TONS PER YEAR METHANOL PRODUCTION PLANT USING OXYFUEL COMBUSTION CO2 CAPTURE TECHNOLOGY

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## SUMMARY

Emissions of greenhouse gases (GHGs) are serious environmental issues which have become worldwide problems. Global warming is occurred when in the atmosphere, level of carbon dioxide ($CO_2$) increased. The planet become warmer than it would be naturally because of more heat is trapped by the atmosphere. Carbon dioxide ($CO_2$) is one of the main greenhouse gases (GHGs). Nowadays, about 85 percent from world energy consumption is contributed by fossil fuels. The combustion of fossil fuels produced carbon dioxide ($CO_2$). Therefore, to reduce both carbon dioxide ($CO_2$) emissions and fossil resource depletion, capture carbon dioxide ($CO_2$) and use it as an alternative carbon feedstock for chemicals, fuels and materials have the potential. The objectives of this research are to design methanol production plant using oxy-fuel combustion $CO_2$ capture technology and to evaluate methanol production capacity form different power plant in Malaysia using oxy-fuel carbon capture technology. By using carbon dioxide ($CO_2$) that has been capture using oxy-fuel combustion capture technology as raw material, methanol is produced. This research is to design methanol production plant using oxy-fuel combustion carbon dioxide ($CO_2$) capture technology in order to produced 50000 tonnes per year by using Aspen Hysys Software. Then, from the research, methanol production capacity from different power plant in Malaysia using oxy-fuel carbon capture technology is evaluated. The value is obtained from Aspen Hysys. What can be observed is in order to produce $50000\ \frac{ton}{yr}$ required 20209 $\frac{\text{kg}}{\text{hr}}$ of carbon dioxide emissions and 8960 $\frac{\text{kg}}{\text{hr}}$ of carbon dioxide captured. This value is nearest to the amount of carbon dioxide emissions and methanol production from Sepanggar Bay Power Station which are 32767 $\frac{\text{kg}}{\text{hr}}$ of carbon dioxide emissions and $8.0774 \times 10^4\ \frac{ton}{yr}$ of methanol. About 100MW electricity capacity is need to be produced in order to get 32767 $\frac{\text{kg}}{\text{hr}}$ of carbon dioxide emissions. Therefore, to get 20209 $\frac{\text{kg}}{\text{hr}}$ of carbon dioxide emissions to produce 50000 $\frac{ton}{yr}$ of methanol, the electricity that needs to be generated is less than 100MW. From this research what can be understand is in order to produced 50000 $\frac{ton}{yr}$ of methanol , only small plant with small capacity is required.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Research Background

A greenhouse gas is a gas that absorbs infrared radiation (IR) and radiates heat in all directions (B. Singh et al., 2011). Greenhouse gases in the earth's atmosphere absorb IR from the sun and release it. Some of the heat released reaches the earth, along with heat from the sun that has penetrated the atmosphere. Both the solar heat and the radiated heat are absorbed by the earth and released; some is reabsorbed by greenhouse gases to perpetuate the cycle. The more of these gases that exists, the more heat is prevented from escaping into space and consequently the more the earth heats. This increase in heat is called the greenhouse effect. Greenhouse gasses are effected global climate change. Climate change is serious global environment issue. According to Kyoto Protocol, carbon dioxide ($CO_2$) has global warming potential of exactly 1 as a base line unit to which all other greenhouse gases are compared. Carbon dioxide ($CO_2$) is produced from combustion of fossil fuel such as coal, natural gas. Global population increase from year to year. When population increases, the world energy demand become increases.

The main supplier to energy consumptions is fossil fuel. The combustion of fossil fuel generated combustion. So, in order to overcome this problem by using carbon capture technologies carbon dioxide can be utilized to become new chemical such as methanol. There are three types of carbon captured technologies which are post-combustion, pre-combustion and oxy-fuel combustion. Figure 1.1 shown block diagrams illustrating post-combustion, pre-combustion and oxy-combustion systems.