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Biobased Products: The Sustainability Solution? Insights from the [*Journal of Industrial Ecology*](#)

Interest in the use of agricultural products and wastes for energy and industrial materials is growing throughout the world. Optimists foresee a new system of production that will produce a virtuous cycle of benefits for the environment and society. Envisioning a return to renewable raw materials in lieu of feedstocks and fuels based on petrochemicals, they predict a reduction in demand for fossil fuels, a decrease in greenhouse gas emissions, as well as the mitigation of a host of other environmental threats.

A more pessimistic outlook for the bioeconomy also exists, which foresees the increased use of synthetic fertilizers, a related reduction in water quality, and an increase in soil erosion and greenhouse gas emissions.

Emerging research, published in the prestigious *Journal of Industrial Ecology* (and available free in full text at <http://mitpress.mit.edu/jie/bio-based>) examines the environmental implications—good and bad—of increased use of biobased materials and fuels using the concepts and tools of industrial ecology.

Articles in the special issue analyze the opportunities, processes, and environmental impacts of biofuels, bioplastics, biolubricants, and biosurfactants. Government initiatives to support biobased products are summarized and leading biobased product companies are profiled. The special issue also features a look at the predecessor to today's efforts to make greater industrial use of agricultural crops and residues, the American chemurgy movement of the 1920s and 30s.

Research published in this issue suggests:

- New analysis methods can, without detailed product-specific information, predict the environmental performance of bioproduction strategies such as capacity to displace fossil fuel use. These tools can rapidly screen new processes and identify promising opportunities.
- Surprisingly, making composite materials and plastics from biobased resources is superior to energy production from energy crops, in terms of energy savings and greenhouse gas emissions, when these impacts are computed per unit of agricultural land rather than per unit of product.
- Using ethanol fuel made from corn stover, the residues left over in corn fields after the grain is harvested, to produce a mixture of ethanol and gasoline (known as “E85”), can yield important benefits. For each kilometer fueled by the ethanol, the car uses 95% less petroleum. Total fossil energy use (coal, oil, and natural gas) and greenhouse gas emissions are lower on a life-cycle basis. Air quality impacts are mixed, however, with some pollutants increasing and others decreasing.

Robert Anex, associate professor of agricultural and biosystems engineering at Iowa State University in Ames, Iowa, USA, served as the guest editor for the special issue. Support for the special issue was provided by the U.S. National Institute of Standards and Technology (NIST).