The Oil Drum: Europe
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Renewables to the rescue?

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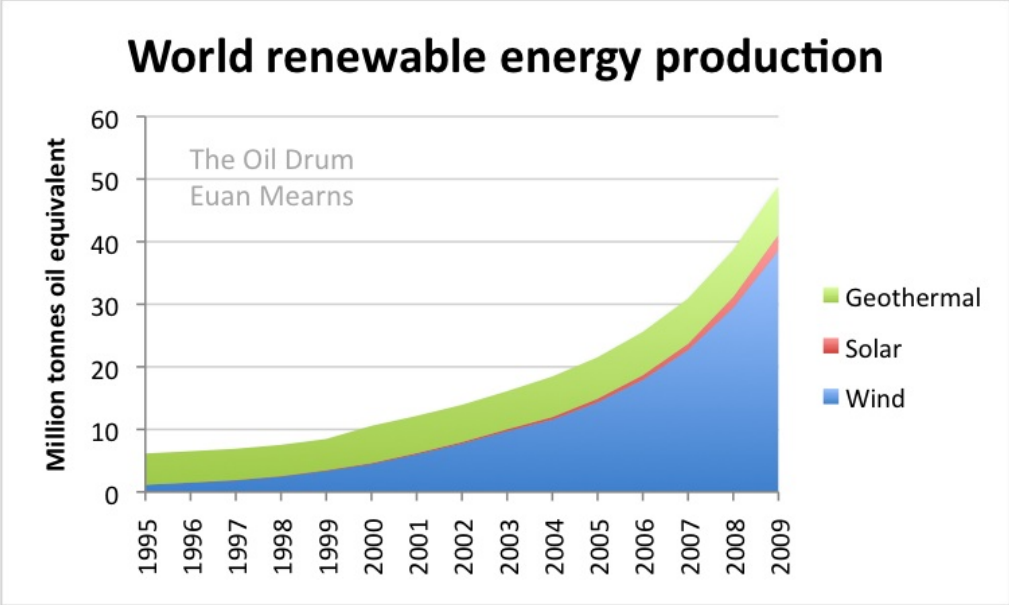
With the tragic Gulf of Mexico oil spill now focussing President Obama's and the American people's minds on where their energy comes from, and what some of the collateral costs might be, its an opportune moment to look at how renewable energy may help supply our future energy needs.

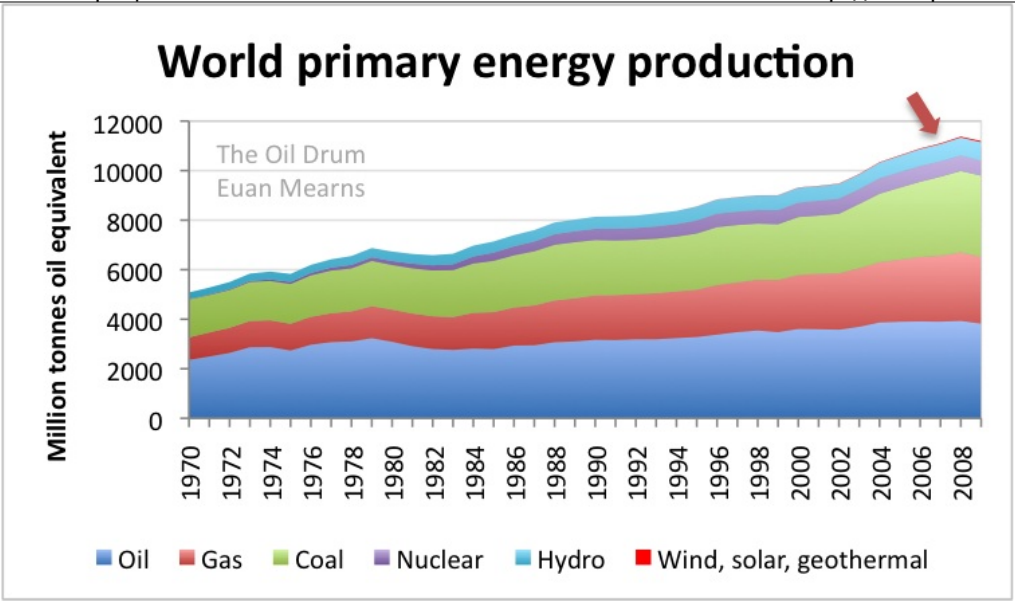
Somewhat ironically, it is BP that provides the energy world with a priceless service through their **annual review of world energy** that was published last week (with little fanfare) which this year, for the first time, includes data on renewable energy.



Exponential growth in wind energy over the past 15 years has boosted energy from renewables to near 50 million tonnes oil equivalent per annum.

So is this the way to go? Will renewable energy save us from future environmental catastrophes such as the Macondo blow out?

Well I'm sorry if I raised your hopes too high. The chart below shows that global primary energy production is running at about 11,000 million tonnes oil equivalent (MMTOE) per year and that the 50 MMTOE provided by renewables is barely significant - it is the skinny red line marked by the big red arrow.



*World primary energy production 1970 - 2009. In 2009, fossil fuels (oil, natural gas and coal) accounted for 87.5% of the energy we used. Wind, solar and geothermal combined accounted for 0.4%. Data source **BP 2010.** (to download data click on workbook in the historical data box).*

What is primary energy?

As the term suggests, it is primary as opposed to secondary energy production. Much of the energy we use at home in the form of electricity is secondary, produced in power stations by burning primary energy like coal or natural gas. And so to avoid double counting, the best way to get a handle on how much energy the world uses is to simply focus on primary energy. Nuclear and Hydro Power both produce electricity directly and so they are counted as primary energy. Similarly, wind, solar and geothermal produce electricity directly and may also be counted as primary energy.

Why tonnes oil equivalent?

One problem in studying energy is trying to equate the energy content of different energy sources. How do you compare 1 barrel of oil with 1 tonne of coal with the power output from a 1 GW nuclear reactor. One way is to reduce all these to the actual energy contents as measured in Joules (J) or British Thermal Units (BTUs), but there you end up with very big numbers. Another way is to normalise everything to their oil equivalents. In other words how many tonnes of coal or natural gas are equivalent to a tonne of oil? Since BP already provide tables that convert all primary energy sources to MMTOE this is a very convenient standard to employ. However, they do not provide this information for wind, solar and geothermal and I had to do the conversion myself.

1 TOE = 42 gigajoules
1 TOE = 40 million BTUs

Converting installed electrical capacity to MMTOE

For renewable electricity sources, BP quote values for installed capacity in megawatts (MW). Now the wind does not always blow and the sun does not always shine so installed capacity needs to be reduced by a factor to take into account this intermittency. Geothermal provides continuous power. The following load capacity factors have been used:

Wind 0.33
Solar 0.15
Geothermal 1.0

The next stage is to convert from MW to MW hours by multiplying by 24 and to then get MWh per year by multiplying by 365.25. So that gives us the amount of electricity generated in a year. To convert to MMTOE you divide by 12,000,000, employing standard conversion factors also provided by BP.

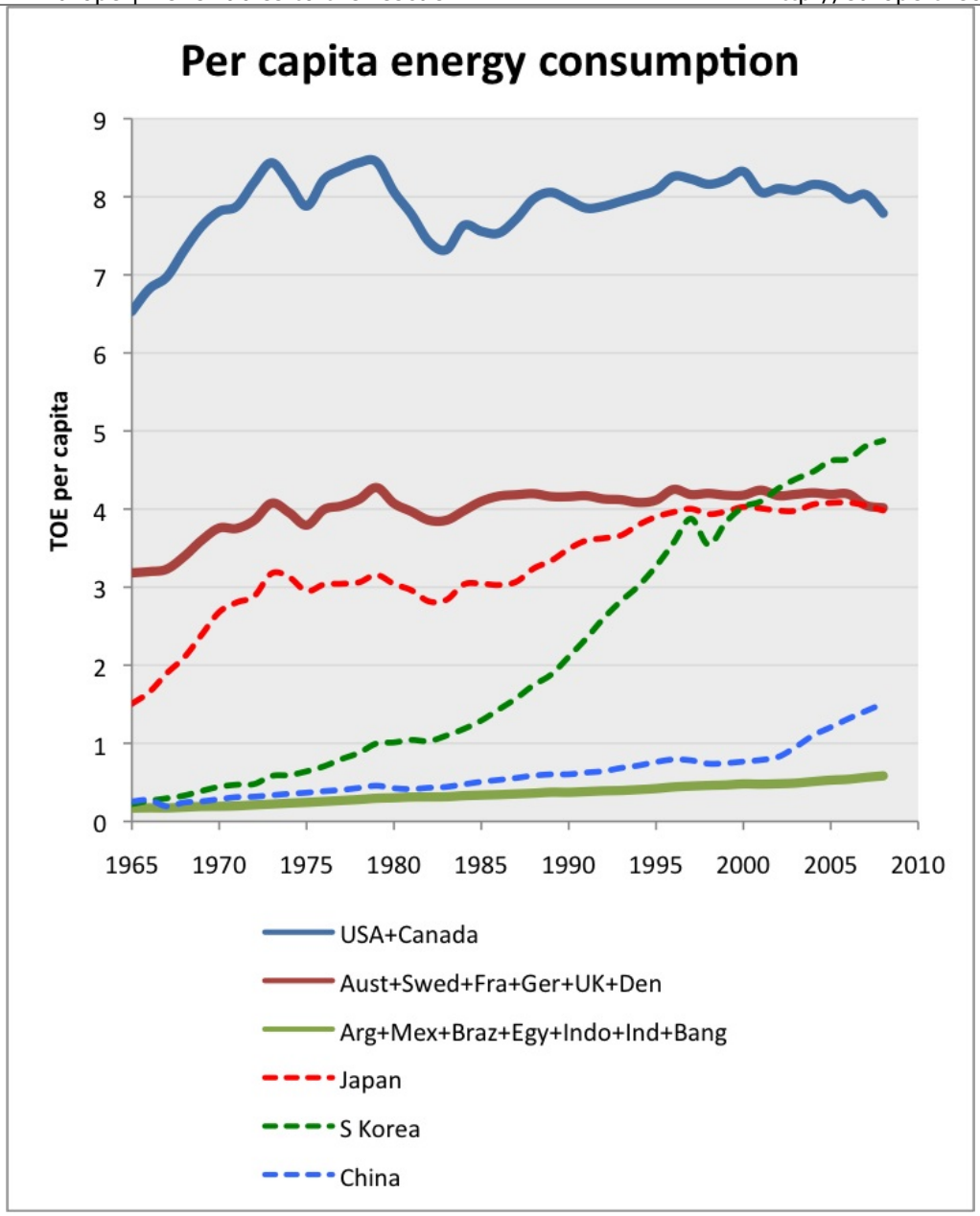
Some other key observations

The drop in primary energy production between 2008 and 2009 (oil, gas and nuclear production fell while coal and hydro production rose) is caused by high energy prices leading to recession, compounded by high debt and financial mismanagement by banks and government. With higher demand, production may rise again, leading to higher energy prices that will likely lead to further recession.

Despite high oil / energy prices, global oil production has been on a plateau since 2004. In recent years, much new oil production has come from deep water. The Macondo blow out seems certain to jeopardise some of this new production in future and this could lead to further pressure on oil supplies.

Nuclear and hydro both make significant contributions to the global energy mix but it is fossil fuels that dominate. When their production begins to decline it is difficult to see alternatives (nuclear, wind solar etc) filling the gap.

The solution here is to use less energy. The following chart shows how much energy we use on a per capita (per person) basis - draw your own conclusions.



Summary of per capita energy consumption of key groups of countries. The OCED norm (Australia, Sweden, France, Germany, UK and Denmark) is around 4 tonnes oil equivalent (TOE) per annum. The USA and Canada use double that amount. Developing countries on average use around 0.5 TOE per capita per annum. Note that OECD per capita consumption has been reasonably flat for 40 years while per capita energy consumption in the developing countries is still growing. This picture is clouded by energy embedded in manufactured goods that are produced in developing countries and consumed in the OECD.

A time for reflection

Macondo has eventually gripped the media and political eye. It is time for sober reflection on the global energy predicament and not for knee jerk reactions. How important is primary energy production and consumption for the OECD way of life? It links to economic growth, tax receipts and all that these pay for, pensions, manufacturing, food production, defense, leisure, comfort and security.