

## **The Future of Energy**

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Many experts believe big changes are ahead in the world when it comes to energy, especially how we supply and use it.

Last October, the City of Houston and the UH College of Technology sponsored the third annual meeting of the Association for the Study of Peak Oil—USA. There, Matt Simmons, T. Boone Pickens and other oil experts discussed the concept of *peak oil*: how close the world is to producing as much oil as it can. Some, like Pickens, think the peak has already past. Statistically, the current peak occurred in May 2005, and world oil production has declined (slightly) since then. Others disagree since recent price increases have spurred more exploration and development.

What is more, Al Gore galvanized popular opinion with his award-winning book, presentation and movie, *An Inconvenient Truth*. Many claim that he exaggerated the threat. While there is natural variation in the Earth's climate, almost all scientists explain the dramatic rise in greenhouse gases and in the Earth's temperature as the result of the combustion of fossil fuels.

There will be many twists and turns from here, but it is worthwhile to explore what the energy system might look like in the long-run. Will it be the end of civilization as we know it? Will it be a permanent return to conditions we experienced following Hurricane Ike? Probably not, but it will be different, and we should start preparing for those differences today.

### ***Oil***

The U.S. imports about 60 percent of its crude oil – a number that has been rising annually since 1985. We hold 3 percent of the world's oil reserves, yet we consume 25 percent of the supply. So there is no way the U.S. can meet its oil needs domestically. For now, we are dependent on our suppliers, friends and foes alike.

There may be a substitute for oil, but it will not be cheap. The easiest would be another liquid hydrocarbon, perhaps produced from natural gas or biomass, so we can use the present infrastructure. However, corn-based ethanol won't work because it costs too much to grow, transport and harvest; and it competes with food production, driving up food prices worldwide.

Brazil became energy independent in 2006 based on a sugarcane-based ethanol system,. Since the climate in the U.S. is not conducive to massive sugarcane production, that avenue is probably closed to us as well.

While research still needs to be done, early reports suggest that algae is much more productive per acre than any field crop. Algae also can be grown wherever the sun shines – near cities and on non-arable lands, so it may be a logical substitute for transportation fuel.

While airplanes will always need a high density liquid fuel, automobiles and trucks can run on electricity. Gasoline-electric and plug-in hybrids, to be released next year, are promising. While current storage technology allows a small car to go only about 50 miles on a charge, parking garages and meters could be equipped with recharge plugs at a cost. The fuel cost of an electric vehicle today is only about 25 percent the cost of gasoline.

## ***The other fossil fuels***

Natural gas consumption has not increased much in the U.S. since the 1970s, though its use has shifted from electricity production to other uses today. The U.S. imports about 15 percent of its natural gas today, and there does not seem to be an imminent shortage of natural gas, at least for now. In fact, some are looking to vast natural gas reserves in shale formations in the Northeast. Releasing the gas requires a lot of water, however, and environmentalists are worried that the cost to the environment won't be worth the benefits of the gas recovered.

Coal accounts for 50 percent of the U.S. electricity production, but it also accounts for 35 percent of the emissions of U.S. greenhouse gases. Capturing coal's emissions before they leave the stack and sequestering them underground is an active area of research and development, but it would most certainly boost the price of electricity.

## ***The other energy sources – hydro and nuclear***

Almost all of the locations that could produce electricity using hydro are doing so. Some states are actually dismantling hydro facilities because of damaging environmental effects. Others are threatened by reduced rainfall in the Southwest.

Since the public has become concerned about the price of energy and the effects of climate change, nuclear power is being revived and is expected to grow slowly. But since concerns remain over what to do with the waste, nuclear is not expected to increase much beyond its current 20 percent share of U.S. electricity production.

## ***The renewables***

With subsidized costs comparable to coal, wind energy is clearly the renewable of choice today. Wind power has doubled in the last two years, but its share of electricity production is still less than 1 percent. Wind will be a component of the future energy mix, but the goal to produce 20 percent of electricity by 2030 is questionable. It has two hurdles to overcome: 1. The wind blows where people aren't, and 2. The wind does not blow all the time and not at the right time.

The longer play in renewables is solar. Huge amounts of the sun's energy fall on the earth daily. It can be used directly to heat water for homes and businesses, to run turbines to generate electricity, or can be converted into electricity via photovoltaic (PV) cells, which continue to improve, especially with the application of nanotechnology.

Photovoltaic systems promise to decentralize electricity generation as dramatically as the PC decentralized computing. All buildings in the future will sport solar appendages that will generate a good portion of the building's electricity, and might even return some to the grid. This will slow the growth of expensive and environmentally questionable central electricity capacity.

Areas near seismic faults, like California, will certainly exploit geothermal energy near the surface. Others are looking to harness wave or tidal energy although those systems are still in the research phase. All renewables will get a boost from any legislation that attempts to put a cost on emitting carbon. While good for the climate, any such scheme will also mean higher costs for consumers.

The take-away to all of this: there will be no *one* substitute for oil, or any other energy source in the future. Our society has formed itself around a relatively inexpensive, high density, easily managed energy source – oil. In its place, we are likely looking at a whole complex of different, more expensive, less easily managed sources. “There are no silver bullets,” as the saying goes, “only silver BBs!”

### **Other strategies**

Another strategy for replacing oil is not to demand as much energy in the first place--. Amory Lovins and others believe that the potential for energy efficiency far outweighs the potential for new energy sources. Once we put our engineering talent and ingenuity to the task, under the discipline of higher prices and lower availability, we may realize significant energy efficiencies. So, we maintain our standard of living by using what energy we have more wisely.

If finding new energy sources and energy efficiency doesn't work, we will be required to change our behavior. Few expect human society to disappear in a reduced energy environment, but it could change dramatically. We have already seen some inevitable changes – driving less, cooler homes in the winter and warmer in the summer, more local production of food and manufactured goods. Other changes will take longer – higher population density in cities, increased telecommuting, alternative vehicles for different purposes, more mass transit options and increased walking and cycling. Under this scenario, the world could be considerably different in 2050.

### **Conclusion**

While we can't predict the future, exploring plausible scenarios in the story of human civilization is exciting and valuable for us today. Who knows how much energy a reconfigured system will deliver, or how much energy we can save? In any case, behavior will square the circle and fill the gaps. Will future generations develop more powerful energy technologies? Will they resent us for using all the oil, or be fine with lives that rely less on energy? Since the Enlightenment and the Industrial Revolution, each generation has felt it has progressed from what previous generations had. When it is all said and done, future generations might even value their lives over ours.

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