

Economics of multi-functional biomass systems

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Aanleiding

The goal of this PhD is to analyze the effect of energy policy and large-scale multi-functional biomass systems on the production of biomass and bio-electricity production, land use, agriculture and the rest of the economy of Poland. Multifunctional biomass systems can take the following forms:

- multiproduct crops;
- cascading of biomass;
- biorefinery technologies;
- mutli-functional biomass plantations.

Methode

To meet the goal of the PhD, a partial equilibrium model is created which analyzes the effect of two different policy instruments (tax on conventional electricity or a tax on emissions) on the above mentioned factors. A general equilibrium model is being created which analyzes the effect of an extra policy measure (tradable emission permits). The underlying assumptions, concerning the yields and availability of by-products used in the calculations are on the 'low side' of the data range extracted from other literature.

Resultaten

Partial Equilibrium model

Two different policy measures have been analyzed (carbon tax and electricity tax). When stimulating bio-electricity and biomass production, the best results are achieved when implementing an electricity tax. Implementing a carbon tax produces better environmental effects than an electricity tax, but is also induces higher welfare losses. Due to factor reallocation the competition between land use for biomass and other, more traditional, use of land (e.g. agri-cultural crops), is not as strong as envisaged in other studies.

Applied general equilibrium model

Within this model a number of different scenarios have been analyzed. Therefore the scenarios are not extensively described. Within this model tradable emission permits are used in combination with different subsidy and tax options. There are a couple of general conclusions valid:

- There is a possible increase in prices for agricultural commodities ranging between 0 and 5%, except for the multifunctional biomass systems;
- The way in which Poland has formulated it's EU agricultural subsidy programme, causes an increase in forestry production. This could increase the amount of bio-electricity due to a bigger availability of woody biomass;
- it can put Poland in a leading position regarding bio-electricity.

Implementing a subsidy on bio-electricity has a large impact on the amount of bio-electricity and induces the least loss in welfare. Moreover, it stimulates a substantial increase in biomass production.

Multi-functional biomass systems can reduce a pressure on the amount of available land. Moreover, thanks to by-products utilization and use of contaminated land for biomass

production, the pressure on agricultural sector is smaller. Keeping in mind that the estimates of by-products are on the lower side, this effect can be enhanced. By-products of agricultural and biomass sectors are used first to produce bio-electricity.

Another possibility is using polluted land which cannot be used for the production of food for producing biomass. This has a large impact on local availability of biomass but contributes very little to the total amount of bio-electricity, since on the large, country, scale the amount of contaminated land is limited. Utilizing this polluted land increase polish potential to become an exporting country of biomass and bioelectricity. Besides the mentioned effects, the polluted land is being cleaned when using the land for the production of biomass. This is caused by a process called phytoremediation.

Implementing advance technologies that require biomass (and what follow, needing land) as a resource for the production of goods (biorefinery systems producing bio-nylon and 1,3PDO) can cause a strong competition between biomass for the production of bio-electricity and biomass used in the biorefinery. The cascading system associated with biorefinery products enhances slightly this effect. The effect of implementing these technologies on the amount of bio-electricity is limited. Therefore the focus should lay on dedicated biomass plantations for the production of energy crops, though the by-products and contaminated biomass should be utilized.

Consequenties en aanbevelingen

International targets did not stimulate the bio-energy production in Poland, since Poland already complied with Kyoto requirements. Furthermore, the current policies are not likely to be sufficient to stimulate the production of biomass and bio-energy.

When subsidizing bio-electricity and biomass production combined with a low level of emission reduction increases the share of bio-electricity at smaller welfare losses than using tradable emission permit alone.

The least amount of welfare losses occur when taxing conventional electricity production and transferring the revenues in a lump-sum manner to the private households.

Meer informatie

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