Market Dynamics of Allocating Land to Biofuel and Forest Sinks

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Abstract: Large scale use of biofuel, that is fuel derived from biological materials, especially in combination with reforestation of big areas, can lead to low cost reduction of atmospheric carbon dioxide level. In this paper a model of three markets – fuel, wood products and land – is considered with the aim to evaluate the impact of large scale biofuel production and forestry on the markets and to estimate the cost of a policy aimed at the reduction of the carbon content in the atmosphere. It is shown that the cost is lower than has been expected previously.

Keywords: Kyoto Protocol; Biofuel; Carbon sequestration

1. INTRODUCTION

It has been suggested [Read, 1994] that large scale biofuel production, especially in combination with sequestration forestry, can achieve low cost reduction in greenhouse gas levels, in particular CO_2, and hence lead to meeting the ultimate objective of the Framework Convention on Climate Change (FCCC) – to "stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".

Biofuel (fuel derived from biological materials) displaces fossil fuels and thus, through fossil fuels not extracted, prevents release of underground fossil carbon. Biofuel is the only renewable fuel providing chemically stored energy of the kind to which the current energy supply system has become adapted and can potentially substitute for fossil fuel with minimal infrastructural change, providing a backstop technology until other innovative technologies can take a sufficient market role.

Forestry offer a large mitigation potential with modest costs, low risk and other benefits and is one of the few 'no regrets' opportunities available in most countries all over the world [Kohlmaier et al., 1997]. The Kyoto Protocol's Article 3.3 recognises enhancing forest sinks as a mean of meeting the proposed emissions reduction commitments entered into for 2008–2012 by Annex 1 Parties to the FCCC. This places forestry alongside biofuel production as a land using activity that can – within the jurisdictions of these Parties, and possibly elsewhere through cooperation with other Parties – be encouraged to achieve the ultimate objective of the FCCC. Such a policy assumes a large-scale intervention in the allocation of land as well as in the energy market. This leads to the question what will be the costs and consequences of such a policy. It is believed that the first attempt to model the interacting market impacts of policy-specified land use changes that are focused on carbon mitigation, including biofuel production and sequestration forestry together, was the FLAMES model (Fuel/Forest/Food Land Allocation Model for Energy/Environment Sustainability) [Read, 1997]. FLAMES is a partial equilibrium model of three interacting markets – energy, forest products and land – under action of large scale land allocation for biofuel production and sequestration forestry. In this paper we report further development and refinement of the model.

The main objective of this paper is to model the impact of large-scale biofuel production on the world fuel and conventional wood products markets and to estimate the cost of a policy aimed at the reduction of the carbon content in the atmosphere by means of