Asian potential of biofuel market: Case of ASEAN[1]

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Overview

This paper is on the Asian potential of biofuel[2] market. There are two aspects in this study. One is the demand/supply of the biofuels in the region and the other is the functionality of the market. The first aspect can be approached through investigations of demand/supply of individual country. The second aspect needs to take account of the interaction among countries including trade as well as the influences of international fuel oil prices. In this paper, the analysis was updated based on recent policy changes in the major ASEAN countries. The second aspect is closely related to the policies on energy security, rural development, agricultural productivities as well as international trade of not only biofuels but also foods including sugar and vegetable oils.

In this paper 4 countries, Indonesia, Malaysia, Philippines, and Thailand are selected to study as these countries are more advanced in biofuel production and utilization. And this paper is structured as: following this section is Chapter 2 in which methodology of estimation of future biofuel market and supply potential will be introduced; The analysis and implications of the results will be presented in Chapter 3; in Chapter 4 the benefit and barriers on regional market integration will be analyzed and discussed the paper ends with a conclusion section.

Methods

Projection of Biofuel Demand

Though biofuels could be utilized in various sectors, the present study was focused on biofuels for road transportation. The basic formula used for calculating biofuel consumption for road transport is:

$$Biofuel = TotalDemandofCertainLiquidFuel \times BlendRate$$

Demands for two types of biofuels are projected in this study, bio-ethanol and biodiesel. Bioethanol is used blending with gasoline and biodiesel with diesel, thus the demand for gasoline equivalent and diesel equivalent will be projected. Since liquid fuel consumption depends significantly on the number of vehicles on the road, ownership of vehicle is projected first to calculate the liquids demand.

Projection of Biofuels Supply

In this study, the Cobb-Douglas Production Function is used for calculating the production of Energy Crops in each country. The basic formula for calculating production of energy crops is shown below:

$Y = aA^{\alpha}L^{\beta}K^{\gamma}$

Taking log form of both sides and the equation is converted to:

$\log(Y) = \log(a) + \alpha \log(A) + \beta \log(L) + \gamma \log(K)$

Where: Y = Output (Production of Energy crops); A = Land (Cultivation Area); L = Labor; K = Capital Stock, or I = Input (Machinery, Fertilizer); The time variant (TREND) is used in this calculation because the production is explicitly dependent on time.

The potential feedstock supply for biofuel production is calculated as the remained production after domestic consumption for food and other use. The structure of the model is shown below.

[1] Most of the findings presented in this paper were based on the study that has been supported by the Economic Research Institute for ASEAN and East Asia (ERIA) under the *ERIA Research project working group on Asian Potential of Biofuel Markets*, the latest progress of which can be found at http://www.eria.org/research/energy/study-on-asian-potential-of-biofuel-markets.html

[2] Bioethanol and biodiesel of first generation

Results

Aggregation of the results of the 4 countries indicates that under the current policy the 4 countries as a whole is expected to face a shortage of bioethanol. The shortage is estimated to be 11,362 ktoe in 2030. On the other hand, the 4 countries as a whole has a considerable surplus of biodiesel even after government target has been realized. The excessive capacity is estimated to become 34,789 ktoe in 2030.

Besides trade with other countries, the variation on bioethanol and biodiesel market scale and supply potential also indicates that there is a possibility of market for biofuel trade within the 4 countries.

On the other hand, if the market cannot be integreated, the market equilibrium cannot surpass demand or supply. Therefore, the maximum potential of the market of each country without import and export is the smaller number of either demand and supply. This constrained market potentials of bioethanol and biodiesel are calculated and showed in the following figures as the yellow lines at the bottom (which indicate the constrained market potential). The yellow areas are the differences between the integrated potential and the constrained potential. The average annual additional market of biofuels created by regional market integration is estimated to be 6,332ktoe/year (6,885 million kl of diesel equivalent) for biodiesel and 4,931ktoe/year (5,870 million kl of gasoline equivalent) for bioethanol.

Conclusions

The projection results suggest that the 4 ASEAN countries vary greatly on biofuel market scale and supply potential through 2030. If the current policy situation extends in the future, Indonesia is expected to face shortage of bioethanol while has considerable surplus for biodiesel. Malaysia will have no bioethanol consumption or production but as a world top palm producer like Indonesia is projected to have large potential for biodiesel supply. Although Philippines is self sufficient on biodiesel supply due to its large production of coconut, it is expected that the country will face shortage of domestic biodiesel because of its increasing consumption of coconut for food. And the country's shortage of bioethanol is supposed to remain over the outlook period. Thailand has a large capacity for bioethanol production and the country is likely to have substantial surplus of bioethanol even with its increasing domestic consumption. However, given the country's limited plantation area for palm oil, shortage of domestic biodiesel supply have a high chance to happen.

The region as a whole is projected to facing substantial shortage of bioethanol but have considerable surplus of biodiesel. The variation of country's market scale and supply potential indicates that a regional market for biofuel trade will help to achieve effective biofuel utilizaiton within the region. The study results suggest that compared with independent national markets, a regional integrated market of the 4 countries could bring an additional of 11.3 MTOE of biofuel consumption each year, which can result to a reduction of more than 76.8 million barrel crude oil per year. However to establish a regional market for biofuels trading several issues such as common standard of biofuels, and variation of countries' interest to promote biofuels need to be addressed.

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