

The pluses and (mostly) minuses of biofuels

February 23 2009, By Robert Sanders



Cornfield waste, or stover; perennials grown on marginal land; or municipal waste, ranging from kitchen scraps to cardboard, could be used as feedstocks to produce ethanol using cellulosic technology.

Speakers at last week's AAAS meeting presented abundant evidence that tropical rainforest destruction has accelerated in recent years, at least in part because of the worldwide push to produce more biofuels.

As Europe and America rush to supplant polluting fossil fuels with plant-derived fuels like ethanol, soy and palm oil, farmers in the tropics are accelerating forest clearing to plant more sugarcane, soybeans and palm trees to meet the demand. What should be carbon-neutral biofuels - the carbon dioxide these plants take in while growing is returned to the atmosphere when they're burned, resulting in zero net carbon release - end up spewing more CO₂ into the atmosphere as forests are slashed and burned.

Carbon dioxide is such a potent greenhouse gas that one recent study estimated it will take hundreds of years to recoup the greenhouse gas

damage of clearing rainforests to grow and harvest plants for biofuels.

In one session, Michael Coe of Woods Hole Research Center in Massachusetts illustrated one ripple effect from the stampede to create more ethanol from corn in the United States. As corn prices skyrocketed several years ago, soybean fields were converted to corn, and the price of soy rose. As a result, farmers in Brazil, one of the main countries with the soil, climate and infrastructure to make up the difference, began to bulldoze rainforest to grow more soybeans.

"If reduced U.S. soybean production results in a parallel increase in Brazilian soybean production, a potential net release of 1,800 to 9,100 Tg (trillion grams) of CO₂-equivalents of greenhouse gas emissions due to land-use change is possible," Coe wrote in a summary of his talk. That is equivalent to more than 9 billion metric tons of carbon dioxide.

Bulldozing Indonesian rainforests to plant oil palms

In the same session, Holly Gibbs of Stanford University reported that, despite assurances by biofuel producers that biofuel crops are being grown on degraded or already cleared lands, forest clearing throughout the tropics has increased. In Indonesia and Malaysia, especially, deforestation has accelerated as farmers scramble to plant oil palms to supply Europe with biodiesel fuel.

While growing crops on degraded land "would be restoring the land to a higher potential to provide environmental services for people," she said, "if biofuels are grown in place of forests, we're actually going to end up emitting a huge amount of carbon."

In the face of these reports that biofuels are worsening global warming, Dan Kammen, a UC Berkeley professor of energy and resources and director of the Renewable and Alternative Energy Laboratory, tried in a

Feb. 14 session to put biofuels into perspective.

"No matter what people say about the good or bad aspects of a given fuel, whether it's oil, tar sands, biofuels, solar or wind, the fact is, a large number of these will be used for economic reasons, based on subsidies, momentum, vested interests, whatever," he said in his talk, "A Hunger for Power: The Global Nexus of Energy and Food." The key, he said, is to design global models that will guide policy makers in making the right choices.

The country has to develop models that allow us to assess "biofuel demand from a global perspective. You can't just look at it in terms of what happens on a hectare of land in Iowa, but also in terms of the conflicts between food, fiber, fuel and nature," Kammen said.

With regard to biofuels, Kammen was in agreement with the scientists reporting the negative aspects of biofuels in use today.

From a global perspective, he said, it's clear that "if we pursue the path we are on, it is an environmental and food security loser." Based on a soon-to-be-published study by Kammen and colleagues at Purdue University, no matter how sustainably the United States grows corn for ethanol, it will have a negative impact on greenhouse gases because of the growth of soy in tropics.

Leading the way to cellulosic

Research programs like UC Berkeley and LBNL's Energy Biosciences Institute, funded last year by oil giant BP to the tune of \$500 million over 10 years, are developing such models at the same time as they are pursuing next-generation biofuels. Cellulosic biofuels, made by more complete fermentation of biofuel feedstocks, won't be commercially viable for 5-10 years, but they and other technologies, including algae,

are attractive options that together may combine to produce as much as 10 percent of the nation's energy needs, he said.

“None is a home run individually, but if together they could be done sustainably, they are big enough opportunities that there will be strong economic forces to develop a range of them,” said Kammen.

He held up California as an example of what the nation and the world can do to reduce greenhouse gas emissions using biofuels as one part of a broad “energy portfolio.” The state's AB 32, passed in 2006, presents a framework for reducing carbon emissions, with the 2020 goal of returning California emissions to what they were in 1990, which would amount to slightly more than a 25 percent reduction from current emissions.

More importantly, a 2005 executive order by Gov. Arnold Schwarzenegger established the goal of reducing carbon emissions 80 percent by 2050, which is the number that “those of us who work with the IPCC (Intergovernmental Panel on Climate Change) have effectively endorsed, not as a solution to global warming, but as the best soft landing; the beginning of what we want to get to,” Kammen said.

Combined with California's low carbon fuel standard, which addresses carbon emissions from vehicles, and the state's developing renewable energy portfolio, which mandates that 33 percent of the state's electricity come from zero-carbon sources by 2020, California has created a model for the nation. In fact, he said, “a version of California's plan, scaled up to the size of the nation, is Obama's evolving federal plan - the endpoint numbers are about the same, though the paths are not yet set.”

While Kammen admitted that he expects biofuels to be replaced by better and sustainable sources of energy within 50 years, for now they will remain part of a portfolio that will include solar and wind as well as

coal, oil and nuclear power.

“We, as a nation, need to use what is happening in the U.S. West and in California as an example of the context in which biofuels are being explored,” said Kammen.

Provided by UC Berkeley

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