

SUSTAINABLE ENERGY AND TRANSPORTATION: ENGINEERING IN THE 21ST CENTURY

Mark Holtzapple

Texas A&M University, College Station, TX, USA

Developing sustainable energy systems for transportation is a key challenge of the 21st century. As world population grows and standards of living improve, more demands are placed upon finite oil reserves. Because it takes decades to implement new energy technologies, we must develop sustainable energy technologies now.

To meet this challenge, we are developing a process that transforms biomass (e.g., municipal solid waste, sewage sludge, manure, agricultural residues, energy crops) into liquid transportation fuels. In the process, biomass is treated with lime to enhance digestibility. Then, the lime-treated biomass is directly fermented to mixed carboxylic acids (e.g., acetic acid), which are concentrated and chemically converted to alcohol fuels (e.g., isopropanol). Our economic evaluations indicated that the alcohol fuels are economical. Further, biofuels do not produce net carbon dioxide emissions, which helps address global warming.

To reduce the “footprint” needed to produce the biomass, we are also developing a high-efficiency StarRotor engine, which will potentially triple the fuel mileage of automobiles. Because it uses the same thermodynamic cycle employed by jet aircraft, it is power dense. Other potential advantages include extremely low pollution, multi-fuel capability, low maintenance, long life, and quiet operation.