

Biofuels: Science or Fiction?

Technologies that perpetuate our reliance on cars only divert us from a sustainable solution.

By Ronald B. Swenson

The quest to reduce our oil addiction and to develop new liquid fuels has a new focus, the siren song of *biofuels* — literally and figuratively, the last straw.

The mass media, technical magazines and even scientific journals are bombarding us with articles extolling the virtues of ethanol and biodiesel. We are told that corn ethanol, despite its limited merits, will soon lead us to the promised land of cellulosic ethanol — even though the technology is not yet perfected and claims that vast quantities can be produced depend on exaggerated, unfounded assumptions. We are told that biofuels are *sustainable*, have *vast potential*, will *reduce climate change*. ...

Tragically, this obsessive focus on biofuels diverts us from the real issue: a flawed transportation system relying on personal vehicles with unquenchable fuel appetites, navigating roadways that are never wide enough to deliver us to our far-flung neighborhoods. With the double jeopardy of peak oil and climate change, time is short to overcome the myths associated with biofuels and move toward sustainable renewable energy solutions.

Refuting the Myths

Myth: Biodiesel is green. In fact, palm oil plantations in Malaysia destroy orangutan habitat so that European Green party members can fill up their tanks with biodiesel, clearing their consciences in the belief that they're "saving the environment." Here at home, writer Michael Pollan points out that Iowa has already lost half its topsoil. What will ethanol mean for the fencerows, the birds, the biodiversity?

Myth: Sugarcane ethanol is a big success in Brazil. Ethanol replaces 40 percent of Brazil's gasoline but Brazil's fuel of choice is diesel. It turns out that ethanol is only 8 percent of Brazil's fuel. In the bargain, rivers dry up during the growing season, 20 percent of the cane workers are treated as slaves and large tracts of Amazon forest are cleared daily to expand "production." After President Bush's trip to



Ronald B. Swenson

Brazil to promote biofuels, Fidel Castro emerged to point out that Americans running cars on ethanol will lead to Third World people starving. It's already pretty grim in Mexico, where the price of corn has skyrocketed.

Myth: Ethanol reduces climate change. This is a big stretch of the truth. According to a report in *Science* (January 27, 2006), most of the energetic content of corn ethanol derives from fossil fuel inputs: 40–70 percent from coal (for electricity), 5–20 percent from oil (tractors ...) and 5–30 percent from natural gas (process heat), producing 81–96 kilograms (kg) of carbon dioxide per megajoule, compared to gasoline at 94 kg of CO₂ per megajoule. The energy content of the corn hardly matters, since it represents at best 5–26 percent of the total.

Most damaging to hope for rational energy policies are bold claims that biofuels can replace a significant portion of our oil requirements.

Myth: Ethanol yields significant net energy. In a recent *SOLAR TODAY* article (see "Cellulosic Ethanol: Answer to the Biofuels Challenges?" May/June 2007), the pathetic energy return on investment (EROI) of corn ethanol was duly noted and then, in a pure flight of fantasy, it was argued that cellulosic ethanol had an EROI four times better than corn ethanol. Since no commercialized cellulosic ethanol refinery exists, this claim is unfounded.

Myth: Biofuels can meet X percent of our energy needs by the year Y. Most damaging to hope for rational energy policies are bold claims that biofuels can replace a significant portion of our oil. This myth keeps us locked into widening freeways and producing more cars, instead of hit-

ting the panic button and investing in transportation systems built to be sustainable for the long run. For example, the 25x'25 organization proclaims that biofuels could yield the equivalent of 2 billion barrels of oil by 2025. This rhetoric hinges on a recent USDA-sponsored study arguing that we can repurpose the equivalent of 80 percent of our cropland and 20 percent of our forests to make biofuels (see Perlack et al., 2005, "Biomass as Feedstock for a Bioenergy and Bioproducts Industry," www.eere.energy.gov/biomass/pdfs/final_billionton_vision_report2.pdf). This fails to account for soil depletion or declining water supplies due to climate change. Spend a few minutes with a calculator and you'll see that this proposal is pure madness. (See www.oilcrisis.com/ethanol.)

Myth: "There is no magic bullet." The fog around biofuels is symptomatic of a larger confusion. Who is willing to go out on a limb to pick a winner? Hermann Scheer is: "The perception that there exist no overall alternatives to conventional energy supplies ... pollutes peoples' minds." (Scheer, "Busting Myths, Leading Transition," *SOLAR TODAY*, May/June 2007.)

When we ask, "What liquid fuels can be produced to run our cars?" we have framed the argument for failure. Cars are the problem, not the solution! We don't need more fuel; we just need a way to get around.

As the biofuels debacle unravels, will there be any good news? Fortunately, yes! In the quest for transportation alternatives, there will be clear winners. Biofuels (and perhaps hydrogen) in small

quantities will be used for heavy equipment, trucks, ships and airplanes, but renewable electricity will predominate to meet routine transportation needs.

Detroit Is Dying

Americans have a love-hate relationship with the automobile. I can see the down side. Like many of you, I have lost family members in automobile accidents. Enough of us drive to the pearly gates every week to fill two 747s.

So what about plug-in hybrids? Plug-in hybrids are still cars. They are subject to the same dangers on the highway and the same laws of congestion, and they tie up as many materials as regular cars, if not more. They use inherently inefficient liquid fuel engines. An

ordinary internal combustion engine is perhaps 25–30 percent efficient when operating optimally, but typically delivers only about 10 percent of net fuel energy to the wheels. With an average occupancy of 1.3 people and a combined weight of 200 pounds in a car weighing 3,000 pounds, the efficiency of moving people vs. metal is only $200/3,000 = 6.7$ percent. Combining that with 10 percent fuel efficiency, we get $6.7 \text{ percent} \times 10 \text{ percent} = \text{less than } 1 \text{ percent}$. If we could triple the well-to-wheel efficiency to 30 percent with a plug-in hybrid, we still would get only 2 percent overall efficiency.

Sorry, I'm not thrilled with the flex-fuel, plug-in hybrid. We are interested in moving people, after all, not materials. In 21st century America, isn't an overall efficiency of 2 percent embarrassing?

So what about pure electric vehicles (EVs)? Maybe. EVs fueled by 100 percent renewable energy-generated electricity might serve as a stopgap measure while we develop better options, but we run the risk of using up the time and resources available to achieve lasting solutions. (See "Transitioning to a New Paradigm," *SOLAR TODAY*, March/April 2006.)

So what about light rail? Light-rail cars weigh about 50 tons, normally 3 tons per rider but at least 1,000 pounds per person when fully loaded. Stopping and starting tons of steel kills efficiency, whether it's "light" rail or the 2-ton car that protects your children from a drunk's 3-ton SUV.

So if we give up our cars, won't our economy suffer? If we are the last to let go, yes: we will then be importing solutions from other countries, as we did when Japan began offering energy-efficient cars and Detroit ignored market demands. Doesn't it make more sense to simmer

down our economy, rather than grow it at the expense of our planetary ecosystem?

Transitioning to a Safe, Secure Paradigm

So can we make it without oil or biofuels — and abandon those millions of vehicles that were designed with oil in mind?

Yes, we can. The answer will be found in breakthrough modes of transport powered by direct renewable energy. In fact, though it's only in its infancy, just such a system is being developed in Uppsala, Sweden. The *podcar*, developed within the framework of a *general transport system*, is undergoing exhaustive testing by the Swedish Rail Authority. Additional pilot projects based on this technology are lining up rapidly around the world. (See www.solarevolution.com/prt.)

Can we move people more safely and efficiently? *Yes, we can.* By using grade separation to keep riders several feet above



Innovative modes of mass transport powered by renewable energy would offer great benefits over advances like biofuels that perpetuate our reliance on energy-inefficient, gridlock-bound cars. Sweden, for instance, is testing a podcar system.

the Mack trucks, we can reduce weight without sacrificing safety.

Can we achieve energy independence? *Yes, we can.* For example, highly efficient lightweight podcars on fixed guide-ways can be powered 100 percent (net) by photovoltaics with a payback *vis-à-vis* gasoline in less than five years, without subsidies.

Can we relieve global climate change? *Yes, we can.* With podcars running on renewable electricity, we will save a pound of CO₂ per passenger-mile.

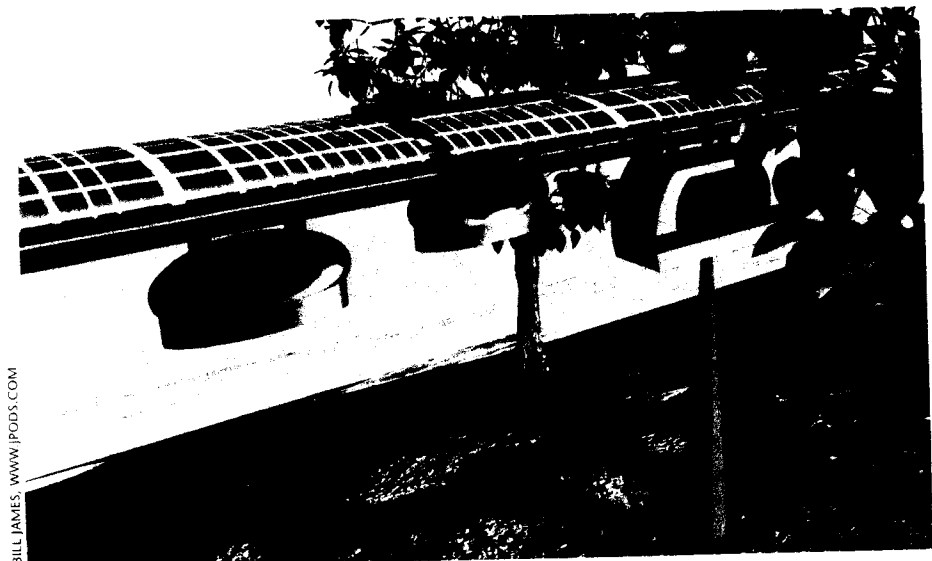
Can we do it soon enough, fast enough? *Yes, we can.* Because solar-powered podcars operate in a different plane than current traffic, we do not have to risk giving up the automobile option as we make the transition. Offering a safer, personal, uncongested trip to and from work, podcars will lure people away from cars. That's far less risky than propping up our failing system, trying to abandon the laws of physics while destroying what's left of our depleting biological heritage. Instead of virtually shoveling topsoil into our cars, advanced transit systems such as podcars powered by renewable energy can be built today with off-the-shelf technology on existing rights-of-way. On April 28, 1869, Central Pacific laid 10 miles of track with manual labor. With modern tools, podcar networks can be built at the rate of 10–30 miles per day per installation team.

Can we do it economically? *Yes, we can.* Operating at a small fraction of the cost of automobiles, podcar networks generate such large paybacks that they can be privately financed and require no subsidies. Efficiency pays!

If we act quickly, we can overcome inevitable oil shortages and avoid social chaos. But time is short. Peak oil and climate change are changing the rules of the game. Sweden has set an example, pledging to abandon oil by 2020. By tapping into secure, locally produced renewable electricity, efficient and safe personalized solar transit will flourish in a world beyond oil. ●

Ronald B. Swenson (rbs@solarquest.com) is co-founder of ElectroRoof, SolarQuest and Solarevolution, publisher of OilCrisis.com and board member of ASPO-USA (the Association for the Study of Peak Oil and Gas, www.aspo-usa.com). A former ASES board member representing the Renewable Fuels and Sustainable Transportation Division, he has published numerous peer-reviewed articles in this field.

The opinions expressed in "Readers' Forum" do not necessarily represent the views of the American Solar Energy Society, *SOLAR TODAY* or its advertisers.



Highly efficient lightweight vehicles powered 100 percent (net) by renewable electricity are the key to energy independence.