



Energy costs are becoming more critical

Posted by [Heading Out](#) on November 5, 2006 - 10:52pm

Topic: [Demand/Consumption](#)

Tags: [drilling](#), [eroi](#), [innovation](#), [lasers](#) [[list all tags](#)]

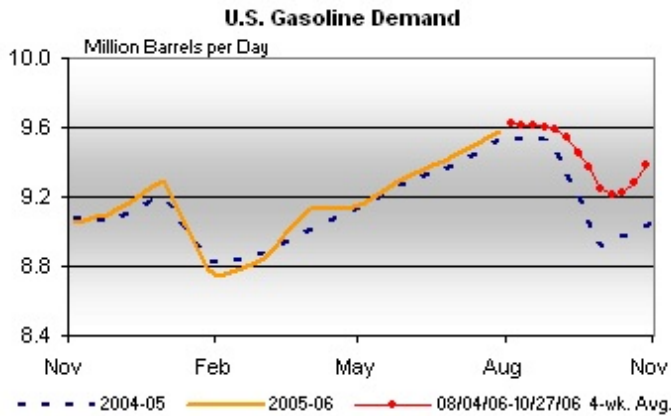
Well it is that time of year again, and I've just spent an hour or so sweeping the chimney and cleaning the stove. Getting ready to start heating "the old-fashioned way" is a very long way from earlier this week when I walked around the exhibition at [Fabtech](#), the largest metal forming trade show in North America. There were robots welding, pipes bending, punches thudding, waterjets cutting and 6 kW lasers carving out samples from metal plates. It was one of those places where, if so inclined, you could watch fascinating displays almost all day (and I did). But it led me very quickly to thinking about the energy that is now consumed in manufacturing, as we have moved from getting things hand-made by the blacksmith down at the forge, to where the entire process can be robot-operated, without human touch. This change has been one of those steps that keep North America ahead in a time of global markets and much cheaper labor elsewhere. But that change, and the power of many systems today, has rarely, `til recently, had to consider the cost of energy, as a significant part of the operational expense.

That now is changing, and energy costs are already having an impact that goes outside the more obvious ones of driving less, or turning down the thermostat. Anecdotally one hears that the [National Glass Center in Sunderland](#) is closing four of its furnaces, because of the rising price of natural gas. That's one way to cope with the increase in cost, simply stop doing what you were, or at least at the same level. But as the entire economy becomes a victim, long-term that is not going to help.

The shape of things to come is presaged, in places such as sub-Saharan Africa where, as the [President of Senegal noted](#)

The oil crisis is not a vexing "cost crunch"; it is an unfolding catastrophe that could set back efforts to reduce poverty and promote economic development for years. . . . Here in the capital of Senegal, gasoline costs \$5.62 a gallon. . . . in a country where per capita income is \$849 a year. Senegal's electrical utility has been forced to turn off the lights throughout the nation for long periods every day, a crippling problem that could be eased if energy cost less.

Unfortunately the Cornucopian point-of-view that we will soon be swimming in oil and gas again, doesn't help encourage any thought of change in the way that energy is used. There is an implied thought that if we can just stick it out, soon we will be back in the land of plenty. For example the EIA data shows, the U.S. demand for gas is continuing to grow, despite the price.



As a result efforts to find new ways to operate with less energy are not given much attention, or support, since (learning from the lessons of the 80's) that investment will be found to have been thrown away when the tap re-opens. And this is a pity, since the last of the generation that worked on these problems the last time they came around, are now retiring. Further, since a lot of the work was done before the Internet was around, there is little of it that can easily be recovered through Search Engines, and thus it will likely be lost.

I was thinking of some of this as I watched the lasers at the Fabtech show. In cutting applications they work by either melting, or more often vaporizing the target material. This is inherently a less efficient method of cutting than, at the other extreme, a guy with a pair of steel shears, in terms of what we call specific energy - i.e. the amount of energy required to remove a unit volume of material. Laser cutting is much more energy intensive, though it gives a precision and speed, that is often hard to match if you were doing it, with less energy cost, by hand.

And if you were thinking of using it to drill an oilwell, then Bill Maurer, has some [sad news](#) for you.

SYSTEM	SPECIFIC ENERGY (joules/cm ³)
Rotary bit	100
High-pressure jets	1,000
Thermal spalling	1,500
Melting	5,000
Vaporization	12,000

You have the same level of cutting energies when you use the same sorts of tools for cutting steel. So it is that we are now using one of the more energy-expensive techniques for cutting. It is possible, by narrowing the beam, to remove only sufficient material to allow separation, and the process can, in that way be more efficient. But there is only a certain amount of change one can make in a system like this before one reaches a limit. Vaporizing material just costs a lot of energy, period. Which suggests, as energy costs become a greater part of the industrial process, that we should see more research to try to find new and better ways to get things done with less energy.

I was thinking about vaporization on the plane back from Atlanta, and was reading in the latest [Wired](#) that the brain allows alcohol molecules in, while keeping others out (something they are trying to overcome) and did suggest to my students that perhaps if we put a tap in their ear, and allowed them to drink to excess we might find a new way of concentrating the alcohol from cellulosic production - but this obviously was not the humorous aside I thought it might be.

My point, however, was that we are in need of finding different approaches to saving energy in most of the things we do. In many cases the older ways did not use as much energy, but were slower and required some skill that has, in large measure, been lost. The values for energy cost that are assumed in many of these cases are not absolute values, but are reflective of the current way in which we carry out the work. A man with a pick can mine coal at around 4 joules/cc, which is a mere fraction of that needed by a laser. But he (there were no female miners in the UK in those days) did it by breaking the coal out in large pieces, using the leverage of his pick to extend existing cracks. If a laser is used, then the existing crack system is not taken advantage of, and the energy cost is much higher. (And to anticipate the comment - if you use a pico-second laser the coal will not ignite as it is vaporized). There is thus a lot of potential in reconsidering how we use energy beyond just the improvements that can be made in transportation efficiency.

But, sadly I do not think that we are looking for these alternate approaches that intensely. It was legitimate and timely for Matt Simmons to [point out the lack of investigators](#) (at 24:30 on) and that there are very few break through ideas on the drawing board for the fossil fuel industry. Though he spoke specifically to the crude oil problems. He also pointed out that the majors aren't funding research in these topics, and that the relevant departments at the universities have shrunk and lost their budgets, so that the technology pipeline is nearly empty.

I have bemoaned this problem before, but the steps that I see coming from the government seem more tied to single, large center funding, rather than encouraging a multiplicity of studies to find answers. Which is not to say that they are not there, but if folk aren't looking that hard for them, (because of both a lack of interested faculty and students, and a lack of funding) then it will take that much longer to find answers when it will no longer be needed as a prudent step but rather as a vital one.

And in the meantime, it is back to working with that fuel that warms me twice. The first time when I split it (as in now) and then, later, when I burn it.



This work is licensed under a [Creative Commons Attribution-Share Alike 3.0 United States License](#).