



Questions and Answers on Energy Issues

Posted by [Robert Rapier](#) on October 21, 2007 - 10:30am

Topic: [Miscellaneous](#)

Tags: [algal biodiesel](#), [biobutanol](#), [biofuel](#), [ethanol](#), [gas inventories](#), [oil production](#), [oil refineries](#), [peak oil](#), [refining margins](#) [[list all tags](#)]

Not too long ago, [I nearly quit writing](#), because I was losing control of my free time. [I came to a compromise solution](#) that has worked out well for me: I have continued to write, but I have reduced time dedicated to debates, correspondence, and addressing questions or criticisms about my essays. It is now apparent that it was not the writing, but instead the peripheral stuff that was really eating up all my time.

However, as a result of the change, some comments and questions that are directed at me go unanswered. Sometimes someone will make a criticism or comment that I would like to address, but I know it will lead to several more responses. In order to "catch up" with some of this without once again getting involved in protracted exchanges, on my way out of town for a business trip [I put up a brief post](#) inviting readers to ask questions or make comments. I hadn't originally intended to post it here, but there were quite a few topics that have been discussed at length here at TOD. So, I went through, picked out some of the questions, and took a stab at answering them.

There are questions on biobutanol, gasoline inventories, refinery margins, debunking, ethanol, investing, the future of the oil industry, where to live to ride out Peak Oil, and whether I have now lost hope. I sometimes excerpted the questions, but I linked to the originals so you can see them in complete context.

The Questions

Chris said: *Dr. Ramey has created a new and more efficient method of production which increases the yield of butanol and decreases the number of and volume of byproducts....not all species of high oil yielding algae are perfect but there are plenty to choose from.*

Questions:

1. Don't you think that at least one of these species could efficiently produce oil if the electrical energy input was reduced?
2. What was the reasoning behind the #3 point saying that closed bioreactors are "totally absurd"?
3. Since you have ruled out the two most efficient and promising fuel alternatives, what do you propose we replace gasoline and diesel with? [Answer](#)

Tad asked: *Where do you see the oil industry in 20 years?* [Answer](#)

Jeff Sutherland asked: *It seems to me that electricity is going to be the key energy source in*

the future....Biofuels, like ethanol, if produced with electrical equipment seems like a good method to store energy....What do you see as the best option for a transportable form of energy in the future? [Answer](#)

[Rob asked:](#) *Have you given up hope? Based on your more recent posts, it certainly looks like it. [Answer](#)*

[Doug asked:](#) *What would be an optimal location to live in ten or twenty years from now? [Answer](#)*

[Armchair261 asked:](#) *There's always a lot of press about gasoline prices and inventory levels. How are these inventories affected by demand for other products, like diesel, propane, or fuel oil? Are refiners having trouble meeting demand for those products too, and is this siphoning some crude away from gasoline production? [Answer](#)*

[anonymous asked:](#) *What is the motivation to maintain high gasoline inventories? [Answer](#)*

[Optimist wrote:](#) *Here's my request: write a posting describing how one might tell if a given technology is promising or not. I think this would be immensely helpful to non-technical readers. [Answer](#)*

[Fat Man asked:](#) *You said you were going to cut back on blogging in order to spend more time with your family. You seem to be blogging as much, or more, as you were before that promise. Are you doing what you said you would, or are you shorting your family? [Answer](#)*

[Anonymous asked:](#) *Would ethanol make more sense if it was simply burned at the production facility to make electricity vs trying to build infrastructure to transport it? Or is the EROI still to low even in that case? [Answer](#)*

[Rice Farmer asked:](#) *...can ethanol be produced by powering the farm machinery and trucks on ethanol and still come out ahead? I think not. So it seems to me that ultimately, the large-scale biofuel industry will collapse and that biofuels will just be produced locally and on a small scale for local needs. Powering the current huge fleet of cars and trucks on biofuels is just a pipe dream.*

So what's your take? [Answer](#)

[Anonymous asked:](#) *Then would the EROI of using biomass for electrical generation actually work out to be favorable from an realistic economic standpoint (i.e., not completely propped-up by subsidies)? Or is it still a big enough sink as far as energy consumed per unit created that it would still be unfeasible to use for energy production? [Answer](#)*

[scp222 asked:](#) *Refining margins are quite low now after been about \$30 a while back. What do you think the future holds for crack spreads and the refining business in general? [Answer](#)*

[garsky asked:](#) *A couple of posts ago you mentioned some things you were doing to prepare for a worst-case scenario. How about some details? Especially the part about your savings. [Answer](#)*

The Answers

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Answer

First of all, I certainly don't want to denigrate Ramey's work. It is a good contribution. However, it is clear to me that many people do not understand the real problem with bio-butanol. It is not a problem of conversion rate or reaction speed. Those are the areas that Ramey addressed, and while those things are nice to have, there is a knock-out factor that has not been addressed. That is, if you read Ramey's patent (which I have done many times), he is still talking about butanol concentrations in the range of 2.5%. That is the problem, not whether the conversion is 25% or 35%.

Butanol is highly toxic to the "bugs", so it is very difficult to increase the concentration of butanol in the solution. What is needed is a breakthrough that would allow the bugs to thrive at the solubility limit of butanol, which is about 8%. (This would be similar to humans thriving in an atmosphere with 5% oxygen). In that case, excess butanol production would phase out of solution, and separation would be much less energy intensive than a distillation. But you can't afford to distill off a 2.5% solution of butanol. The energy inputs into the process will be far greater than the energy content of the butanol. I know this from experience. I have spent several years doing butanol distillations. At a 3% concentration of butanol, we didn't even attempt to separate it out. Even using relatively cheap (at that time) natural gas, it didn't make economic sense to extract that butanol. Those levels of butanol are sent to wastewater treatment for disposal.

Believe me, I have a soft spot for butanol. I want to see it work. But right now there are serious issues. That's not to say that it isn't worth pursuing. In fact, I am working on it myself. But I have to be realistic.

Now, your specific questions:

1. Don't you think that at least one of these species could efficiently produce oil if the electrical energy input was reduced?

The collection is the problem. If you go back to first principles of solar insolation, in the absolute best case a square meter of water can produce about a gallon per year of biodiesel. Once you add up the costs and energy inputs to harvest that meter and process the oil, it becomes an exercise in economic futility. Will it ever be economical? I won't say never. I will say that it is nowhere close.

2. What was the reasoning [behind the #3 point](#) saying that closed bioreactors are "totally absurd"?

I didn't write that. It was written by Dr. John Benemann, who was involved in the algal biodiesel work and coauthored the closeout report of the project. He has 30 years of experience in the field, and like me, he likes to reel in hype when it gets out of hand. That's what he was doing. His reasoning is that the cost of closed bioreactors is far too high - by a couple of orders of magnitude - to justify the amount of biodiesel that you could produce from the process.

3. Since you have ruled out the two most efficient and promising fuel alternatives, what do you propose we replace gasoline and diesel with?

It's going to take conservation, efficiency, inputs from biofuels, electric transportation, public transportation, etc. There is nothing out there, and nothing on the horizon, that can actually replace our current usage of gasoline and diesel. We have to come to grips with this as soon as possible, and start spreading our bets a bit more. Right now, everyone is counting too heavily on

biofuels to deliver.

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Answer

I think the oil industry is going to evolve quite a bit over the next 20 years. There will still be a lot of oil in 20 years. I don't believe supplies can possibly meet the demand growth projections I have seen, which of course means continued high prices.

I see a fairly high probability that the U.S. government will pass punitive measures as the public continues to be outraged at the cash flowing out of their pockets into oil company coffers. It won't matter. I have yet to see a punitive measure that I truly believe will result in lower prices for consumers.

Now, while there will be oil in 20 years, I don't think there will be enough oil. So, oil companies are going to be tuned to developments in alternative energy. A number are already involved in these areas. Even the pure oil companies like ExxonMobil will find themselves moving into this space. And because of continued high oil prices, they will find themselves with the cash to get into any field that looks promising.

The apparent widespread perception that oil companies will sit around twiddling their thumbs while alternative energy companies put them out of business is ludicrous. I have said before that if they wanted, the oil industry could own the ethanol industry. The entire ethanol production of the U.S. only amounts to the output of 1 mid-sized oil refinery. So, why don't they own the ethanol industry? Because they see that their capital is better employed elsewhere at the moment. But if that changes - or if a significant breakthrough occurs in butanol, for instance - the oil companies have the infrastructure and the expertise to capitalize.

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Answer

First, I agree that electricity is going to be key. We have the ability to produce much more electricity than we do now, but I don't think we have the ability to significantly increase our output of liquid fuels. However, I would not produce biofuels from electricity. It would be too inefficient to go that route. For instance, if I started with biomass, I wouldn't convert it into electricity, I would gasify it and convert it into a liquid fuel. The heat produced from the process could be used to produce electricity, but the energy efficiency of the biomass is going to be much higher if you go straight to liquid fuels (if that's what you intend the final product to be).

As far as the best option, I think electric transport will be the core of our transport system long-term, but we will always have a need for liquid fuels. I think biofuels can fill part of this gap. But we have to get away from this belief that we are going to displace most of our current oil usage with biofuels. That kind of thinking is very dangerous, because it could divert too many resources and waste precious time that could be used on more sustainable long-term solutions. Right now, governments are banking far too much on biofuels as THE solution, when they should be spreading the bets a lot more than they are doing.

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Answer

Absolutely not. In fact, I am more hopeful than I have been in some time. I believe I am realistic, in that we are going to have to reduce our energy usage. But I am cautiously optimistic that if things get really tough, we can change in ways that don't seem likely at the moment. We don't give ourselves enough credit for our adaptability. If oil did peak soon and the price went a great deal higher, a lot of people would find areas of fat that they could cut out. This sort of behavioral shift would give us added time to formulate a better strategy than counting on biofuels to provide the net equivalent of 40 or 50 million barrels per day of oil.

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Answer

I think it will be safe within the walls of my compound. :-)

Seriously, if you strongly believe in a worst-case scenario, there are certain attributes that I would look for. I want to see a high ratio of farmland to surrounding population. I want to be relatively close to decent medical facilities. I would like to be close to transportation via rail or water. I want the place to have a reliable water supply. Those are just a few of the things that would be on my check-list, and there are some places that fit the bill. I think certain areas on both coasts of the U.S. will fare well. Needless to say, I think Scotland - which will still produce a lot of oil and gas for a long time - will fare well. I absolutely would not want to live (among others) in Houston, L.A., Phoenix, or Las Vegas (although one could argue that the latter two are well-placed for reliable solar energy).

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Answer

Refiners are always looking at margins on diesel and gasoline. When margins for diesel are higher than for gasoline, they will shift production toward diesel (which will also affect things like the propane balance). A typical refinery can shift between diesel and gasoline to a limited extent - perhaps 5%. If production is shifted toward diesel, then that should eventually improve the gasoline margins as supply is taken off the market, and as this happens they will shift some production back. And they literally look at this and adjust multiple times per week.

The one big caveat is that commitments to existing customers take precedence. So, if margins for diesel look better, but you would have to short an existing gasoline customer to take advantage, you are stuck. You can't declare *force majeure* for something like that. Maintaining relationships with your customers sometimes means that you have to give up short-term profits.

Are refiners having trouble meeting demand? Yes. Refinery utilization has been down since Hurricane Katrina, and the only thing that has kept this from resulting in \$4 gasoline are strong gasoline imports. If the imports dried up, refiners would attempt to maximize gasoline, and this may precipitate a distillate shortage. And we don't import much in the way of distillates, because demand is high elsewhere in the world (unlike gasoline, which is produced in excess, allowing some to be exported).

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Answer

Ideally you only keep inventories where they need to be to make sure that you are always able to supply product to your customers. If you keep inventories too high, you obviously have money

... tied up that's not doing anything for you. But let's say you were maintaining high inventories in 2005. Suddenly, Hurricane Katrina comes along, prices go through the roof, shortages start to crop up, but you are in fat city because you had high inventories. So, it's a balancing act.

One thing you will see if you look back, is that after Katrina refiners started to keep their crude inventories much higher than before. They saw the effects of a supply disruption, so they played it cautious for a while. Over time, I think we will start to forget, and inventories will creep back into the normal ranges.

Gasoline inventories are a different matter. I think refiners would like to put more product on the market, especially back when margins were so high, but they just couldn't make enough to satisfy demand and refill the tanks.

One other time that refiners are motivated to keep gasoline inventories high is when they are headed into a turnaround. You need to have very full gasoline tanks when you shut down, so you can supply your customers while you are down.

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Answer

If it was that easy, people wouldn't keep offering me money to vet technologies for them. Seriously, there seems to be a great big vacuum in this area. I get questions from intelligent people who can look at an energy idea with a major flaw, but they can't see it.

There is no magic formula. I think it requires experience, and you have to take them on a case by case basis. If someone brought me a potential breakthrough in biotechnology, I would be in the same boat as a lot of people are when they try to interpret the latest hyped energy breakthrough. Even though biotech is an interest/hobby of mine, it may be difficult for me to spot a fatal flaw. A molecular biologist may take one look, and say "You see that step where they say 'insert gene A into position B?' Well, the status of the technology is nowhere close to being able to do that."

I think it just pays to be a skeptic first. There is nothing wrong with being a skeptic, even though many people confuse skepticism with negativity. I always tell people that I am a skeptic, but also a problem-solver. I am not shooting these ideas down for fun; I want some of them to work. But you have to sort the wheat from the chaff.

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Answer

You are correct that I am blogging about as much as I did before. However, I realized that it wasn't the blogging that was taking time away from the family. I write very fast. I can knock out an essay very quickly, and I usually do it when I am up early before everyone else. But it's all of the peripheral stuff that was taking up so much time: Answering e-mails (this was consuming over an hour every day), getting involved in debates (another hour), answering questions in the comments section, etc. I have cut those things out.

I have taken my e-mail address offline (although a number of people still have it, and others still find me), and this has cut down the time required to handle e-mail by 90%. While I still have essays put up at The Oil Drum, I haven't commented there since August. I rarely comment on my own blog anymore (and this post was an attempt to catch and address a lot of comments at once).

Now, do I ever short my family as a result of the blog? Sure, sometimes I have to tell my kids to wait just a bit as a finish something up. But do I come home from work and spend the rest of the evening doing correspondence? No. I think I have found a reasonable compromise, and one that my family is pretty happy with.

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Answer

[Joules answered this question](#) in the same way I would have: You would burn the biomass directly to produce the electricity. The EROEI is not the problem; capital costs for biomass-to-electricity plants are much higher because it is more difficult to handle the biomass. But long-term, I think this option will be one that we will count on heavily.

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Answer

I agree. I believe that if ethanol had to be used to provide energy to grow the corn and produce the ethanol, the whole thing would collapse. Remember, the energy balance is already very marginal. The only reason it is 1.3 or so is because of the credits for DDGS byproduct. On a fuel in versus fuel out basis, it is very close to parity.

I am convinced that we have to learn to get by on a lot less energy, but biofuels will provide a portion of our energy needs. I personally believe that the bulk of the solution must come from electricity. I contend that it is simply not possible for the world to produce enough biofuels to displace our current usage of petroleum. Conservation, greater efficiency, and electricity are going to have to be big parts of the equation.

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Answer

I am a fan of biomass gasification to produce electricity. In the long run, I think we really need it. But as I stated above, it isn't the energy balance that is the problem; capital costs are much too high to enable it to compete with coal or natural gas. If carbon emissions were taxed, it would give the biomass to electricity option a boost.

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Answer

With gasoline inventories still so low, I think crack spreads are likely to explode again - certainly by late spring. Right now, with oil as high as it is, and with gasoline inventories where they are, it doesn't make much sense that gasoline prices are soft. There is a bit of disconnect here, but one that I have seen frequently. This situation should put to rest any notion that refiners are in control of their margins, such that they boost profits by boosting margins. I know this seems to be a very popular notion, especially among those with the [Oil Watchdog](#) mentality, but any time I hear someone say it, I immediately know that at least on that topic, they are ignorant of the facts.

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Answer

I am not a financial planner, so bear that in mind. I will tell you what I have done, but I can't say that this strategy would work going forward, and it may not work for you. My strategy is very long-term; I do not attempt to time the market. Going all the way back to the early 90's, I put a lot of thought into a very long-term strategy. I tried to identify sectors that I thought would fare best over a 20-year period. Health care/biotech was one of the sectors that I could see outperforming, especially as the Baby Boomers grew older. People are going to spend money on health care. I still believe that, so I have a fair amount of money in that sector (and have had for many years).

In the late 90's and early part of this decade, I partially abandoned my long-term strategy and jumped on the tech bandwagon like many others. I got burned like many others. Why did I get burned? Primarily, because I didn't really understand the things I was investing in, and I was lured by the prospect of the incredible returns that tech stocks were delivering. I joined the flock with the other sheep and got sheared. So, I reevaluated, and decided: Stick to the areas that I really know, and focus on those. I brainstormed on what I thought the future held, and I concluded that higher oil prices were very likely. But the U.S. is very dependent upon oil, so it appeared to me that the economy in the U.S. is very vulnerable to higher oil prices.

So, these assumptions were the basis of my strategy. I left my position in the chemical industry for a position in the oil industry. I figured that as oil supplies tightened up and the price rose, and people continued to need energy, the people providing that energy would have very good job security. To hedge against the dollar, I put about 20% of my portfolio into international funds (this is more than financial advisors typically recommend). I also made a bet that energy stocks were undervalued. More recently, because I have taken a position in the UK, I have further insulated myself against the falling dollar because my compensation is now tied to the British Pound.

Following the tech stock fiasco, my strategy since 2001 has paid off. The size of my portfolio has increased by 6.3 times since 2001 - which translates to an average annual increase of 36% for 6 years. If I exclude the money that I have added into the portfolio over the past 6 years, the returns alone have averaged 26% a year for 6 years. To put that in perspective, 26% a year will quadruple your initial investment in 6 years. I am now in the process of using some of that capital to acquire land in various locations, which will provide further diversification. (Someone here recently said that while I may know a lot about geology, I can't seem to make the connection between geology and finance. Frankly, I think I have done well with my finances precisely because I made that connection).

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Thanks to all who asked a question or made a comment. I think this has been a productive exercise, and I hope you find my answers useful. I may do this again at some point, but for now, I am back to posting and then lurking.



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