

Brief Description of Sun Grant Project

Modeling and analysis of the logistical challenge of supplying biomass for biofuel and biopower

Bruce A McCarl, Texas A&M University

Neil Geismar, Texas A&M University

Yuan-Yao Lee, Texas A&M University

Stephen Searcy, Texas A&M University

Jeff Vitale, Oklahoma State University

This project developed methods to improve efficiency of biomass supply chains with a long term goal of reducing final product cost by 15% enhancing market penetration plus improving sustainability while aiding in meeting greenhouse gas and other goals. Additionally, the project materials could possibly contribute toward achieving bioeconomy goals in the South Central region exploiting regional biomass availability while producing liquid fuels and power.

The project developed a model for the design of logistical, supply chain systems that exploit regional seasonality of biomass supply and examined whether feedstock diversification lowers storage needs. We also looked at yield risk management and means for reduction in logistics cost. The project considered perennial grasses, woody biomass, agricultural residues and logging residues.

In pursuing this project a number of goals and research questions were addressed:

1. We developed a comprehensive modeling framework that simultaneously considered feedstock location, seasonality, yield uncertainty, depots and their location, storage as an uncertainty buffer, densifying equipment, multiple feedstocks, storage options and demand limited to a region versus external demands.
2. We implemented the model for at least two now completed case studies in Texas with an ongoing one in Oklahoma.
3. We used the case study models to study the optimal logistics system plus the benefits of using or omitting possible logistics components.
4. We on this web page are releasing the study results and modeling framework
5. We have discussed the modeling and results with EXXON plus made the files accessible to them and will notify other industry and government contacts about its availability.

Methodology

In the modeling optimization based integer and stochastic programming are used coupled with spatial analysis. The model minimizes cost offset by pelleting revenue under risk.

The model includes multiple production locations; production of conventional crops, residues, dedicated energy crops, and trees on crop and marginal land; densification; storage; conversion scenarios; depots; stochastic feedstock yields; seasonal variation in harvest time; optimized depot location plus installed storage and preprocessing equipment; densifying equipment; use of more than one feedstock; densifying options; storage options; preprocessing options; external demands for transportable feedstock; and capability to study implications with and without depots, preprocessing, and forms of storage,

We conducted two case studies. One in the Texas High plains with residue and one in East Texas where wood is available in locations with sufficient biomass according to the billion ton study. In east Texas we also consider an area where energy crops and forests can be simultaneously drawn upon plus where energy crops can be grown on marginal lands.

For more information

See the website <http://agecon2.tamu.edu/people/faculty/mccarl-bruce/logistics.html>