New Cabinet Position-"Energy and the Environment"?

Posted by Nate Hagens on November 10, 2008 - 9:30am
Topic: Policy/Politics
Tags: barack obama, coal, energy policy, environment, ethanol [list all tags]

Last night on the Change.gov website, the major 'categories' for the transition administration included the usual headings: 'Commerce', 'Defense', 'Education', etc. But there was a curious entry in the list: "Energy and the Environment", (which is no longer there). My eyes expected to see "*Energy*" and "*Environment*" under separate headings. (Todays listing of cabinet positions is now identical to the current admininistrations.) But for a brief, heart pounding moment, I thought this might be a sneak preview into a sea change in the way policy leaders see the world, one unified Cabinet position, linking two critically interconnected areas, Energy and the Environment. I expect it was a snafu, or I misunderstood what I was seeing. As such, this brief post is not about advocating or predicting such a cabinet position will emerge. But as we go forward in these challenging Liebigs Law times, such a cabinet position might be the first step in recognition both of limits, and of the wide boundary impacts of our internalize profits / externalize costs social system. Of course there are risks with such a union...

OBAMA'S ENERGY PLANS

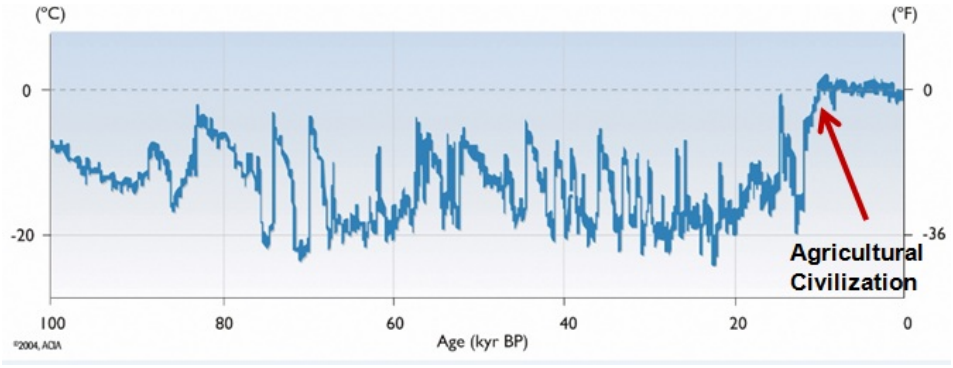
Last night I caught up on what is happening with President-elect Obama and his energy policy plans. Since I haven't owned a television since 2001, I read numerous articles and watched the above and other speeches on Obama's energy website. There was a great focus in the speech (and other speeches and articles) on energy independence, and creating jobs from generating

renewable fuels here at home. Obama specifically mentioned being completely free of oil from the Middle East and Venezuela by 2025, and replacing 7.5 million barrels of oil imports with renewable fuel. He also mentioned climate often, specifically in regards to leaving a planet for our children and grandchildren to enjoy.

In the coming 2 weeks, theoildrum.com is going to have detailed review/critique/feedback on the IEA WEO 2008 Report due out this week outlining the future of world's energy supplies. So I will not go into specific energy details on the gargantuan task of becoming energy independent, even oil independent, in the next 20 years, (short of a complete change in how we use energy). Instead I would like to highlight the increasing linkages between energy and the environment. Though President-elect Obama has oft mentioned global warming, there are many other important areas where energy procurement and environmental health exert opposing forces.

ENERGY AND CLIMATE

Let's start with climate, as Obama has made it a priority to reduce carbon emissions. Today we hear that more climate scientists are advocating phasing out of coal because we are already in the danger zone on CO_2 emissions.



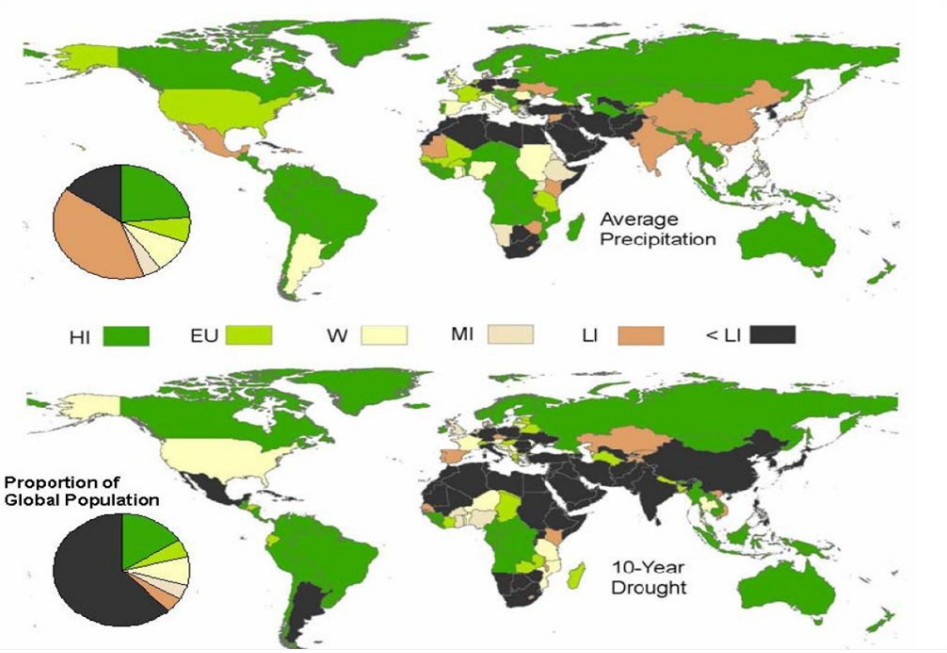
100,000 Years of Greenland Temperature - Source 2004 Artic Climate Impact Assessment

I am not a climate expert, but I do know that the human brain developed and our flexibility and adaptability was possibly influenced during periods of rapid climate oscillations over the past million years, and in particular over the past 100,000 years. Since the dawn of agriculture, we have not only had a 'warm' period' but also incredible lack of volatility in temperatures. A goldilocks climate subsidy.

The main arguments about energy and climate change cluster around three key questions: 1)how quickly will our high quality low cost fossil fuels deplete?, 2)how quickly, if at all, will our climate continue to warm (and what feedback mechanisms are involved), and 3)if the answer to both questions is something in the order of 'yes, quickly', what chunk of the low cost energy must be allocated towards mitigation of climate disruption. If the answer to either question 1 or 2 is 'not quickly', then we can prioritize the other. These questions most crucially center around coal, and how expensive it will be to sequester carbon using CCS. Rough estimates are that carbon capture and storage will use 20% of the original energy output. Of course, reducing consumption, or some other social paradigm other than competing for the most stuff, reduces both carbon, and oil use. So energy procurement, and reduction in GHGs are only at loggerheads in a business as usual, nominal growth-as-measured-by-GDP oriented world.

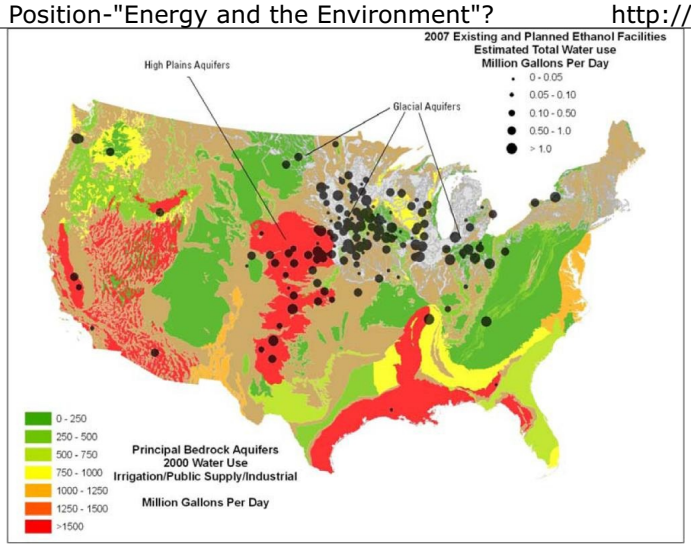
ENERGY AND WATER

While the impact of human activities on climate is broadly publicized, the impact of human activity on other areas of the environment is less so. Energy production, in particular biofuels, uses a great deal of water.



Countries by population able to allocate water towards energy usage. Source: *Burning Water: Energy Return on Water Invested* Mulder, Hagens, Fisher. Pub pending 2008

In an upcoming paper, I show that using WHO population estimates and BP energy production statistics, that fully 70% of the worlds population (by country) will be severely limited by using water for ANY energy production by the year 2025 in 1 in 10 drought years. 50% in normal precipitation years. Fully 3/4 of our water goes towards energy or agriculture (which itself is increasingly going towards energy). In the United States, thermo-electric power and irrigation accounts for fully 82% of our fresh water usage. (S. Hutson et. al 2004). Our study was probably conservative. For example Australia, as a 'country' did not show up with any water restrictions for energy use, but the resolution did not focus down on the breadbasket areas, where water is needed. Already last year, Australia narrowly averted complete water/irrigation shutdowns due to drought.



Existing and planned ethanol facilities (2007) and their estimated total water use mapped with the principal bedrock aquifers of the United States and total water use in year 2000.(Source USGS) Click to enlarge.

The National Academy of Sciences has a report on The Implications of Biofuel Production for United States Water Supplies. Not only are biofuels more water intensive, but there are a great number of other negative externalities as well, including soil loss, atrazine in water reservoirs, nitrogen runoff creating hypoxia in GOM, and others. All the while we focus on biofuels for energy, we are depleting fossil sources of another kind: water in the Ogalalla and other non-renewable aquifers in the United States.

NASA ASTER image of an approx. 557 mi² area of fields (1443 km²) in Kansas which are watered from the Ogallala aquifer with center pivot irrigation systems. CLICK TWICE TO ENLARGE

ENERGY AND ENERGY

In addition to our fossil fuel bank account, we have an enormous amount of energy 'interest' available to the planet's denizens.

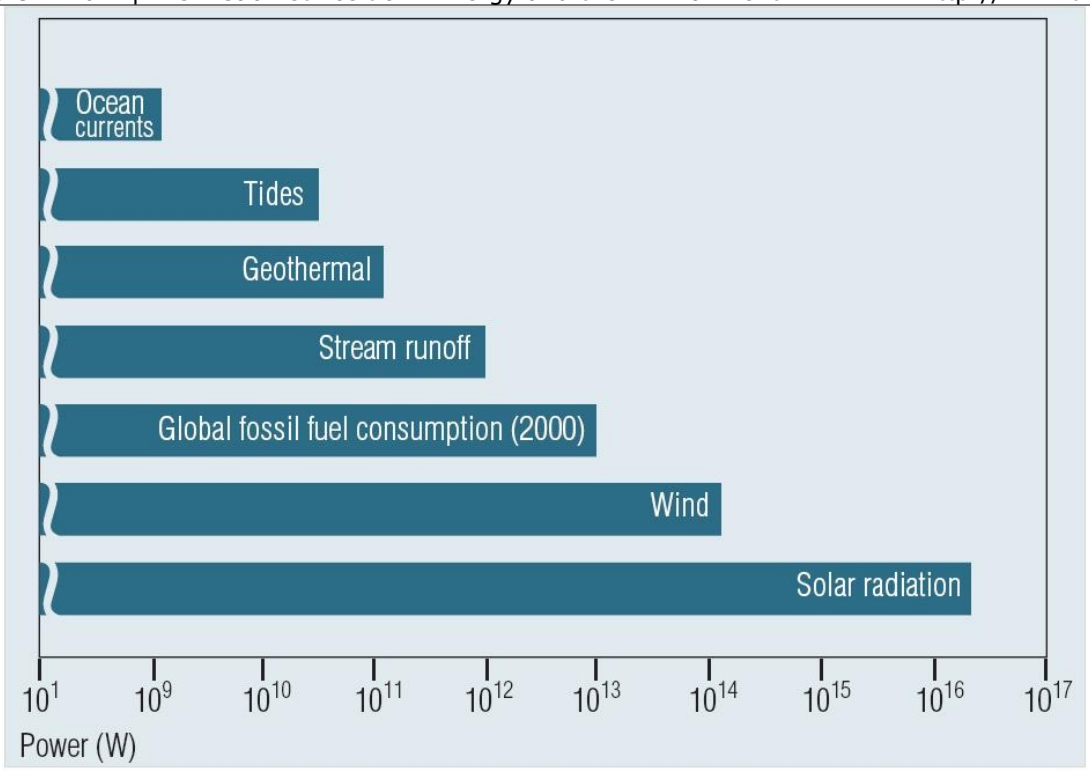


Figure 3. The global flux of fossil and renewable fuels. (Source: Smil, V. 2006. "21st century energy: Some sobering thoughts." OECD Observer 258/59: 22-23.)

The global flux of fossil and renewable fuels. (Source: Smil, V. 2006. "21st century energy: Some sobering thoughts." OECD Observer 258/59: 22-23.)Click to Enlarge

But as has been written about here extensively, all energy is not equal. Not only does each energy technology have unique impacts on the environment, large or small, but it also has different properties in power density, energy density, and intermittency.

From Energy Transitions Past and Future:

> Due to the enormous amount of geologic energy invested in their formation, fossil fuel deposits are an extraordinarily concentrated source of high-quality energy, commonly extracted with power densities of 100 or 1000 W/m2 of coal or hydrocarbon fields. This means that very small land areas are needed to supply enormous energy flows. In contrast, biomass energy production has densities well below 1 W/m2, while densities of electricity produced by water and wind are commonly below 10 W/m2. Only photovoltaic generation, a technique not yet ready for mass utilization, can deliver more than 20 W/m2 of peak power.

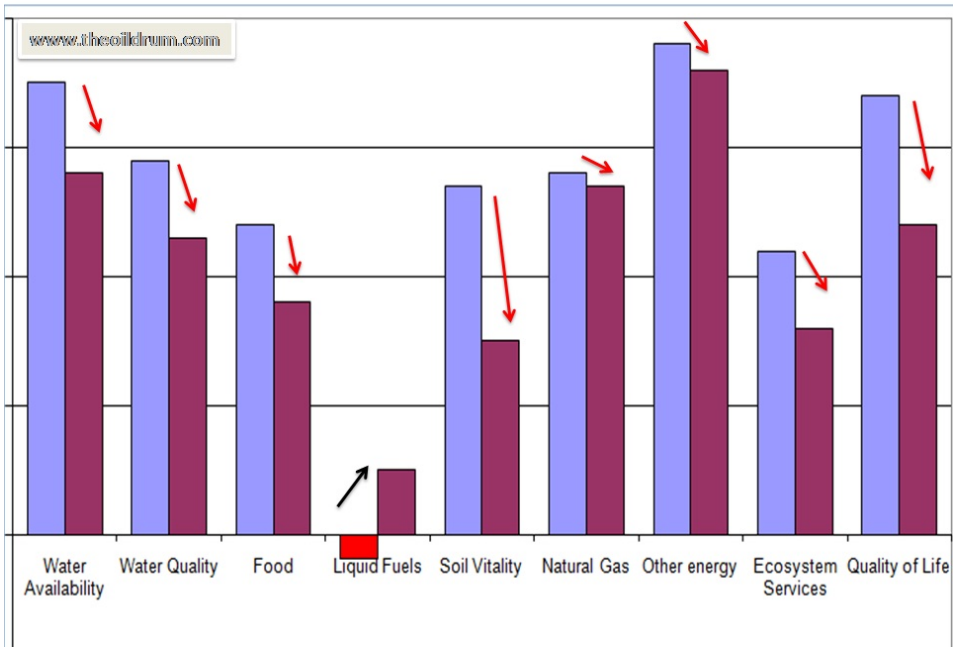
Perhaps most importantly, the energy returned on the energy invested into the technology is a critical, (but not standalone) metric. Energy is what we combine with resources, ideas and labor to create economic work. We only think we pay for things in dollars, but energy is the ultimate currency. Without it, the dollars eventually become meaningless...

ENERGY AND THE ENVIRONMENT

Society is gradually recognizing we have an energy problem. There is simply not enough low-cost, low-externality, high-quality, high-density energy available to fuel the appetite of a full planet. From here forward, there will almost always be tradeoffs between energy and 'something else', be

it GHGs, water, soil, ecosystem health, biodiversity, etc. On top of that, energy needs to be cheap enough for all stakeholders, lest their be social unrest due to rising income/wealth inequalities. It is for this reason that, however unlikely, a Cabinet position "Secretary of Energy and the Environment", makes complete sense. If history is any guide, our individual (and government) penchant to put out short term fires while increasing the odds of long term napalm, will likely (after/if our financial storm passes), choose to address shortages in liquid fuels without studying the wider boundary impacts of their actions.

An Increase in Liquid Fuels at What Cost?



WHAT COST GASOLINE? (Hypothetical graphic)*Click to Enlarge*

Additionally, as a new administration transitions towards 'renewable systems', we will have to adapt our land area use to lower power density renewable sources (especially if coal is being phased out). According to energy scientist Vaclav Smil, if we are to power the existing residential, industrial and transportation infrastructures built from fossils, a renewable-based society will have to concentrate otherwise diffuse flows to overcome the large power density gaps. Essentially, we would require a great deal more land for primary conversions, especially while relying on inherently inefficient photosynthesis which has very low power density: "the mean is about 450 mW/m2 of ice-free land, and even the most productive fuel crops or tree plantations have gross yields of less than 1 W/m2 and subsequent conversions to electricity and liquid fuels prorate to less than 0.5 W/m2" (Smil 2007).

Already wood is being targeted for gasification, pellets, and for heating. My essay Home Heating with Wood showed that we could replace only a small fraction of heating oil and natural gas use with the annual forest growth is being presented next week to the North American Electricity Reliability Corporation (NERC) meeting in Durham NH. The threads that connect energy and the environment are being weaved, largely behind the scenes, into an interconnected tapestry. In sum, an energy transition towards 'green sources' has to account for complex inputs and outputs (costs and externalities) that were primarily assumed away during a cheap fossil fuel era.

TRAGEDY OF THE ENERGY INVESTING COMMONS

My biggest fear that accompanies my hope of a new administration tackling some of these difficult problems is that we will replace our declining High EROI, high externality (in the case of coal) fuels, with low EROI, low externality renewable fuels. We require a minimum energy surplus to power industrial civilization and *many* of the renewable sources targeted are environmentally benign but also energy duds. Furthermore, the environmental benefits of many ostensibly low externality technologies like cellulosic ethanol are still open to debate. (Systems analysts, not common at high government meetings, must begin to weigh a portfolio of inputs, energy being a very important one, but by far not the only critical one. The rather complicated graphic below shows formulae (defined in paper linked) for a framework to measure both WHAT is included in the energy return of a fuel source (wide boundary vs narrow boundary analysis), and HOW it is included (non-energy inputs excluded, a single criteria, or multiple non-energy inputs included). Ultimately, we should strive for the highest (physical) return on the most limiting input(s).

	Basic EROI	**Total EROI**	**Multicriteria EROI**
Narrow Boundary	$\frac{ED_{out}}{ED_{in}}$	$\frac{ED_{out}}{ED_{in}+\sum_k \psi_k I_k}$	$\frac{ED_{out}}{I_k}$
Intermediate Boundary	$\frac{ED_{out}}{\alpha\left(ED_{in}+\sum_k \gamma_k I_k\right)}$	$\frac{ED_{out}}{\alpha\left(\begin{array}{l}ED_{in}+\sum_k \gamma_k I_k \\ +\sum_k \psi_k \pi_{X,k} I_k\end{array}\right)}$	$\frac{ED_{out}}{\alpha\sum_k \pi_{X,k} I_k}$
Wide Boundary		$\frac{ED_{out}}{\alpha\left(\begin{array}{l}ED_{in}+\sum_k \gamma_k I_k \\ +\sum_k \psi_k \pi_{X,k} I_k \\ +\sum_i \upsilon_i E_i\end{array}\right)}$	$\frac{ED_{out}}{\alpha\sum_k \pi_{E,k} I_k}$

EROI Framework (Source: Energy Return on Investment: Toward's a Consistent Framework, Mulder, K., Hagens, N. AMBIO Vol 37 Issue 2 Mar 2008 pp 74-79) *Click to Enlarge*

CONCLUSION

I think the President-elect limits his inner thoughts:spoken word ratio (don't we all?). But sifting through datapoints on speeches and articles, one might conclude that 'he get's it', more than any leader we have seen in recent times.

A few minutes later he summoned me to the plane's first-class section, evidently choosing an economics discussion over a DVD of "Mad Men," which was sitting on his side table. His eyes were tired, and he looked a good deal older than he had only four years ago, on the night that he became famous at the 2004 Democratic convention. But we ended up talking for an hour. After I returned to my seat, the press aide walked back to tell me that Obama had more to say.

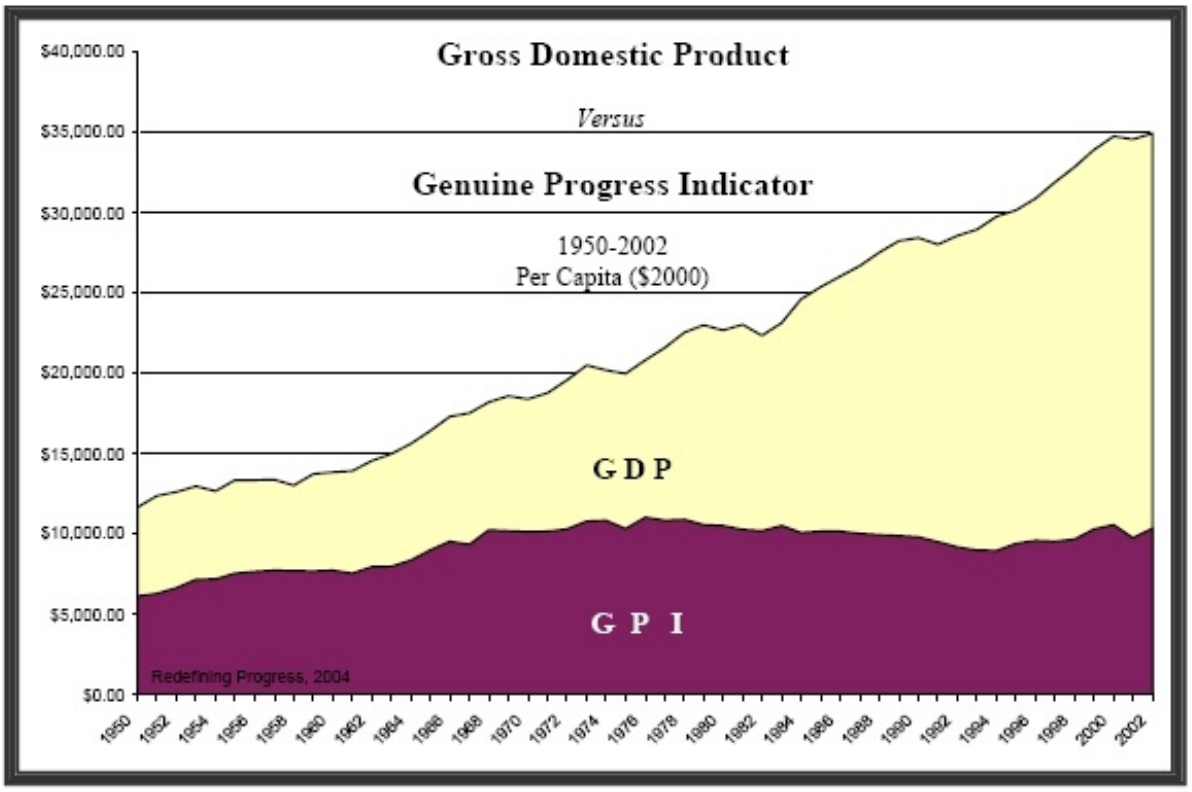
"Two things," he said, as we were standing outside the first-class bathroom. "One, just because I think it really captures where I was going with the whole issue of balancing market sensibilities with moral sentiment. One of my favorite quotes is — you know that famous Robert F. Kennedy quote about the measure of our G.D.P.?"

I didn't, I said.

"Well, I'll send it to you, because it's one of the most beautiful of his speeches," Obama said.

In it, Kennedy argues that a country's health can't be measured simply by its economic output. That output, he said, "counts special locks for our doors and the jails for those who break them" but not "the health of our children, the quality of their education or the joy of their play."

The second point Obama wanted to make was about sustainability. The current concerns about the state of the planet, he said, required something of a paradigm shift for economics. If we don't make serious changes soon, probably in the next 10 or 15 years, we may find that it's too late.



Genuine Progress Indicator vs Conventional GDP Source: Redefining Progress *Click to Enlarge*

Fusing economics, energy and the environment is the challenge of our generation. While perfect may be the enemy of good; short-term and narrow boundary thinking are also the enemies of long term social (and environmental) sustainability. In other words, renewable energy at all costs will come with some big costs. As high quality fossil fuels deplete, more energy will have to be diverted away from other sectors of the economy, (irrespective of costs measured in fiat currencies), towards energy procurement. The mismatch between the inherently low power densities of renewable energy 'interest' and high power densities of fossil 'capital' means that Obama's focus on energy independence via renewable systems will require profound spatial and social restructuring with major environmental and socioeconomic consequences. I might suggest that equal or greater efforts be spent on reducing energy demand than on sticking our hands further in the monkey trap.

New Cabinet position? How about 'Secretary of Redefining Progress'?

> ***"We cannot solve our problems with the same thinking we used when we created them."-*** *Albert Einstein*