



## Production of fuels and chemicals based on the conversion of carbon dioxide biomass and methane

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### ARTICLE INFO

Received: 15/12/2018

Accepted: 25/12/2018

#### Keywords:

Methane, Carbon Dioxide,  
 Biomass, Hydrogen,  
 Chemical Conversions.

### ABSTRACT

In the circumstances of climate change caused by the rise in CO<sub>2</sub> emissions, the role of renewable energy sources, including those that generate carbon neutral cycles, is increasingly important. This mini-review addresses the pathways that should lead to the production of different types of fuels on the basis of conversions of methane (natural gas), biomass and even CO<sub>2</sub> that is still considered as a component that causes climate change. Most of the chemical conversions are concerned with the involvement of hydrogen - an important constituent and are being targeted by scientists and energy companies to find the pathways, leading to the possibly cheapest production.

### Introduction

The use of fossil fuels for production of electricity and in transport is a major and growing contributor to the emission of carbon dioxide - a greenhouse gas that contributes significantly to global warming and changing the world climate. The climate change is affecting, in one way or another, almost all countries, including Vietnam. One of the main problems that the world is now facing is how to satisfy the foreseen increase in energy demand using all available sources in the most efficient manner, and without increasing the emission of CO<sub>2</sub>. In this consideration, together with other forms of renewable energy, such as solar and wind sources, the contribution of renewable fuels should be considerably increased.

Nowadays governments, scientists and energy companies are doing everything possible to accelerate the use of renewable forms of energy that do not increase CO<sub>2</sub> emissions, including biofuels. In fact, in recent years, solar and wind power has grown rapidly, supplying about 7% of the world's electricity; solar energy in the form of photovoltaic (PV) conversion increased by 28%/year and wind power - by 13%/year

[1]. According to REN21 [1], biofuel is the largest renewable contributor to global final energy demand, providing nearly 13% of the total (mainly for heat and building), but the advanced biofuels provide only 3% of transport needs. Production of biofuels for transport increased 2.5% in 2017. The production and use of new transport fuels such as hydrotreated vegetable oil (HVO) have grown significantly over the last five years, and in 2017 HVO accounted for about 6% of total biofuel production by energy content. Progress also is being made in developing the technologies needed to produce advanced biofuels for aviation use, for example.

The last decade has witnessed the appearance of the concept the Methanol Economy, which has changed the perception of the role of CO<sub>2</sub> in chemistry and chemical engineering, leading to a number of advanced technologies in the reuse of CO<sub>2</sub> as an energy carrier and chemical raw materials. It is interesting and fascinating that the concept "the Methanol Economy" with CO<sub>2</sub> as an energy carrier can visualize the carbon cycle, in which biomass and methane also play their important roles in producing diverse products, including fuels and chemicals. On the basis of the carbon cycle in the