

# CAREER: Models for Supply Chain Design and Logistics Management of Biofuels

**Principal Investigator: Sandra D. Eksioğlu**

My *long-term research goal* is to help build the infrastructure that is necessary to switch from using petroleum to using biofuels as a source of renewable and sustainable energy. In particular, *the research objective* of this CAREER proposal is to increase the practicality of biofuels as a source of energy by building integrated supply chain design and management systems. In pursuit of this objective, I propose the following two research areas: 1. *Supply chain design* problems. The models I propose *integrate location decisions with transportation and inventory management decisions*. 2. *Production and distribution* problems. I propose a multi-criteria optimization approach to biomass planning that *minimizes costs* in the supply chain and *maximizes the positive impact to the environment*.

The *educational objective* of this CAREER proposal is to help our undergraduate and graduate students gain knowledge and research experience needed to be successful in their profession and get K–12 students excited about engineering. In pursuit of this objective, my efforts will concentrate in the following three areas: 1. *Education*. I plan to enrich the educational experience of our undergraduate and graduate students by enhancing the existing curricula and providing research experience. 2. *Outreach Activities*. The targets of outreach activities planned are minorities, women, and high school students. 3. *Industry*. I plan to establish strong collaboration with industry partners by delivering workshops; organizing on-site visits; and participating in regional working groups and boards that deal with issues about sustainable energy.

***Intellectual Merit.*** Bioenergy has been recognized as one of the future power sources in the U.S. that will reduce the nation’s dependency on petroleum, thereby having a positive impact on the economy, environment, and society. It is expected that production of renewable energy will increase from 9 bgy (billions of gallons per year) in 2008 to 36.0 bgy by 2022. The U.S. government plans to make substantial invests in the next few years to support construction of bio-based refineries.

This proposal is *creative and original* because, unlike in the case of industrial products, no studies exist that take an integrated view of biomass supply systems. The main outcomes of this research are supply chain models for biomass that (1) reflect the specific nature of supply; (2) take an integrated view of production, transportation, and inventory; and (3) integrate strategic, tactical, and operational decisions.

The contribution of this proposal will be a well-coordinated supply chain model for supplying biomass. This contribution is *significant* because it is expected to increase the feasibility of biofuels as a renewable and sustainable source of energy. Using innovative biomass supply options and logistical arrangements is beneficial because it will reduce the cost and uncertainty related to producing bioenergy. Other industries, such as the personal computer industry, have already taken advantage of sophisticated supply chain designs. The models and solution approaches I propose will contribute not only to the area of supply chain design but also to the energy science literature. I also expect that my research program, when integrated into departmental teaching, will create a “magnet” for students that will serve to attract and motivate them.

***Broader Impacts.*** This research will significantly advance the knowledge base needed to address supply chain design and management problems for biomass. The outcomes of this research will be *broadly disseminated* through peer-reviewed publications and presentations at local, national, and international professional conferences. In addition, the research results will find a wide range of applications as most of the problems discussed are motivated by biofuels industry. One of the most positive aspects of the proposal is the *integration of teaching and research* through the development of case studies. In addition to integrating the research findings in the classroom, I will involve in my research undergraduate and graduate students who are members of *minorities and other underrepresented* groups. This proposal will enhance the *infrastructure for research* in our institution by establishing collaborations with industrial partners. Finally, this research is expected to *benefit society as a whole* as it is in accord with the nationwide efforts in developing sustainable and renewable sources of energy. This effort is a reflection of the rising awareness of the consequences of climate change; the desire to improve energy sustainability; and the need to create new jobs in rural areas. The proposed research has the potential of creating substantial *economic value for farmers and biorefineries*.