

SEMINAR
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11:00 – 12:00 pm
Seminar Room 4080 AIR Building

BIOFUEL SUPPLY CHAIN DESIGN UNDER AGRICULTURAL
LAND USE COMPETITION AND GOVERNMENT REGULATIONS

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Abstract

The rapid expansion of the U.S. biofuel industry diverts a large amount of farm land into energy feedstock production, and in turn affects food, energy and land market equilibria, as well as agricultural economic development in local areas. In this talk, we present Stackelberg-Nash game models that incorporate farmers' decisions on land use and market choice into the biofuel manufacturers' supply chain design problem. The models determine the optimal number and locations of biorefineries, the required prices for these refineries to compete for feedstock resources, as well as farmers' land acquisition and production decisions. We also introduce government farmland use regulations that aim at balancing food and energy production and marginal land use, and a cap-and-trade implementation mechanism. Spatial market equilibrium is utilized to model the relationship between crop supply and demand and the associated price variations in local food markets. We develop solution approaches that transform the original discrete mathematical program with equilibrium constraints into a mixed integer quadratic programming problem, and explore adaptive decomposition methods based on Lagrangian and linear relaxations. The proposed methodologies are illustrated with an empirical case study of the Illinois State. The computation results reveal interesting insights into optimal land use strategies, government regulations, and supply chain design for sustainable development of the emerging "biofuel economy."

(Joint work with Yun Bai and Jong-Shi Pang)

Yanfeng Ouyang is an associate professor and the Paul F. Kent Endowed Faculty Scholar of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign (UIUC). He received his Ph.D. in civil engineering from the University of California at Berkeley in 2005. His research interest mainly focuses on the areas of transportation and logistics systems, interdependent infrastructure systems, traffic flow theory and operations, and applications to renewable energy, sensor, and agricultural systems. He currently serves as a department editor of IIE Transactions (Focused Issue on Operations Engineering and Analytics), an associate editor of Transportmetrica B, a guest editor of Transportation Research Part B (special issue), and he is on the editorial advisory board of Transportation Research Part B and the Journal of Infrastructure Systems. He received the Faculty Early Career Development (CAREER) Award from the U.S. National Science Foundation in 2008, the High Impact Project Award from the Illinois Department of Transportation in 2014, the Engineering Council Outstanding Advisor Award from UIUC in 2014, the Xerox Award for Faculty Research from UIUC in 2010, and the Gordon F. Newell Award from Berkeley in 2005.