Energy from biomass – Where's the beef?

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Government energy policies have historically been based more on wishes and hopes than on plans that have any reasonable chance to produce large-scale results in deriving energy from sources other than coal, oil and gas, putting nuclear energy aside as temporarily barred by public relations problems.

We are now entering a vast new era of planning where independence from conventional sources of energy is driven less by fear of OPEC and gasoline lines and more by fear of climate change. Less feared, but wrongly so, is the eventual catastrophe that will surely result if the 2 or 3 billion people in developing countries are not better supplied with clean household energy and the jobs to earn the money to pay for it. These people will not solve their problems alone. The developed countries have to develop the solutions and introduce them into developing countries, very likely with substantial aid money. As yet the developed countries are not embarked on policies that are long-range enough to attract private capital and start us down the learning curve on costs versus benefits on alternate energies in general, never mind energy from biomass on which so many wishes and hopes uneasily rest today.

The first requirement of a national energy policy, beyond assurance that we have enough of various kinds of energy to keep the show going currently, a policy we take for granted, is to recognize that we need a bridge between where we are and where we think we want to be, one, two, three or more decades away. Without "bridge thinking" we can't get there from here.

Bridging means going along paths that can phase into renewable energies as soon and as smoothly as possible. For example, building integrated coal gasification combined cycle plants prepares us to switch such plants to Btus from biomass one day. Either we merely change the front-end gasifier, (e.g., away from the Texaco type) or we use one in the first place that can be adapted to gasify biomass.

We use this example for two reasons: (1) coal is our largest low cost fossil resource and (2) such plants can be very clean with respect to toxic pollutants (CO_2 is another matter, but IGCC plant CO_2 per kwh is less than conventional coal-based power plants).

If we are to introduce new fuels, as for example, methanol or Dimethyl Ether (DME), made initially from fossil resource, we should see a way to make these from biomass-derived synthesis gas down the road, and, in this case, we already can see the way, economics aside.

The other thing policy makers do not seem to realize is that research cannot solve all problems. For example, it is virtually impossible economically to introduce a new fuel, whether biomass-derived or not, in competition with entrenched fuels. The hurdle must be overcome by government policies unless we want to jump the hurdle many years away in a state of sheer crisis.

If we are to introduce new fuels based on biomass, as for example methanol, this will require special commitments on the "where's the beef" problem if biomass is to be a major energy resource.

The developed world, or much of it, yearns to return to biomass believing it to be our salvation in respect to climate change. But, ironically, about one third of the people are trying to leave biomass and a large faction of the other two thirds wants to return to it. Can either group achieve its objectives? The answer is neither can at our present state of knowledge and biomass resources nor is there any early change in sight. Neither group has the resource base for large-scale conversion of biomass into more usable and

desirable energy forms, never mind having the further technology improvements that might be made in conversion processes.

Today we could make an improved liquid fuel from biomass – methanol – at about 50% thermal efficiency. If we improved this to 75%, about the limit of what is possible, it would only increase the potential of the resource base by 1.5. But this would make little real difference because the resource base is so small. We could probably build an integrated wood gasification combined cycle plant (IWGCC) today that could achieve close to 40% efficiency to electrical energy or perhaps 60% in a combined heat and power (CHP) mode, compared to prior technology at about 20% and 50% respectively. These changes would make no real difference for the same reasons.

The problem is mainly "where's the beef?" which might be modified to "where is the hamburger?" because we need lots of cheap biomass to make a difference. When it comes to biomass beef we cannot afford sirloin steak, and we simply do not have the biomass hamburger nor is there any reasonable prospect of having it. This stark conclusion will not be pleasing to energy-from-biomass advocates. Indeed, in the past we have found that biomass advocates do not even want to hear it in offered papers. The solutions to problems are usually only found when problems are faced squarely. This one isn't being faced up to.

Could we change the biomass resource situation quickly if cost were no object, either the delivered cost of the raw biomass or the cost of converting it or both? The answer is "no". It is only reasonable to ask why. The simple answer is land availability. It would take enormous new acreage planted to biomass to reach in a decade or so a truly significant sustainable output of biomass in relation to the total usage of the common raw energy sources: coal, oil, natural gas and uranium. Today we fight bitterly over land usage and we argue vehemently pro and con over monoculture of biomass. Land is not productive without water, and for most species of biomass, some fertilizer is needed. Large biomass plantations need roads and hordes of trucks to haul biomass as well as much machinery to harvest it and prepare it for the ultimate conversion steps. This machinery runs on fuels derived from fossil sources although, interestingly enough, all of it can run on either methanol or ethanol. During World War II, all of the machinery on large sugar plantations in the Philippines ran on ethanol.

Most of the developed world, at least those parts that are far from self-sufficiency in petroleum, has been struggling since the early 1970s to replace petroleum. So far the only significant answer has been to use more gas most of which happens to be coproduced with petroleum. Synthetic fuels plants are hard to find and not one is stand-alone on economics. Before 1970 we had at least 40 years of research on syn fuels to help us after 1970. With this record to look at, how do we expect to get into the nirvana of renewable energy in a few decades? To do it will take a mighty change in direction from what the past shows.

This paper will suggest ways to get on the learning curve both with specific strategies and specific government policies so we can get on with what we talk about so much but act on so little. Specific examples will be given applicable in developed countries in some cases and in developing countries in others.