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A Biofuel Debate: Will Cutting Trees Cut Carbon?

By Eduardo Porter
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Does combating climate change require burning the world's forests and crops for fuel?

It certainly looks that way, judging from the aggressive mandates governments around the globe have set to incorporate bioenergy into their transportation fuels in the hope of limiting the world's overwhelming dependence on gasoline and diesel to move people and goods.

While biofuels account for only about 2.5 percent today, the European Union expects renewable energy — mostly biofuels — to account for 10 percent of its transportation fuel by 2020. In the United States, the biofuel goal is about 12 percent by early in the next decade. The International Energy Agency envisions using biofuels to supply as much of 27 percent of the world's transportation needs by midcentury.

The reasons for such ambitions are clear: It is nearly impossible under current technology to run cars, trucks, ships and jet planes on energy generated from wind or sun.

What is more, bioenergy is now being drafted to make electricity. Last November, officials at the Environmental Protection Agency issued a policy memo widely seen as encouraging the harvest of forests to produce power by treating it as a carbon-free source.

There is a big problem with this strategy, though. An economist would say that it ignores the "opportunity costs" of deploying vegetation as a source of energy. Others call it double counting.

"Dedicating land to bioenergy always comes at a cost because that land cannot produce plants for other purposes," said Timothy Searchinger, a researcher at Princeton and the World Resources Institute and a co-writer of a recent report that calls for a rollback of crops dedicated to biofuels.

In a nutshell, says Mr. Searchinger, the energy from forests and fields is not, in fact, carbon-free.

The argument for aggressive deployment of bioenergy assumes that it is carbon-neutral because plants pull CO_2 back from the air when they grow, offsetting the carbon emitted from burning them as fuel. But diverting a cornfield or a forest to produce energy requires not using it to make food or, just as important, to store carbon.

"Burning biomass instead of fossil fuels does not reduce the carbon emitted by power plants," a group of 78 scientists wrote on Monday to Gina McCarthy, the E.P.A.'s director, warning against the new power plant policy. "Burning biomass, such as trees, that would otherwise continue to absorb and store carbon comes at the expense of reduced carbon storage."

Used cooking oil can be collected from restaurants, to be recycled into biofuels. Justin Sullivan/Getty Images

If the critics are right, the hunt for biomass on a large scale could vastly change the world's land use, food supply and ecosystems while helping little to prevent climate change.

The argument for caution has so far mostly fallen on deaf ears. The reason is that policy makers see little choice.

Last year, the Intergovernmental Panel on Climate Change rendered its latest assessment of scientists' collective understanding of how to slow the pace of global warming. Riddled with the usual uncertainties of science, it seemed pretty certain of one thing: Doing it without biofuels would be much harder.

Absent a big increase in bioenergy supplies, the climate change panel's analysis reported, it would cost about two-thirds more, on average, to prevent the earth's temperature from rising more than 2 degrees Celsius above preindustrial levels, generally considered the tipping point for climatic upheaval.

The availability of biofuels makes more difference to the ultimate price tag, the panel concluded, than whether electricity generation can be harnessed successfully to the sun and wind. Only carbon capture and storage technology is more important.

In most of the climate change panel's models that bring temperatures back under the 2-degree ceiling by the end of the century, biofuels are assumed to produce about 250 to 350 exajoules of energy a year.

To put that in context, 300 exajoules is over half the world's current energy consumption. Today, the energy content of all the biomass harvested for food, fodder and everything else amounts to about 220 exajoules.

The question is, Where will the land to produce all this additional vegetation come from?

As a committee of the European Environmental Agency noted, to reduce the amount of CO_2 in the air, bioenergy production "must increase the total amount of plant growth, making more plants available for energy use while preserving other benefits."

André Faaij, an expert on energy systems at the University of Groningen in the Netherlands and author of many important assessments used by the panel on the potential for bioenergy, argues that it is definitely feasible.

The world could feed 35 billion people (the earth's current population is seven billion) if only the productivity of agriculture and livestock in the developing world were brought to developed country standards, he said. "Mozambique could feed all of Africa if it just increased its productivity to that of the Netherlands."

Dried distillers grains are a byproduct of the making of ethanol.
Jeffrey M. Smith/The Port Huron Times Herald, via Associated Press

That could free up a lot of land. Deploying just 10 percent of the world's five billion hectares currently used for crops and pastures to grow biofuels could generate 100 to 150 exajoules by the end of the century. An additional 60 to 70 could be had from planting biofuels on currently degraded land. The rest could come from better harvesting of forests and the use of organic waste.

In a recent research article, Professor Faaij and colleagues calculated that it would be technically possible to get about 100 exajoules by 2050 from what they call "surplus forest growth," meaning the bits of forest that are neither protected nor already exploited for wood, and wood waste.

This sort of calculation drives Mr. Searchinger up the wall. "Surplus forest growth" he said, is already pulling CO_2 from the air. Harvesting it for energy will provide no further benefit for climate change. The same could be said of idled agricultural land, where forest usually starts regrowing soon, capturing carbon from the air.

"In many contexts, allowing a forest to grow will do more to reduce carbon dioxide in the atmosphere for decades than producing bioenergy," he told me.

And he finds the estimates of future agricultural productivity unbelievable when applied to any reasonable understanding of the real world. Indeed, it will be hard to maintain the productivity growth of the last several decades, he says, let alone substantially increase it.

“Because the world needs to produce 70 percent more of virtually all the products of land — crops, grasses and wood — by 2050, there is no additional room for bioenergy, and any capacity to increase crop yields and to make better use of any underutilized land is already needed for these other purposes,” Mr. Searchinger said.

Professor Faaij says the skeptics are wrong, arguing that the alternatives to a huge increase in biofuel production would be even more difficult to achieve.

But it could be possible to produce the zero-carbon energy the world will need without incurring such steep opportunity costs. Much of the transport fleet could be electrified, reducing demand for liquid fuels. Solar power could be used to produce hydrogen to burn in fuel cells.

There is probably a limited role for biofuels from waste products. But the biofuels juggernaut — which has helped garner the support of agribusiness in the battle against climate change — could end up doing more harm than good.

The United States used to rely heavily on bioenergy for transport: 100 years ago, tens of millions of acres were devoted to growing feed for pack animals. Since then, much of this land has reverted to forest. Razing it again for fuel is not the best idea.