Producing Sustainable Biofuels #2
The Place of Biofuels

By Patrick Mazza

Once the transportation system ran entirely on biofuels. When motive power was supplied by horses and other animals, wide swathes of countryside were devoted to growing the fuel for these biological "engines." Even the railroad ran on wood in its early days, drawing fuel from forests surrounding the tracks. Then came coal-fired locomotives and petroleum-propelled cars and trucks. Farm and forest lands turned to other uses while oil took over as the dominant vehicle fuel. From using the plant products of current photosynthesis, we shifted to the fossil residues of ancient photosynthesis.

Today biofuels are reemerging primarily in the form of ethanol and biodiesel, and farm fields are back in competition with oil fields to drive transportation. This is raising questions about the place of biofuels in the overall use of agricultural lands, and in the transportation system itself. To what degree should we return to using farm and forest lands to supply vehicle fuel? Rely on biofuels to meet all our needs? Or don't use them at all because demands on the land for food, feed and fiber are already too great? Somewhere between these polar opposites the answer is to be found.

At its root the biofuels debate is over the degree to which current photosynthesis can replace prehistoric photosynthesis. Obviously the plant growth of today cannot equal millions of years of accumulated fossil biomass. But it can generate significant amounts of biofuels, as a collaboration of top U.S. bioenergy experts concluded in one of the most comprehensive scenarios for replacing petroleum with biofuels, the Role of Biomass in America's Energy Future (RBAEF). This project for the bipartisan National Commission on Energy Policy was "unprecedented with respect to the breadth of technologies considered and the diversity of participants involved – representing the technical, environmental advocacy and policy communities," notes Lee Lynd of Dartmouth College, one of the project leaders and a key researcher on advanced biofuels.[1]

Biofuels critics have unfairly characterized the move toward biofuels as an evasion of crucial needs for dramatic transportation efficiency gains. The RBAEF scenario contravenes this criticism with a thoroughgoing understanding of the bigger picture. The

[1] Lee R. Lynd, Testimony Before the Senate Committee on Agriculture, Nutrition and Forestry Hearing on Emerging Opportunities for Utilizing Agricultural Biomass to Enhance Future Energy Production and Security, May 6, 2004.

scenario sets a major shift to biofuels in the context of an agenda to make driving less necessary and vehicles more efficient. Under business as usual conditions RBAEF projects daily U.S. transportation oil demand growing from the current 15 million barrels daily to 32 million by 2050. By doubling average light-duty vehicle fleet mileage to 50 mpg, this consumption is cut by 11 million barrels. Another three million barrels are eliminated with smart growth policies to create more compact communities where walking, biking and transit are more feasible options. These are places in which picking up a gallon of milk requires only a few minutes walk to a nearby store rather than a 15-minute drive to the nearest commercial strip.[2]

Better cars and communities still leave 18 million barrels of oil burned daily. RBAEF concluded that the U.S. has sufficient land to replace the equivalent of 8 billion daily barrels with biofuels based on cellulose. This is the material of which most of the plant world is made. Much more abundant and cheaper than the starch feedstocks which serve most of the U.S. biofuels market today, cellulose has the capacity to support mass biofuels production.

RBAEF focused on perennial switchgrass crops and projected that its scenario would require 48-114 million acres of land, or 12-25 percent of current U.S. farm acreage. This is not inconsiderable, but not unimaginable either. By coincidence, the higher figure is the portion of American farmlands used to feed farm draft animals in 1920. Switchgrass would replace soybean acreage and generate valuable proteins to replace soy animal feed. It would also dramatically reduce water use and soil erosion. Compared to the corn from which most ethanol now comes, switchgrass would diminish erosion 10-100 times and nitrogen runoff by nine times.[3]

The RBAEF numbers come with two caveats. The lower land use figure relies heavily on using corn crop residues to make fuels, while the higher would require using conservation reserve acreage. Use of crop residues must prove to be both economically and environmentally sustainable, with practices that make sure soil fertility is maintained. Employment of conservation reserves must respect wildlife and soil preservation values. Most of these lands are already planted in perennials, so mowing the grass once or twice a year could be compatible.

Land needs could also be smaller than RBAEF projects for at least two reasons.

First, the study did not include vehicle electrification. Plug-in hybrid conversions are already gaining 100-150 mpg performance. Electrical drive is inherently more efficient than mechanical drive, and with improvements in batteries electricity could play a far greater role in fueling vehicles. Of course, this change should come with a greening of the power grid in order to avoid shifting the problem from oil to coal. Second, RBAEF did not consider non-agricultural residue streams. Biofuels also can be produced from municipal waste, wood products wastes and food processing leavings.

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[2] Nathanael Greene, *Growing Energy: How Biofuels Can Help End America's Oil Dependence,* Natural Resources Defense Council, Dec. 2004, pp 66-70

[3] Ibid, pp29-31

These added non-oil options could also replace some of the 10 million daily oil barrels still being used in the RBAEF 2050 scenario. Efficiency improvements in heavy-duty vehicles paralleling light-duty improvements could take a big bite out of remaining oil use as well.

Ultimately as we resolve the place of biofuels in the transportation mix, it must be in the transportation efficiency context. There is no question that vehicle mileage should at least double over coming decades, while we should go back to building complete communities where it is possible to walk to the store and conveniently grab a bus. Beyond that the question circles around how much petroleum we still pump into our tanks versus how much biofuels.

As the RBAEF scenario shows, we have substantial capacity to replace petroleum with biofuels, and in ways that make for more environmentally and economically sustainable farming. Future installments of this column with focus on how to make sustainable biofuels production a reality in the Pacific Northwest.

Patrick Mazza is Research Director for Climate Solutions, This is the second of a series of articles that explore ways to build a sustainable biofuels industry. Articles are posted at www.harvestcleanenergy.org and www.climatesolutions.org. Permission to reprint is granted. Please send comments to patrick@climatesolutions.org.