The Oil Drum: Europe
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

The Slavery of Oil

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Tags: crude prices, demand destruction, economics of oil, peak oil [list all tags]

Last week, I attended a round table discussion of ASPO Switzerland held here in Zurich. The topic of the discussion concerned the price of oil. Can we explain what happened in recent months to the price of crude oil? Why did it rise sharply last spring to a value of $147/barrel to then drop again down to a value of $36/barrel? What can we expect that the next few months and years will bring?

The aim of this short article is not to discuss that meeting in any detail. Such issues have been discussed to quite some depth already here at the Oil Drum. The purpose of this article is to discuss a single remark that one of the attendees, a Professor of Economics of the University of Geneva, made during the discussion.

This gentleman, unfortunately I didn't get his name, claimed that the price of crude oil could not rise much above $120/barrel in a sustainable fashion, because at such prices, we would use up our entire GDP for the procurement of energy only.

We all know that, after the peak, the oil must invariably become more expensive. We also know that, as the oil becomes expensive, demand destruction sets in that reduces the demand for the commodity, driving its price back down again.

What I had not come across before was a methodology that would allow me to quantify the price level at which our economies will stall, and this is precisely what my colleague from Geneva suggested.

The goal of this article is to review his proposed methodology.

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Let me start from the beginning.

Many years ago I read a science fiction novel, I don't remember its title, with the following plot. The story played in a mining town somewhere in Latin-America. Employees of the mining company were lured with an offer of free housing and an attractive salary. Yet, as they arrived they found out that there was only a single store in town, owned by the mining company, that sold food, and that food was horrendously expensive. In fact, it was so expensive that the employees had to spend more than their entire salary just to stay alive.

The company would allow them to buy food on credit, but if and when they did, they had to sign an agreement that they would not leave town until they had repaid their debt. As they were forced to spend more than their entire salary just to stay alive, they had essentially become slaves of the mining company. The longer they stayed, the more indebted they became.

Most economic systems are difficult to understand. They are entangled, and there are so many conflicting variables with opposing effects that it is hard to predict how they develop over time.

Yet, the above ploy is so simple that it doesn't require a higher degree to understand how it works.

My colleague argued that a similar mechanism applies to our procurement of energy. As energy becomes more expensive, we may soon experience a situation where we spend our entire GDP and more just to procure the energy needed to maintain our life style. This claim is what I wanted to verify.

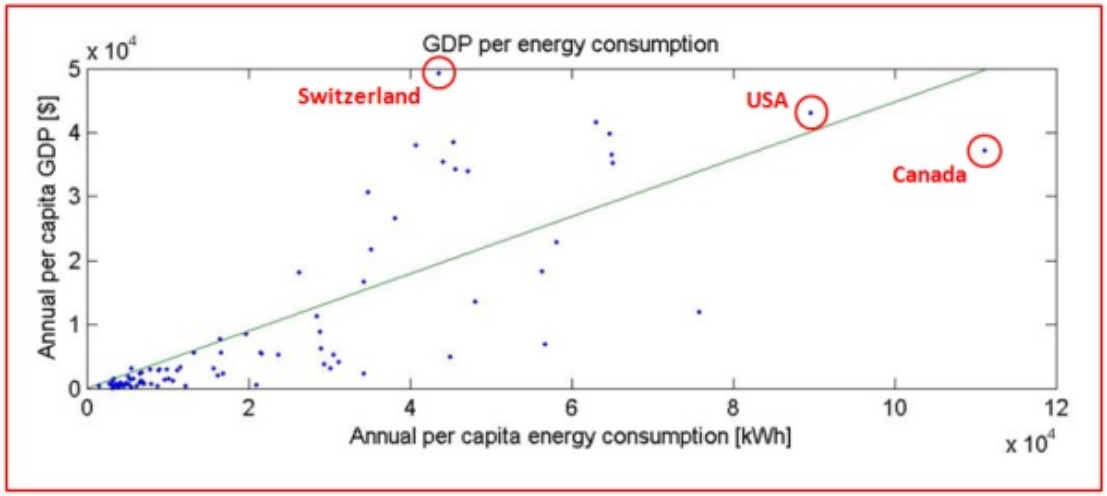
I started out with population data. These are easy to come by. I used Wikipedia to jot down the populations of the 100 most populous nations on this globe.

Also the annual GDP of different countries (measured in U.S. Dollars) is easily found on the web. I augmented my spredsheet with data from Nationmaster.

Primary energy consumption data are more difficult to come by. I started out with the BP Statistical Review of World Energy. However, this report lists only the most important countries independently. Many of the less important energy consumers are grouped together. I found additional data on the website of the International Energy Agency. All energy consumption data are given in Mtoe (millions of tons oil equivalent) consumed by a given nation per annum. I simply eliminated from the spreadsheet those few countries for which I couldn't find energy consumption data.

I then calculated the annual GDP per capita, as well as the annual energy consumption per capita. I converted the per capita energy consumption from Mtoe to barrels on the one hand (1 toe = 7.4 barrels), and to kWh (1 toe = 11,630 kWh) on the other.

I then plotted the per capita annual GDP against the per capita annual energy consumption (in kWh):



Switzerland is the most energy-efficient among all of the countries displayed in the graph. It generates the highest GDP per kWh of consumed energy. Canada is the biggest spender in absolute terms. It consumes the largest amount of energy per capita, while generating a GDP that is considerably lower than that of Switzerland. The least energy-efficient country is Uzbekistan, as it generates a very low per capita GDP while still consuming some energy in the process. The U.S. is about average with respect to energy-efficiency, but it is also the second biggest spender in absolute terms.

Some countries weren't included in the graph as they didn't make the list of the 100 most populous nations. Luxembourg generates a per capita GDP that is almost twice that of Switzerland ($84,161 per person), but is considerably less energy-efficient than Switzerland (104,072 kWh per person). The United Arab Emirates are bigger per capita spenders of energy

than even Canada (154,005 kWh per person) with a lower per capita GDP ($28,202 per person).

I then fitted a straight line through the cloud of data points using a least square's fit. This line shows that, on average, the different countries exhibit a GDP-to-energy ratio of $0.47/kWh. Yet, this is a per-nation average. It is not weighted by the number of people living in the individual countries. If we take the total GDP produced by the entire world ($48,385,988,612,830.00, according to Nationmaster) and divide it by the total energy consumed (11,099.3 Mtoe = 1.29e14 kWh, according to BP), we obtain a GDP-to-energy ratio of only $0.37/kWh.

This means that, if ever the price of energy should rise to a level of $0.37/kWh, we would spend our entire GDP just on the procurement of energy. This corresponds to an oil price of $590/barrel.

If the price of crude oil should rise even higher, we have only two options left. We can either simplify our life style, or we can indebt ourselves. At that moment, we have all become slaves of the oil companies.

Clearly, our economy will stall much before then, because we also need other things beside energy alone. We need to wear clothes and live in houses. We need to invest money in these items. The $590/barrel therefore constitutes only an upper limit. In reality, the maximum price of oil (or other energy resources) that our economy can handle is considerably lower than $590/barrel, probably lower than $200/barrel.

And by the way, before I forget it, whereas it is true that I read the story about the hypothetical South-American mining company in a science fiction novel first, the plot is based on historical data. You may read up on the truck system and debt bondage, for example.

You load sixteen tons, what do you get
Another day older and deeper in debt
Saint Peter don't you call me 'cause I can't go
I owe my soul to the company store.