Database-development, Modeling and Evaluation of Bio-energy in Thailand

Tatsuzo KAWAKAMI*, Yukinobu KOYAMA, Surin NGAEMNGAM and Tetsuo TEZUKA
Department of Socio-environmental Energy Science, Graduate School of Energy Science,
Kyoto University, Yoshida-honmachi, Sakyo, Kyoto 606-8501 Japan
* : Tel: +81-75-753-3300, E-mail: kawakami@eecom.energy.kyoto-u.ac.jp

<Background>

Bio-energy has recently been attracting much attention as the energy-substitute of petroleum. Thai government is also promoting the use of biomass, and set the goal with the increase the percentage of renewable energy in the total primary energy supply. Although biomass is one of the promising candidates of renewable energy in Thailand, it has several shortcomings which differentiate the use of biomass from that of the other energy resources:

(1) the amount of annual production is limited, and depends on the geography, the climate and so on,
(2) the use of biomass is closely related with the use for food and/or fertilizer, and
(3) the price of biomass depends on the balance between the supply and demand and also depends on the prices of the other fuels.

These items mean that the investment in the bio-energy plants may include high risk. It is well known that the subsidy policy for rice-husk-based power generation increased the price of rice husk about 1000 Bahts per ton. Therefore, energy policy for promoting bio-energy in Thailand should be carefully made by totally evaluating the supply stability, biomass-supply market and land use.

<Aim of the study>

This study aims

- to develop the mathematical model considering the current situation about biomass supply and demand and also the energy policies of Thailand, and
- to evaluate the future bio-energy supply from the viewpoints of amount, cost, carbon-dioxide emission and supply stability quantitatively.

<Method>

(1) The databases about various types of biomass supply and characteristics of biomass-conversion technologies are developed.
(2) The mathematical model for bio-energy supply and demand in Thailand is developed. The important point of this process is to leave the modeling information for other researchers and policy makers so that they can understand the contents of this work.
(3) The mathematical model is solved by GAMS (General Algebraic Modeling System) and the simulation results are represented in the format of the energy-balance matrices.
(4) The model simulations are executed and are evaluated under variety of the market situations of biomass resources and bio-energy products as well as the technological characteristics of bio-energy conversion. It should be noted that biomass resources can be used for food and/or fertilizer production. This relationship is also considered in the model simulation.
(5) Recommended are the energy policies about the rules for subsidies, investments and energy markets necessary for the desirable utilization of biomass.

<Results>

The extendable database for model simulation has been made, which includes the data sources and modeling information for other researchers and policy makers so that they can understand the contents of this work. The mathematical model has been developed for estimating carbon-dioxide emission reduction by introducing bio-energy technologies.

The simulation results of the mathematical model are represented in the format of the energy-balance matrices issued by DEDE (Department of Alternative Energy Development and Efficiency, Thailand) for easier comparison of the simulation results with current energy balance in Thailand