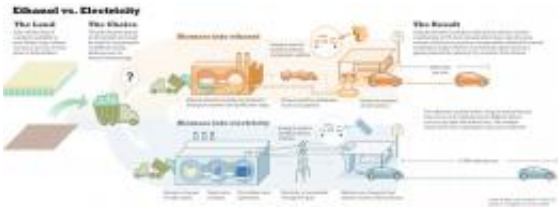
Ethanol vs. Electricity: Biomass converted into electricity could be more efficient than ethanol (w/Video)

May 7 2009



Ethanol vs. Electricity. Credit: McDade & Campbell/UC Merced

(PhysOrg.com) -- Concerns over petroleum gas prices and long-term effects of greenhouse gas emissions on the environment have prompted scientists to look for alternative renewable energy sources for transportation use. One of the questions at hand is determining what that preferred technology should be.

Scientists are examining biomass - plant matter that's grown and used to generate energy - as a potential power source. Two biomass technologies involve ethanol and electricity. Biomass converted into ethanol, a corn-based fuel, can power internal combustion vehicles. Biomass converted into electricity can fuel a vehicle powered by an electric battery.

A study by University of California, Merced, Assistant Professor Elliott Campbell and two other researchers in the May 8 issue of the journal

Science suggests that biomass used to generate electricity could be the more efficient solution.

In the study, Campbell, along with Christopher Field of the Carnegie Institution's Department of Global Ecology and David Lobell of Stanford University, the scientists found that biomass converted into electricity produced 81 percent more transportation miles and 108 percent more emissions offsets compared to ethanol.

In other words, said Campbell, vehicles powered by biomass converted into electricity "got further down the road" compared to ethanol. As a result, Campbell continued, "we found that converting biomass to electricity rather than ethanol makes the most sense for two policy-relevant issues, transportation and climate."

The scientists based their study on two criteria: miles per area cropland and greenhouse gas offsets per area cropland. In both cases, scientists considered a range of feedstock crops (corn and switchgrass0 and vehicle types (small car, midsize car, small SUV and large SUV.

First, they looked at how many miles a range of vehicles powered by ethanol could travel versus a range of electric vehicles fueled by electricity. Second, they examined offsets to greenhouse gas emissions for ethanol and bioelectricity. Land use is an important factor to consider when evaluating each method. Globally, the amount of land available to grow biomass crops is limited. Using existing croplands for biofuels could cause increases in food prices and clearing new land, or deforestation, can have a negative impact on the environment.

The authors are careful to point out their study looked at two criteria, transportation and greenhouse gas offsets, but did not examine the performance of electricity and ethanol for other policy relevant criteria.

"We also need to compare these options for other issues such as water consumption, air pollution and economic costs," Campbell said.

Campbell joined UC Merced as an assistant professor in the School of Engineering in 2008. He earned bachelor's and master's degrees at Stanford University and his Ph.D. from the University of Iowa. Prior to joining UC Merced, Campbell received national attention for another study that concluded the United States Could meet up to 6 percent of its energy needs with biofuels produced on abandoned or degraded agricultural land.

More information: A copy of Campbell's abstract can be viewed online at sciencemag.org/

Source: University of California - Merced