

## Alternative Power Sources

*By Louis P. Solomon with Dick Van Orden*

Science is amoral. There are no morals associated with science. The applications of science become intimately involved with politics, economics, and a host of other issues, but the actual science itself does not. In order to apply science, however, it must be understood. Then, human beings may use the science or not: that is a decision with many facets. In the meantime, I thought it would be a good idea to talk about potential solutions to the development and employment of alternative power sources, based purely on science, which might solve some of our national and international problems.



This column will begin a series of one or more columns that will consider the problem of alternative power sources with particular emphasis on the large scale power needs of the United States. I have the pleasure of being assisted by a friend and colleague of long standing, Dick Van Orden, who at one time was the Chief of Naval Research. This fact alone should establish his credentials to comment on these issues.

Oil is currently the basis for the United States power usage. It is turned into gasoline, and is used to power our cars. The cost for gasoline in the United States has suddenly become very high, relatively, and it also has put us at the mercy of oil producing countries throughout the world. The question is: can science do something about this? As a general rule, scientists are considered to come up with interesting facts and neat applications, but applying this to a real problem that is nationwide, or even worldwide, is a rare event. Can the United States, with its geographical distribution of people, its enormous size, its culture, and its physical transportation systems change how it is powered? Does there exist a real example where science actually addressed and solved this problem? The answer is, yes: Brazil.

Brazil? Yes, Brazil. A decade or so ago Brazil was in terrible economic shape. It had mortgaged its soul and future to the oil producing nations. Its economy was in shambles. It imported virtually all of its oil, and was politically subject to international pressure from the oil-producing countries. There was no hope. And, what was even worse, Brazil was producing sugar cane in great quantities, but could not sell more than half of it. The leaders of Brazil took a careful look at the problems, gathered their courage, listened to the scientists and engineers, and decided to completely change how energy would be used in Brazil. This decision took considerable political and economic courage—something that in itself is quite rare. It was decided that they would harvest all the sugar cane and using simple chemistry (no kidding) turn it into ethanol, which is a fuel. Now ethanol is not quite as efficient as gasoline, but the Brazilians decided to make lots of it. In addition, I want to point out that ethanol comes from sugar cane which is a renewable resource. The oil is not.

The results were quite spectacular. It took some time to convert an entire country from gasoline to ethanol, but the Brazilians did it over a 10 year period. Their economy is now in great shape. They no longer import any oil or gasoline. The cars, trucks, and all devices that are driven by engines run on ethanol. Further, the cost of ethanol is very cheap. Sounds too good to be true? It does. But, it is true.

Now, there are a few little things yet to be mentioned. The energy content of a gallon of ethanol is not as high as the energy content of gasoline. Cars get less miles per gallon. But, the combustion products are much less damaging to the environment than those of gasoline or diesel fuel. That is pretty good. Further, as already noted, you can continue to grow sugar cane and continue to make ethanol. It is renewable. What if you want a higher energy density? Mix the ethanol with gasoline. In the United States there are already stations that are selling gasoline with 10% ethanol, and there is a proposal that we could manufacture E-85, which consists of 15% gasoline and 85% ethanol. If we did that we would be entirely self-supporting in fuel for our engines.

What about the engines? Do we need new engines? The answer is no, but we do need some changes to the

existing engines. For example, we need different hoses that will not decay with the ethanol mixture, and other technical issues like that. Does this suggested change from oil to ethanol have support in the energy world? Well, the farmers in Nebraska and other states that produce corn think that the idea is wonderful. There are some issues, however. Corn ethanol has less energy than sugar cane ethanol. That means more fuel for our cars, but it is very inexpensive fuel.

The concept that I am presenting here is that there are energy sources that are available, which, when coupled with science and engineering could radically affect our dependence on foreign oil, reduce our energy costs, and use renewable sources. Do the large energy companies wish this to occur? I think that the answer is essentially, yes. They wish to control the product, however, and are a little (maybe a lot) nervous that the world which they have controlled for the past 150 years will change. Who isn't worried about the future and inevitable change?

Now, what about alternative energy sources? Dick Van Orden and I have looked at the possible methods of using alternative energy sources, in the large, to power our country and retain our methods of transportation. There has always been substantial criticism for many years about the so called "love affair" of Americans with the automobile. The reason for this love affair is distance. Europe is relatively small, with very high population density, and a very well developed mass transportation system. We have never focused on mass transportation as an objective. While we have the Metro in the Washington DC area, it has taken 30 years to build, cost billions of dollars, and to efficiently and effectively use it, you can only live in appropriate places. As an example of the type of thinking that is currently going on, consider the proposed major move of government offices from Crystal City in Virginia (supported by an excellent series of Metro stations) to Fort Belvoir, also in Virginia, which has no Metro station. There may be good bureaucratic and even political reasons for the move, but it will be a disaster from the point of view of people who will have to commute to their jobs. There are no Metro sources to bring in the 50,000 people a day in and out to work there. How will people get to work in the Fort Belvoir complex? By car, of course. They have no other option.

Dick Van Orden and I will be focusing on the following issues in the next column or so. These are

1. Electrical power generation, including nuclear power: fusion and fission reactors.
2. Electric cars.
3. Hydrogen engines.
4. Hybrid cars
5. E-85 (renewable fuel)
6. Others

You will note that we are not considering (for example) wind driven power generators. They only work when you have steady, reliable, winds. They are wonderful in certain areas for electricity generation, but they cannot supply a major percentage of the power requirements of the entire country. We are going to focus on possible alternative power sources, with country wide application, and provide you with an idea how realistic these ideas really are. In effect, we are asking, and hope to answer the question: can science help us?