# ECONOMIC GAINS AND GREENHOUSE GASES EMISSIONS OF A BIOFUEL SUPPLY CHAIN IN TENNESSEE

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## Abstract

Expediting the development of domestic renewable energy sources is a major focus of national energy plan in the United States. The economic viability of a cellulosic biofuel industry is directly related to the costs incurred in a biofuel supply chain (BSC) of biomass feedstock and biofuels. Environmental factors, such as greenhouse gas (GHG) emissions, incurred in the BSC are also key to the sustainability of the industry. The objective of this study was to evaluate the net present value (NPV) of cash flows and GHG emissions of switchgrass-based BSC that replaces 20% of transportation fuel in Tennessee. A mixed-integer mathematical programming model incorporating high resolution spatial data was used to determine the optimal location and capacity of conversion facilities and associated feedstock draw area over 20 years. Results showed the BSC system generated more than $5.5 billion over 20 years when the NPV was maximized. An average of 2.1 billion $CO_2$e Mg of GHG emissions was also produced per year. When minimizing the GHG emissions in the switchgrass-based BSC, supplying 20% of transportation fuel per year would produce an annual average of 1.8 billion $CO_2$e Mg of GHG emissions. However, the BSC's total economic gains of $4.1 billion over 20 years were less compared to the NPV maximization case. The location of conversion facilities and feedstock draw areas varied considerably between the two cases due to land coverage selection. This study helps to balance the economic and environmental considerations when developing large commercial biofuel operations in Tennessee and the Southeast.