

## Hybrid Cars as a Baby Step

Have you noticed the futuristic looking cars, with the steeply sloping hood and blunt tail, quietly moving around your community?

They are Toyota Priuses, which are hybrid cars with power supplied by both a gasoline engine and an electric motor. (Be careful when you are around one when it is backing or starting forward slowly, because only the quiet electric motor is providing the power then.)

There are other hybrids; for example, the Toyota Highlander, Toyota Camry, Lexus 400h, Ford Escape and Mercury Mariner. And many more will be on the market by 2009. They are hybrid versions of gasoline models.

The word "Prius" means "forerunner". The name is apt because hybrid cars are the first "baby step" toward freeing the transportation system from dependency on imported gasoline and reducing greenhouse-gas emission from vehicles.

Why is the U.S. so dependent on foreign imports of petroleum to make gasoline? It's because the U. S. peaked in petroleum extraction in the early 1970s and is now almost halfway down the extraction curve. (The "Energy Crisis" of the early 1970s was due to that fact. We then switched into import mode in a big way, mostly from the Middle East.) Alaska oil was a small blip on the extraction curve; and any further Alaska oil will be an even smaller blip.

And, if running out of oil is not bad enough, the vehicle emissions as a result of using petroleum fuels in vehicles is a major cause of global warming. Global warming is already causing disastrous events for humans, and will cause even more in the future.

Ok, you say, we'll just continue importing oil to meet our needs. Not for long! For one thing, other countries, such as the huge-population countries India and China, are greatly increasing their imports. But, more importantly, world oil extraction is peaking now or in the very near future. If you thought the "U.S Energy Crisis" of the 1970s was bad, just wait until you experience the "World Energy Crisis" of the 2000s!

In the March 2005 issue of Scientific American Professor Emeritus William Ruddiman of University of Virginia showed that the advent of agriculture replacing hunting and gathering for human food caused enough global warming to keep the next 100,000-year major ice age from starting a few thousand years ago. About 8,000 years ago carbon dioxide in the upper atmosphere started rising instead of falling as it would have without the effects of farming. Then about 5,000 years ago methane gas, an even more effective greenhouse gas than carbon dioxide, began rising instead of falling as it would have without the effects of extension flooding of land for rice farming in most of Asia. Both of these greenhouse gases kept world temperature from falling rapidly. The global warming of pre-modern agriculture probably is what has caused the unusual length (about 10,000 years) of the present interglacial. (See Ruddiman's book *Plows, Plagues and Petroleum*.)

Then, of course, fossil fuels were discovered and widely used, which caused world temperature to start rising rapidly in a tightly coupled race with rising world population. Within about 100 years all fossil fuels will have peaked in world extraction, and humans will have to deal with the down slope of the production curve of the remaining coal. Petroleum will have been long gone by then.

If the past is a predictor of the future, humans will accelerate their use of fossil fuels, especially coal and other really bad polluters to keep increasing in energy use. Such use will cause world temperatures to rise even faster.

Well, you say, that is great! Global warming has kept a really cold ice age from starting. Whoa! Did you see the movie “The Day After Tomorrow”? It had some good climate science in it, except for the really fast time scale of weeks to months instead of decades to centuries. A major fear of climatologists is that extreme global warming will cut off the crucial Atlantic current, which brings warm water from the equator to the North Atlantic, sooner than it would normally cut off with the long-term steady global warming caused by pre-modern agriculture. (That was the main thesis of the movie.) This may cause the temperature of the European and northern North American coasts to experience temperature drops while the rest of the world is experience temperature rises.

Due to global warming the entire world geography of agriculture will drastically change. Those areas, such as the U.S., where agriculture is now so intensive will lose some or, maybe much, of that capability, while other areas of the world will gain the capability to produce food. Perhaps Canada and Siberia will become the breadbaskets of the world. Needless to say, much disruption of current economic relations among the nations of the world will occur.

What do humans do when they realize that their source of food and energy is being jeopardized? History tells us that they fight ferociously to preserve what they have or to gain more, often killing millions in the fight. That is very scary! Many nations of the world, especially the U.S., have many nuclear weapons already aimed at other nations. Do you think that they will not use them if their land or sources of food and energy are threatened? The U.S. has already set the precedence for doing so in Japan in 1945.

So, there are many things that the world must do to prepare for the troubled times ahead. Certainly, proceeding as usual will not work. All of the action items will require a high degree of cooperation of all nations of the world, not a go-it-alone attitude of any one nation. Here are some action items that are definitely needed:

- Eliminate all nuclear weapons so that no nation will be tempted to use them to secure their land and food and energy sources, since such use would surely kill many millions of people. Since the U.S. has most of them, the U.S. should lead this effort by starting to eliminate its stockpile instead of making plans to produce more, as is now the case.
- Promote world population control by pre-conception methods, which should be morally acceptable to any reasonable person. Reducing population growth would greatly reduce the need for more energy.

- Promote world use of the remaining fossil fuels to develop the infrastructure for renewable energy to enable humans to better survive the decline in available fossil fuels and the imminent plunge into the next 100,000-year major ice age, rather than the mostly frivolous use that occurs now.
- Promote cooperation of all nations in reducing greenhouse gases emissions.
- Promote cooperation of all nations in developing renewable sources of energy.

So how does one get from this gloomy picture of the future to the importance of putting more hybrid vehicles on our highways? As stated above, it is a first “baby step”. Hybrid cars get about double the gasoline mileage of the average car and reduce emissions by huge amounts. Within a decade hybrid vehicles will be the dominant mode of new vehicles for highway transportation.

The next baby step will be “plug-in” or “gridable” hybrid vehicles, a hybrid vehicle with a more powerful battery that can be plugged into the national electric grid. Such a vehicle can travel about thirty miles, less than a typical local trip, on electricity without using its gasoline engine, thus doubling its gasoline mileage and halving its carbon emissions. (Emissions at a power plant can be more easily controlled than emissions at the point of use of each vehicle.)

Another possible baby step might be to use biofuels as the fuel for hybrid cars instead of gasoline. The biofuels need to be made from non-food agriculture products, such as switchgrass and algae.

Oh, you say, we will use hydrogen fuel-cell vehicles. We may use such vehicles in the future, but they will not solve most of our problems and may cause more problems. Electricity has to be used to produce the hydrogen, which has to be produced by some energy source; i.e., coal or nuclear reactions. Huge amounts of infrastructure have to be built to handle hydrogen as a vehicle fuel. Hydrogen is difficult to store and can be dangerous to handle, although perhaps not more dangerous than gasoline.

Has anyone thought of what happens to all the water hydrogen vehicles will dump on the roads? Will there be clouds over the highways and layers of ice in winter? Water vapor put into the atmosphere is a potent greenhouse gas. Will vehicles have to carry huge amounts of water around to be dumped at hydrogen refueling stations?

These problems with using hydrogen in vehicles makes me believe that it would be better to have hydrogen fuel cells in specific locations rather than in vehicles. Then the localized water produced could be used to alleviate lack of clean water. The electricity produced at those specific locations could be used to power the location, to recycle vegetable oil for fuel and to be put into the national grid for charging plug-in hybrid cars at their storing locations. Solar cells at the locations could be used to harness solar energy for producing electricity, part of which can be used to make hydrogen and part can be fed into the national electric grid.

All of the above problems with vehicle fuels make it obvious that trains need to come back as a major mode of transportation in the U.S. as they are in many other places, because trains are a more energy efficient mode of transportation. The U.S. needs an Interstate Railway System similar to its Interstate Highway System.

We need a long-view system approach to transportation and other types of infrastructure to get humans through the transition into the era of declining fossil fuel use and into the next 100,000-year major ice age.

So, when you see one of those futuristic hybrid cars on the streets, you might want to applaud; or go buy one for yourself.

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