

“Solar Farming is the Future

Imagine a crop that can be harvested daily on the most rocky, barren, acrid land ...

... with no fertilizer or tillage input and that produces no harmful runoff or emissions. Imagine an energy source so huge it has the potential to provide many times the energy we could ever expect to need. You don't have to imagine it—it's solar energy. Solar energy falls everywhere at the rate of a horsepower per square yard (1000 watts per square meter), and it's free.

I think it's time to recognize where our energy must ultimately come from, and speed up building for that future. Ag-bio engineers can be an important part of that future in planning and developing what I call “solar energy farming.”

Right now, it appears that the mainstream has realized that making fuel from food (ethanol from corn) is not a very good idea: first, because it raises the cost of food for poor people around the world (is that morally acceptable?), and second, because present practice requires such large inputs of fossil fuel energy.

The emphasis now seems to be shifting to making liquid fuels from biomass and plant cellulose, but a lot of work still needs to be done to develop this process. Certainly the idea of using marginal land, and utilizing wastes that are otherwise a nuisance or a hazard, is laudable, and we are going to need liquid fuels regardless of how many plug-in hybrid cars we have. We should therefore pursue this alternative.

However, in the November 2007 issue of *Smithsonian*, Richard Coniff pointed out that even if we could set aside 41 million ha (100 million acres) for cellulosic ethanol crops, of the approximate 324 million ha (800 million acres) in the United States, we would produce only about one-eighth of the projected U.S. energy consumption in 2025.

By my calculations, the amount of biomass energy produced by an acre of corn in a season is less than the solar energy falling on that acre in one day. That is less than one percent efficiency. Photovoltaic systems can be 15 percent efficient, and concentrating solar thermal plants can be about 30 percent, and they don't need to compete with crops for land.

Why not encourage ag-bio engineers to develop solar energy farms? We could investigate the use of road rights-of-way (the Swiss have done this) and levee slopes as installation sites. In addition, I have read that plants grow better in arid climates between rows of solar panels, possibly because of the concentration of rainfall, so how about symbiotic systems of crops and solar in the same field? There must be many other interesting possibilities for integrating solar energy systems.

Solar electricity could help plug-in hybrids shift about 80 percent of the daily trip mileage to electricity for drivers in the United States. The cost per mile would be one-third as much for electricity as for gasoline (at ten cents per kWh and three dollars per gallon). I have read that a capacity increase of 20 percent or less in our electrical power system would handle this additional load.

Of course, critics say that solar energy is intermittent, and diffuse, and the biggie: “The sun doesn't shine at night!” The greatest load on our current electrical system happens in mid-afternoon in summer, when air conditioners are operating and when solar energy systems would be working just fine. Solar energy could provide much of this peak load, and we could supply a large share of our overall electrical needs with solar before we would need to think much about energy storage. Meanwhile, every hour of sunshine can reduce the use of fossil fuel (and production of emissions). Solar electricity is expensive, but we already know the costs, and they might well turn out to be no more than the more exotic solutions that have been proposed, such as CO₂ sequestration from coal-fired plants.

After several tries, Congress has finally extended the solar tax credits. We need to do more to build a solar infrastructure. On the day the last barrel of oil is pumped, will we be ready?

I believe that engineers are generally believed to be honest and accurate. We need to also be informed and articulate about important issues such as this.