Bio-electricity and Land Use in the Future Agricultural Resources Model (FARM)

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Abstract

Bio-electricity is an important technology for Energy Modeling Forum (EMF-27) mitigation scenarios, especially with the possibility of negative carbon dioxide emissions when combined with carbon dioxide capture and storage (CCS). With a strong economic foundation, and broad coverage of economic activity, computable general equilibrium models have proven useful for analysis of alternative climate change policies. However, embedding energy technologies in a general equilibrium model is a challenge, especially for a negative emissions technology with joint products of electricity and carbon dioxide storage. We provide a careful implementation of bio-electricity with CCS in a general equilibrium context, and apply it to selected EMF-27 mitigation scenarios through 2100. Representing bio-electricity and its land requirements requires consideration of competing land uses, including crops, pasture, and forests. Land requirements for bio-electricity start at 200 kilohectares per terawatt-hour declining to approximately 70 kilohectares per terwatt-hour by year 2100 in scenarios with high bioenergy potential.

Keywords: biomass, bio-electricity, land use, carbon dioxide, general equilibrium