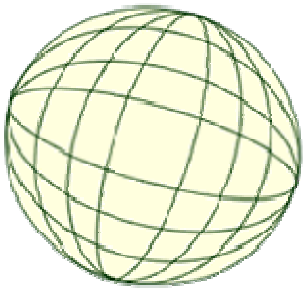
Carnegie Mellon

Ethanol as an Alternative Fuel

Lester B. Lave and W. Michael Griffin



http://gdi.ce.cmu.edu

Background

The US emits 25% of the world's anthropogenic greenhouse gases. The generation of electricity and production and use of transportation fuel accounts for almost 70% of all US CO_2 emissions. We are examining ways to abate transportation related CO_2 emissions and reduce petroleum consumption by adopting alternative fuels and shifting some of the transportation energy to the electricity grid. Converting some petroleum use to renewable biomass resources and electricity is appealing but the approach brings with it important questions;

(1) What is the best use of limited biomass resources?

(2) How does the US replace over 140 billion gallons of gasoline use in a timely fashion, maximizing the greenhouse gas emission reductions and accounting for energy security issues?

(3) Can electricity generation meet the demands for lowering CO_2 emissions while handling demand growth and transportation related electricity demand?

(4) Can we achieve these goals without locking the US into a technology that might prevent adoption of future new technologies?

Work in this area is current funded by NSF and the Blue Moon Fund – www.bluemoonfund.org.

Approach

Corn ethanol production is limited by competition for farm land as well as markets for its co-products (distillers dry grain). Current thinking suggests that production is limited to around 16 billion gallons of ethanol. After this point other sources of ethanol would be needed to meet demand. Cellulosic ethanol is one prospect, as well as importing ethanol from Brazil.

Corn derived ethanol can reduce petroleum use but only marginally reduces greenhouse gas emissions. Cellulosic ethanol and sugarcane ethanol use could result in petroleum reduction and have a major impact on CO_2 emissions. We are currently developing models that explore the life-cycle impacts of supplying various combinations of the three sources of ethanol throughout the US minimizing costs and/or CO_2 emissions.

Informing this work is a joint project with colleagues at the State University of Campinas in Brazil. Brazil has the capacity to produce billions of gallons of ethanol from sugar cane and bagasse and we are exploring the idea of expanding Brazil's ethanol supply and exports.

Results from this work will be compared to previous analyses from the group on biomass co-firing and alternative fuels for electricity generation to determine the “best use” of limited biomass resources.

References

Rogério Cezar de Ceryeira Leite, Manoel Regis Lima Verde Leal, Luis Augusto Barbisa Cortez, W. Michael Griffin, Mirna Ivonne Gaya Scandiffio. 2007. Can Brazil Replace 10% of the 2025 Gasoline World Demand with Ethanol. Energy, Submitted.

Heather Wakeley, Michael Griffin, Chris Hendrickson, and H. Scott Matthews. 2007. Alternative Transportation Fuels: Distribution Infrastructure for Hydrogen and Ethanol in Iowa. ASCE J. of Infras Systems, Accepted.

Morrow, W.R., W. Michael Griffin, and H. Scott Matthews. 2007. State-level infrastructure and economic effects of switchgrass co-firing with coal in existing power-plants for carbon mitigation. ES&T, In press.

Griffin, W. Michael and Lester Lave. 2006. Cellulosic Ethanol in an Oil and Carbon Constrained World. pp 21- 30. In: A High Growth Strategy for Ethanol. Aspen Institute. Wash., D.C.

Lave, Lester B. and W. Michael Griffin. 2006. Importing ethanol solves many problems. Issues Sci. Tech. Spring:40-42.

For more information contact:

Lester B. Lave
(412) 268-
ll01@andrew.cmu.edu

W. Michael Griffin
(412) 268- 2299
griffinm@cmu.edu