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The Magic of Technology and the President's Biofuels Interagency Working Group

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Growing America's Fuel

As I read through this report, I couldn't help but think that it appeared to have been written by an optimistic cheerleader rather than by someone conducting a sober assessment of the situation. It contains very little of "Here is why we have fallen more than 90% short of our advanced biofuel targets." Instead, the report is completely full of Rah! Rah! Rah!

Bear in mind that the advanced biofuel mandate for 2010 was 100 million gallons. The report admits that the shortfall will almost certainly exceed 90% (as I have been saying it would for at least a couple of years), and the report coincided with an announcement that the former 100 million gallon (cellulosic) mandate is being reduced to 6.5 million gallons. Turns out that the government is learning that you can't mandate technology after all.

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Where the report does get into specifics, it makes excuses, suggesting that the technologies themselves aren't the problem, lack of funding is. To that I say that I can make all sorts of things work "commercially" if I am willing to throw enough money at them. But they will only continue to remain "commercial" so long as I am supplementing them with outside funding.

This report would seem to have been written by people who believe that technological progress is

inevitable. All barriers can be broken down by throwing enough money at them. While I am a technology buff, I have a different view on technology. Generally, technological successes are built upon a great many resolved technical problems. Yet it may require only a single unresolved problem to lead to technological stagnation, or failure.

For example, consider the scale-up of a process from the laboratory. I have run laboratory reactors and distillation columns - and scaled those up - so I am familiar with some of the things that can go wrong. The scale of a laboratory process may be on the order of a few pounds a day. At that scale, things behave differently for a number of reasons. When scaling up a lab process to something like demonstration scale – say a factor of 100 times greater than the lab process – many things can go wrong. In fact, I think it is safe to say that most good ideas die in the lab when practical realities intrude upon theoretical considerations.

One of the most important aspects to manage is the heat inputs and outputs. In the laboratory, the size of the equipment is such that the heat losses from surface areas is a much greater percentage of the total than when the equipment is scaled up. What does this mean? It can mean that it is difficult to replicate the temperatures achieved in the lab. It can mean that the temperatures at scale are much hotter than desired, or it can mean that there are undesirable temperature variations within the process. In my experience, this is a frequent cause of failure when scaling up from the lab.

Each successive scale-up filters out more seemingly good ideas, and in a world in which commercial success hinges on actually being able to earn money from a project, this filter works well. In a world in which technological failures are met by excuses and then optimistically throwing more money at the problem, then end result will be a massive amount of spending, and later congressional inquiries into why we wasted so much taxpayer money with so little to show for it.

So success for these projects is far from assured. Even success at one level of scale-up doesn't assure success at full commercial scale. I can rattle off a dozen things that have gone wrong and been apparent only as projects progressed to full commercial scale. Trace contaminants that can easily be disposed of in the lab can become big headaches at scale. Corrosion is often a killer once some of these projects begin to operate at bigger volumes.

But for the technological cornucopians, these are not real problems: They just require more money and they will be solved. But then why do cancer and heart disease still kill so many people each year? Why does my laptop battery only lasts a few hours instead of a week? Why don't we commercially fly people from London to New York in an hour? The reason is that not all problems are solved by throwing more money at them, because the laws of science sometimes get in the way. Further, solutions are generally advanced an incremental step at a time – not exponentially as our cellulosic ethanol mandates were designed to be.

As I have pointed out, cellulosic ethanol technology is more than 100 years old. You heard it here, and you can hold me to it: There will be no breakthrough that suddenly makes it cost-competitive to produce. On the other hand, press releases that announce big breakthroughs for small incremental steps? No end to those I am afraid, nor any retraction when they can't replicate results outside the lab. The impression this leaves is a steady upward march in the commercialization of cellulosic ethanol - and no setbacks that weren't simply related to lack of funding.

Cellulosic ethanol will never be produced in large volumes for less money than corn ethanol can be produced for - and keep in mind that we are still subsidizing that after 30 years. What may

happen is that it eventually can be mildly successful in certain very specific instances. But to think that a billion tons of U.S. biomass will contribute a major portion of the U.S. fuel supply via cellulosic ethanol? Hogwash from many people who have never scaled up anything. The reasons are not from lack of funding, **they are fundamental based on physics, chemistry, and the nature of biomass.** Technological breakthroughs won't get around the laws of physics.

Had I written the report, you can bet that I would have written it differently. It would have been a sober technical assessment, and would have included a root cause analysis of why there was a 93.5% shortfall in the mandated supply of this miracle fuel that is going to end petroleum dependence forever. I would not have recommended to cease all funding - cellulosic ethanol is in my opinion worthy of further research, and can be a niche solution in specific circumstances – but there would have been a recommendation for the government to get out of the business of choosing technology winners. There would also have been a lot of planning for scenarios in which things didn't pan out as expected. I like to have a Plan B that wasn't cobbled together only after Plan A fell apart.