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Biofuels vs. Biomass Electricity

Findings show that turning biomass into electricity is more beneficial than turning it into transportation fuels.

By Tyler Hamilton

A study published today in *Science* concludes that, on average, using biomass to produce electricity is 80 percent more efficient than transforming the biomass into biofuel. In addition, the electricity option would be twice as effective at reducing greenhouse-gas emissions. The results imply that investment in an ethanol infrastructure, even if based on more efficient cellulosic processes, may prove misguided. The study was done by a collaboration between researchers at Stanford University, the Carnegie Institute of Science, and the University of California, Merced.

There's also the potential, according to the study, of capturing and storing the carbon dioxide emissions from power plants that use switchgrass, wood chips, and other biomass materials as fuel--an option that doesn't exist for burning ethanol. Biomass, even though it releases CO_2 when burned, overall produces less carbon dioxide than do fossil fuels because plants grown to replenish the resource are assumed to reabsorb those emissions. Capture those combustion emissions instead and sequester them underground, and it would "result in a carbon-negative energy source that removes CO_2 from the atmosphere," according to the study.

The researchers based their findings on scenarios developed under the Biofuel Analysis Meta-Model (EBAMM) created at the University of California, Berkeley. The analysis covered a range of harvested crops, including corn and switchgrass, and a number of different energy-conversion technologies. Data collected were applied to electric and combustion-engine versions of four vehicle types--small car, midsize car, small SUV, and large SUV--and their operating efficiencies during city and highway driving.

The study accounted for the energy required to convert the biomass into ethanol and

electricity, as well as for the energy intensiveness of manufacturing and disposing of each vehicle type. Bioelectricity far outperformed ethanol under most scenarios, although the two did achieve similar distances when the electric vehicles--specifically the small car and large SUV--weren't designed for efficient highway driving.

The potential is even greater for the bioelectricity option because under the EBAMM model, "we did not account for heat as a [usable] by-product, which would make the electricity pathway even more advantageous," says Elliott Campbell (http://faculty.ucmerced.edu/ecampbell3/index.html) , lead author on the study and an assistant professor at the Sierra Nevada Research Institute, part of the University of California, Merced.

Mark Jacobson, a professor of civil and environmental engineering at Stanford University, conducted a similar but much broader study (http://news-service.stanford.edu/news/2009/january7/power-010709.html) released in December that focused more on the environmental effects of various energy options. He doesn't support using biomass for either electricity generation or ethanol production but says that he isn't surprised to find that the ethanol option performed worst.

Burning biomass, says Jacobson, "is not necessarily an efficient way of generating electricity, but it's more efficient than making biofuel." It just makes sense, he adds: "Electric vehicles are four to five times more efficient than combustion vehicles."

But Vincent Chornet, president of Montreal-based cellulosic ethanol producer Enerkem (http://www.enerkem.com/) , says that it would be a mistake to pick winners: there's room for both options. In places where the infrastructure isn't capable of supporting the mass charging of electric cars, next-generation biofuels are the only other option, he says. Adding biofuels also offers a solution for air travel and heavy transportation that electricity and the current state of battery technology can't address.

Upcoming Events

Lab to Market Workshop
(http://www.technologyreview.com/emtech/09/workshop.aspx)
Cambridge, MA
Tuesday, September 22, 2009
http://www.technologyreview.com/emtech/09/workshop.aspx

(http://www.technologyreview.com/emtech/09/workshop.aspx)

EmTech 09 (http://www.technologyreview.com/emtech)
Cambridge, MA
Tuesday, September 22, 2009 - Thursday, September 24, 2009
http://www.technologyreview.com/emtech
(http://www.technologyreview.com/emtech)

Nanotech Europe 2009 (http://www.nanotech.net)
Berlin, Germany
Monday, September 28, 2009 - Wednesday, September 30, 2009
http://www.nanotech.net (http://www.nanotech.net)

2009 Medical Innovation Summit
(http://www.ClevelandClinic.org/innovations/summit)
Cleveland, OH
Monday, October 05, 2009 - Wednesday, October 07, 2009
http://www.ClevelandClinic.org/innovations/summit
(http://www.ClevelandClinic.org/innovations/summit)

Optimizing Innovation 2009 (http://www.connecting-group.com/Web/EventOverview.aspx?Identificador=6)
New York, NY
Wednesday, October 21, 2009 - Thursday, October 22, 2009
http://www.connecting-group.com/Web/EventOverview.aspx?Identificador=6
(http://www.connecting-group.com/Web/EventOverview.aspx?Identificador=6)