

# ecolonomics

*Paul Mobbs' newsletter of thoughts, ideas and observations on energy, economics and human ecology*

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## ***“Doubt is not an agreeable condition, but certainty is an absurd one” – peak oil, nuclear power and the ecolonomics of existential material reality***

*Sitting in a dusky evening, a conjugating map of ideas linking like the linear lattice of the hedgerow delimited landscape, I mull over the milestone we have reached; and why the mainstream media, political and campaign groups seem to have missed it.*

*Crouch Hill, Banbury, Saturday 16<sup>th</sup> April 2011.*

*Another edition of ecolonomics so soon after the last? It's been one of those fortnights. The response to my last ecolonomics has been somewhat greater than usual – over 3,000 copies have been downloaded. I've had a lot of email too, not just mulling over my critique of George Monbiot, but also looking at the whole context of what I said; which is good, because that's why I wrote it. I'm writing so soon after the last (in terms of size) “double issue” because of the events that have happened since then – events which put the content of the last edition in a whole new light.*

*Almost thirty years ago I bought a copy of a book from a second hand shop – *The Energy Question*<sup>1</sup>, published in 1976 – that raised my interest in energy. A little while later I found another second hand book – *Fuel's Paradise*<sup>2</sup>, published in 1975 – that raised my interest in the subject further. About that time I also read *Small is Beautiful*<sup>3</sup>. All of these books described limits – the finite nature of the environment, and the problems of an exponentially growing human economic process within that system. For example, *Fuel's Paradise* even lays out the reasoning behind why there is a finite limit to the use of uranium because of the net energy issue.*

*Since the last edition of ecolonomics, and almost thirty years since I first understood these realities, and ten years since I began working full time on researching and promoting solutions to these trends, a senior politician has admitted that he too understands what these trends mean.*

**In a letter to Frederick II of Prussia in 1767, François-Marie Arouet (better known as the writer and polemicist [Voltaire](#)<sup>4</sup>) wrote, “Doubt is not an agreeable condition, but certainty is an absurd one”.** That could be descriptive motif for the perceptual “factoid overloaded” of the [Information Age](#)<sup>5</sup> – and certainly of the present debate over energy and the environment. If Thomas Paine is the [patron saint of the Internet](#)<sup>6</sup>, Voltaire is its loyal “intellectual opposition”.

I've always appreciated the words of Voltaire; during the early 1990s I used one of his phrases for my email signature – “God is not on the side of the big battalions, but those who shoot best.” Like many of the other great political writers of history, the clarity of his observations on the generalities of human nature effortlessly span the intervening years of immense material change. How apt then that another Frenchman, the French Prime Minister François Fillon, should give Voltaire's words new meaning when he made any “certainty” about our economic future appear rather absurd when set against the doubts over our future energy supply. On Tuesday 5<sup>th</sup> April, during a debate over energy prices and government support for the energy industry, François Fillon announced to the [French National Assembly](#)<sup>7</sup> –

*La première chose que vous devriez expliquer aux Français, si vous dites la vérité, c'est que nous sommes en face de tendances lourdes d'augmentation des coûts de l'énergie!... Nous avons, en 2009, atteint le pic de production en matière de pétrole. La production ne peut maintenant que décroître, alors même que la crois-*

sance de l'économie mondiale a retrouvé un train de 4,5%. La catastrophe de Fukushima aura forcément des conséquences sur les investissements dans le monde en matière nucléaire... Enfin, nous savons tous que les énergies renouvelables ont un coût très élevé. Nous sommes donc confrontés, de manière tendancielle, à une augmentation des coûts de l'énergie. Face à cette situation, on peut faire de la démagogie ou on peut répondre de manière sincère et pragmatique... aux difficultés que rencontrent les Français.

Now, using my rather terrible French language skills and an English-French dictionary, I make that out to be something along the lines of –

The first thing that you should explain to the French, if you speak the truth, it is that we are opposed to the increasing costs of energy!... In 2009, we reached the peak of oil production. Production can now only fall, even though the growth of the world-wide economy rose 4.5%. The catastrophe of Fukushima will necessarily have consequences on the investment in nuclear power... And finally, we know that renewable energy has a very high cost. We are therefore confronted, due to these trends, to an increase in the costs of energy. Facing this position, one can be a rogue, or one can reply in a sincere and pragmatic way to the difficulties that face the French.

When initially I picked up this report, via *Le Monde's* [petroleum blog](#)<sup>8</sup>, I sat back and had a quiet moment. I've known, after more than ten years of working full time on this issue, that such an announcement was coming soon. This has been something that many academics and industry figures have been [happy to talk about for a while](#)<sup>9</sup>, but not the political class. I also knew that it wasn't likely to be one of the "Anglo Saxon" nations making such an announcement, because of the implications this has for the conventional view of economics. Even so, for a leading political figure within the G7<sup>10</sup> to announce this as a "fact" adds another level of advancement to the energy debate.

It wasn't a moment of happiness or joy either. It was an acknowledgement of the passage of events; like a pause for thought and reflection after reaching a mountain ridge on the way to the distant peak of a greater trend. After all, it's one thing for a political leader within the G7 nations to announce that we've peaked oil production – it's another for the rest of the world to accept that fact (as you will see if you read the transcript of the National Assembly debate from which it is taken). However, given the debate over unclear power – *oops, Freudian typo – nuclear power* that I'm currently engaged in, the growing evidence for, and acceptance of, a problem with energy supply reinforces the ideas which I raised in the last [ecolonomics](#)<sup>11</sup>.

**As I put these ideas together I'm sat upon [Crouch Hill](#)<sup>12</sup>, just outside Banbury. The complex shapes of the landscape mirror patterns in my thoughts;** as I look towards the peach and crimson silhouetted north-west horizon, the long sandstone slab of Epwell Hill looks like a graph I've seen growing for the last four years (in 2009 I used an earlier version in [ecolonomics 5](#)<sup>13</sup>). My reasoning was fairly simple, and was adapted from a method used (by an inspector from Her Majesty's Inspectorate of Pollution I knew in the early 1990s) to monitor contamination. Basically, within a set of monitoring results all readings should fall within two [standard deviations](#)<sup>14</sup> of the long-term mean; this gives you about a 95% confidence that you have a stable process. If the trend is stubbornly falling above or below this limit, it indicates that you don't have stability – you have a changing or unstable trend that requires further attention.

Using data from the US Energy Information Agency for [annual average](#)<sup>15</sup>/[monthly](#)<sup>16</sup> oil production and [prices](#)<sup>17</sup>, and BP's data for [inflation adjusted annual oil prices](#)<sup>18</sup>, I started plotting oil production in order to see if the longer-term rising trend of oil production was transitioning into a plateau – which is what we'd expect to see around a peak in global oil production. Then, having established that you've got a stable plateau, once the figures drop below two standard deviations ( $-2\sigma$ ) of the mean and stay there, you can say with some confidence that you've passed the peak; conversely, if they were to continue to rise above two standard deviations ( $+2\sigma$ ), it would indicate that we haven't yet reached the plateau.

If we look over a long period of time there's not a very good correlation between the "actual" oil price – that is, the price it cost at a particular moment in time – and oil production. However, if we use inflation adjusted values – which value oil at a specific point in time (in this case, 2009) – we do get a good correlation [when oil production is constrained](#). If we look at the period from the mid-1980s to 2000, the price of oil was falling as production rose, reflecting the high levels of production as non-OPEC producers – such as Britain, Norway and West African states – brought more oil into the market. Over this same period, due to the significance of oil prices within the economic process, we saw a sustained period of global economic growth. In contrast, from the early-1970s to the early 1980s, when oil supply was constrained by the political actions of oil producers (such as OPEC or Iran), the price roughly follows the production trend – although not with a very good fit.

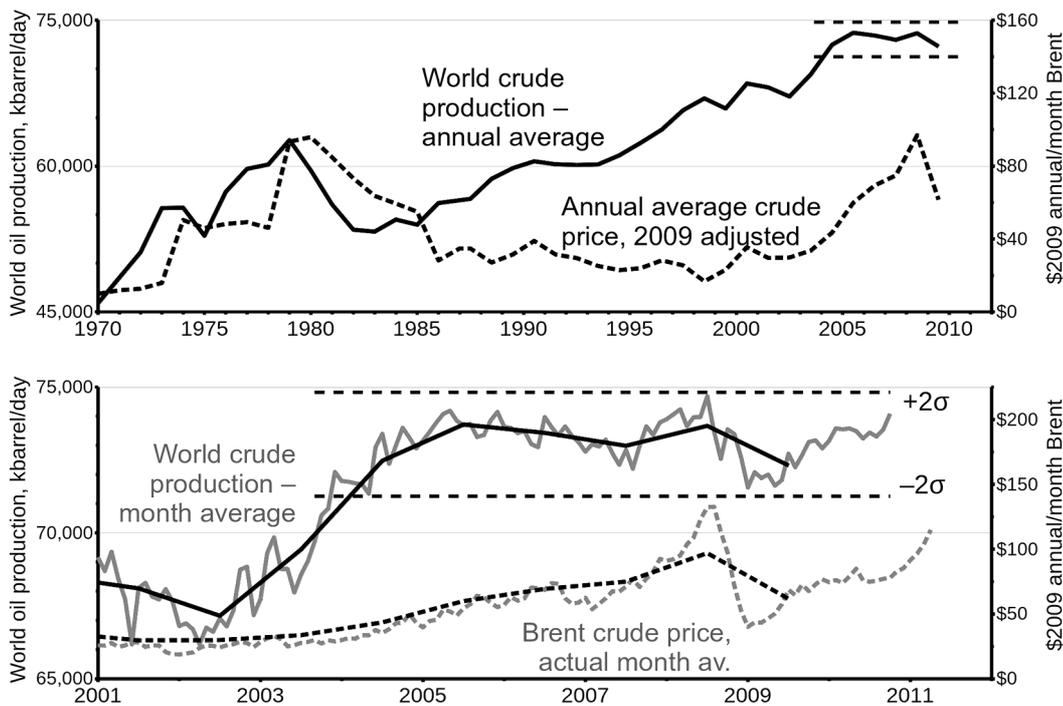
The graph on the next page is split into two in order to contrast three historic states in oil production: the unconstrained (mid-1980s to 2000) and politically constrained (early-1970s to early 1980s) periods explained above; and the most recent *geophysically constrained* period of production. If you look at the

## Defining the plateau in world oil production

Produced from data from the US Energy Information Agency and BP, this graph demonstrates the correlation between the price of oil and constrained production levels, and the plateau in world crude oil production.

The top graph shows annual average values from 1970 to 2009 – the crude price has been inflation adjusted to reflect the value in 2009.

The bottom graph isolates the period from 2001 to 2011, and additionally shows the monthly figures (in grey). You can also see the '2σ' lines more easily at this scale



lower graph you can see that production rises until around 2004/5. This is when oil production reaches the plateau which defines the geophysical limits of oil production – *the plateau of peak oil*. From this point on, as the constrained oil production rises above the mean of the plateau it causes prices to spike; except for the period around 2008/9 which is complicated by the effects of the financial collapse and the credit crunch. Now that the world economy is growing once more, rising demand is putting pressure on spare production capacity, causing prices to spike again.

When François Fillon said, “Nous avons, en 2009, atteint le pic de production en matière de pétrole” (*We have, in 2009, attained the peak of oil production*), I think he's broadly correct – it's a fair interpretation of the plateau trend. I'd put the date somewhere in mid/late 2008, when production peaked before the financial collapse of Autumn 2008. As for production falling again, that all depends on related trends. The figures above are for [conventional crude oil](#)<sup>19</sup> and [condensates](#)<sup>20</sup> – the material which makes up the bulk of the world's oil supply. Not included in this figure are biofuels and oil shale, which have grown significantly over the last decade. Although they're unlikely ever to make a significant difference to the overall level of supply, they can fill in the gaps in production capacity in order to provide a short-term fix to rising prices. Likewise as prices rise it discourages consumption – so called, [demand destruction](#)<sup>21</sup> – which the IEA recently demonstrated was having a [significant effect on oil demand](#)<sup>22</sup>.

What none of these minor trends can forestall is the effect on oil prices when conventional production leaves the plateau and begins, as stated by François

Fillon, its inevitable decline. The IEA's last global review of energy supplies, *World Energy Outlook 2010*<sup>23</sup>, tacitly acknowledged the problems ahead (following [criticism of its approach](#)<sup>24</sup>), when it shifted from forecasting a continual growth in oil consumption to a “new scenario” of roughly static consumption to 2030. However, given the innate characteristics of the peak of production, this scenario is no more realistic than the “predict and provide” models which the IEA promoted before.

Identifying the date of the “end of the plateau” is as fraught as predicting the date of the peak itself; if only because the economic effects of high prices might string-out the plateau in supply for a longer period, rather than producing the near-symmetric trend demonstrated in the peak of other oil producing fields/regions. The  $-2\sigma/+2\sigma$  lines in the graph above begin in September 2003, but the data doesn't begin to cluster around the mean value until September 2004. Taking the peak as October 2008 (the highest peak in the plateau data so far), and assuming a symmetric peak, that puts the down-side of the plateau as around four years later – **Autumn 2012**.

I've been talking about “problems” over the 2012/2013 period for some time now. I remember, in early September 2008, addressing a meeting in Skelmersdale and saying, “Watch what happens to Lehman Brothers next week”; I also talked about 2012/2013 then too, but in the aftermath of what followed I think people were too busy worrying about the immediate economic issues to think about the long-term prognosis. The problem is that, given the current [mystical infatuation](#)<sup>25</sup> with 2012, it's difficult to talk about entering a new “economic phase” without

someone conflating what you're saying with the [Millennial Mayan calendar meme](#)<sup>26</sup>.

Of course, from my end of this research, there's something that I think many people misunderstand; *you can't explore this issue with a conscience and want this to happen*. Sometimes, talking about the larger trends that define our economic and material existence can make you feel like, when you were a child, watching a kicked football arcing on its defined trajectory through the air on its way towards a window; knowing that there's nothing you can do except wish that it's going to bounce off, not break the glass. Politicians must begin acting today to prevent a nasty outcome to the oil production trend. Fillon's statement to the National Assembly is a start, but until there's a general acceptance amongst the political class that their half-century of promising "more" is over, we're not going to be able to move on.

***"Whoever fights with monsters should see to it that he does not become one himself. And when you stare for a long time into an abyss, the abyss stares back into you."***<sup>27</sup> Nietzsche's words are so apt to describe the current debate within environmentalism over nuclear power, ever since, [last month](#)<sup>28</sup>, George Monbiot said that nuclear power was OK. Like the taxing effects of dealing with the peak oil issue, staring into the "abyss" of the effects of catastrophic radiation contamination can be equally taxing on the soul. It's important to keep perspective in your work; that's why I'm out here, just sitting, experiencing, and letting go all the ["existentialist angst"](#)<sup>29</sup> that mounts up when working on such "heavy" issues. In a sense, *ecolonomics* is part of that process too – saying those things which I believe need to be said, but which often most people are not in the mood to hear.

Sometimes, when I work, I know what it is I want to express but communicating that idea, in a form that others can easily assimilate, is very difficult. A few nights ago I was wrestling with an email reply to George Monbiot when I hit upon such an impasse. At such moments I find it useful to go to my book collection, pick a relevant tome (sometimes I even pick one at random), and flick through to somewhere that, from memory, might contain some useful insights into what it is I'm trying to say. Even if it's not directly relevant, I can often stir a better perception of the problem by thinking along parallel lines. It was with such elucidatory hope that I pulled Nietzsche's *Beyond Good and Evil* from the shelf and found<sup>30</sup> –

Forgive me for playing jokes with this gloomy grimace and expression: because when it comes to betrayal and being betrayed, I myself learned a long time ago to think differently and evaluate differently; and my elbow is ready with at least a couple of nudges for the blind rage of philosophers as they struggle not to be betrayed. Why

not? It is no more than a moral prejudice that the truth is worth more than appearance; in fact, it is the world's most poorly proven assumption.

Right now a lot of anti-nuclear activists are feeling "betrayed" by certain – largely self-appointed and unaccountable – figures within the "green" movement. As they perceive it these "green icons" – such as George Monbiot, Mark Lynas, Stewart Brand and others – are promoting one dangerous and damaging technology, *nuclear power*, in order to try and arrest a problem that is created by the wider use of other technologies, *climate change*. Pretty much all the coverage of George Monbiot's "conversion" on nuclear power has focussed on the effects of radiation on health – if only because that's the rod he's chosen to beat the anti-nuclear movement with.

As I look at the issue, and this probably isn't going to please either side in this argument, *the issue of radiation and health isn't going to be a relevant factor in whether Britain and other nations decide to adopt nuclear power*. In fact, from the point of view of the decision-making establishment, it's probably one of the least important. I'm not saying that it should be; and in fact I think there are [good reasons to doubt the "official" view](#)<sup>11</sup> of the effects of low level radiation, and especially internal emitters, upon health. **However, it's precisely because the "official" view of radiation doesn't see low doses and internal emitters as a problem that it will not be considered seriously as part of the permitting process – it's an administrative fait accompli.**

This is why I think George Monbiot is wrong to argue his support for nuclear power from the point of view of radiation and health – *within the present framework of the debate it's a "done deal", and arguing about it proves nothing about nuclear power, but it does demonstrate what's wrong with the popular perceptions of the nuclear issue*. The nuclear establishment are not about to sanction a proper review of the effects of low level radiation because they know what the outcome would be. As a result neither of the three sides in this debate (three because of the pro-nuclear groups who say the official dose model is [too conservative](#)<sup>31</sup>) will prevail. In the mean time, those working on this issue are marginalised in the debate over nuclear power because, irrespective of their evidence, regulatory agencies and politicians will always side with the official "consensus" view.

Irrespective of that, there is a growing body of scientific evidence that the present consensus model is wrong, and can't explain the effects observed – for example, from the [Chernobyl accident](#)<sup>32</sup>. That doesn't mean that the views of those who oppose the consensus view are correct either; if only because they've been starved of the funding and resources required to develop a comprehensive argument as to what the correct explanation is, and need support to develop the research to substantiate that view.

For example, let's take a fairly "un-extreme" view of the problem from F. Ward Whicker, a member of the editorial board of the *Journal of Environmental Radioactivity*, who [summed up the future problems](#)<sup>33</sup> for the study of the effects of environmental radiation in the year 2000 –

I feel that there are many cases, however, where the degree of uncertainty in model predictions is sufficient to cast doubt on the credibility of the risk assessment process for making important decisions. This can, and I think occasionally does, lead to decisions that are unduly influenced by sometimes misguided popular opinion, special economic interests, and political expediency, rather than by scientific quests for the truth.

As stated by Nietzsche, the "truth" is all too often assumed; and reliance upon such assumptions can, as stated by F. Ward Whicker, lead to decisions that are unduly influenced by sometimes misguided popular opinion, special economic interests, and political expediency, rather than by scientific quests for the truth. George Monbiot is not, in his attacks on the anti-nuclear movement through his [recent articles](#)<sup>34</sup>, representing "the truth" either. If we are objectively honest, *we don't know what the truth is*. The only way to resolve this is to carry out a comprehensive and transparent official research programme, such as that on climate change, to find what we "think" we know. In the absence of this, we can't "know" what the effects are whilst valid research exists to cast doubt upon the present [linear no-threshold dose \(LNT\) model](#)<sup>35</sup>; stating that this model is adequate is, in Voltaire's description of such certainties, "absurd".

It's not in the interests of the nuclear or political establishment to look for a truth which they know, as outlined in the quote above, is likely to lead to a potentially costly and politically problematic changes in the definition of what constitutes a "safe" level of radiation. For this same reason those who wish to evade the truth, as in the case of the CERRIE committee I outlined in the last [ecolonomics](#)<sup>11</sup>, are not going to give their support to any such research. This means that, even if independent research indicates there are "known unknowns" about the present radiation dose model, as present decision-making procedures hold that model to represent "the consensus", such research will be marginalised or ignored in the debate over new nuclear power plants.

In the present internecine battle of environmentalists over radiation and health there will be no winners. That's because, within the administrative realities of how industry and politicians are making decisions about new nuclear power stations, such issues are *indeterminate*. In fact, not only are they indeterminate, but in the present climate it's not in the interests of the decision-making establishment that they are ever resolved.

**If we want to understand the major flaw in the present debate over nuclear power, energy and climate change, it is to be found in the intersection between the two issues I've presented thus far** – the political acceptance of peak oil, and the promotion of new nuclear power stations. Quite obviously, if you accept that you can have a peak in mineral oil production, then *you must also accept* the reality of a peak in uranium production. The geophysical processes which create one will create a similar phenomena with the other. More importantly, if you accept that peak oil is a reality, then not only does that redefine the validity of "the unclear option" (arrgh!, that Freudian typo again), it also significantly re-engineers the scenarios behind climate change too.

However, putting the peak uranium issue aside for a moment (I dealt with uranium supply in the previous edition of [ecolonomics](#)<sup>11</sup>), what we have to realise is that comprehending this reality is all a matter of perception – and we must examine, as Nietzsche puts it, how the "truth" behind the current debate is really perhaps no more than an assumption.

As I sit here on the hill top, pondering these heavy ideas, I'm joined by my shadow – cast by the rising near-full moon behind me. Sirius, Rigel and Betelgeuse are sinking with Orion into the last maroon glow of the sunset, whilst behind me Procyon, the Twins (Castor and Pollux), and overhead Capella are twinkling into sight – and though I can't see Virgo, I know where it is because Saturn is rising with it in the south-eastern sky. Below me another constellation of stars are erupting into view – *the lights of Banbury*. Hundreds of low (bright yellow) and high (yellow/white) pressure [sodium-vapour arc lamps](#)<sup>36</sup> spring into life, soon joined by the square-framed panels of domestic lighting. In my ring-side seat on the universe, it's like viewing a [globular cluster](#)<sup>37</sup> close-up – the steam from the General Foods plant, and the haze from a few small garden bonfires, adding just a hint of nebulosity to the scene.

That's quite an elaborate description, but what I'm really looking at is electricity. There are far more lights now than when I first started going out into the countryside at night many years ago; as far as I can see there are small constellations of large and smaller lights of varying colours. Irrespective of their efficiency, averaged across the year [the electrical power I'm looking at](#)<sup>38</sup> derives nearly half of its energy from natural gas, just over a quarter from coal, less than a fifth from nuclear, and perhaps 4% from renewable sources. Although it's nowhere near so simple as saying the words, metaphorically if you could "turn off" half of what I'm looking at the present controversy over coal versus nuclear would go away.

My eyes are seeing lights. However the most oppressive anthropogenic phenomena I experience sitting here is *noise* – and pretty much all of that noise

is the result of petroleum fuels (albeit with perhaps one or two percent of biofuels thrown in). A large part of the impact is road noise, not least because Crouch Hill sits between busy 'A' and 'B' classified roads. As Banbury sits under an air traffic corridor I've noise from above too – although a year ago this week, I positively basked in the few days I managed to escape outdoors when all air traffic ceased after the [Eyjafjallajökull volcano blew](#)<sup>39</sup>.

What's important to understand is the relative difference, at the national scale, between the energy implications of the light and the noise I perceive around me. Looked at from the perspective of [final energy consumption](#)<sup>40</sup>, electricity *for all uses* represents about 18% of the energy directly consumed by the UK population; in contrast, *just for the purpose of transport*, oil represents 36% of the total final energy consumption of the UK.

*OK, let me shout this in bold just to make sure everyone hears above the road noise – today we have politicians, journalists and environmentalists fixated by electricity producing nuclear, coal or renewable power plants, but the fact is that we expend TWICE the amount of petroleum-based energy in the transport sector as is currently used in all final electricity consumption applications.*

*...and now, add peak oil into this equation; has the penny dropped?*

In the graph below I contrast the UK's [final consumption of energy in 2009](#)<sup>40</sup>, both by sector and energy source (note it doesn't quite add up because I've excluded minor energy uses such as public administration or agriculture). In total we consume 2.6 times more petroleum than electricity. Of course, we could argue about the inherent losses in electricity generation but, in terms of how people utilise energy – and certainly how I perceive the impacts where I'm sitting – it's the final consumption that actually energises society and makes things work. To have such great fixations over electricity, from wind-up radios to nuclear plants and wind turbines, is an assumption about the relative importance of certain forms of energy (e.g. electricity) over others (e.g. petroleum)

that's not borne out by the statistics; clearly, the importance of electricity to the economy above other forms of energy is a "poorly proven assumption".

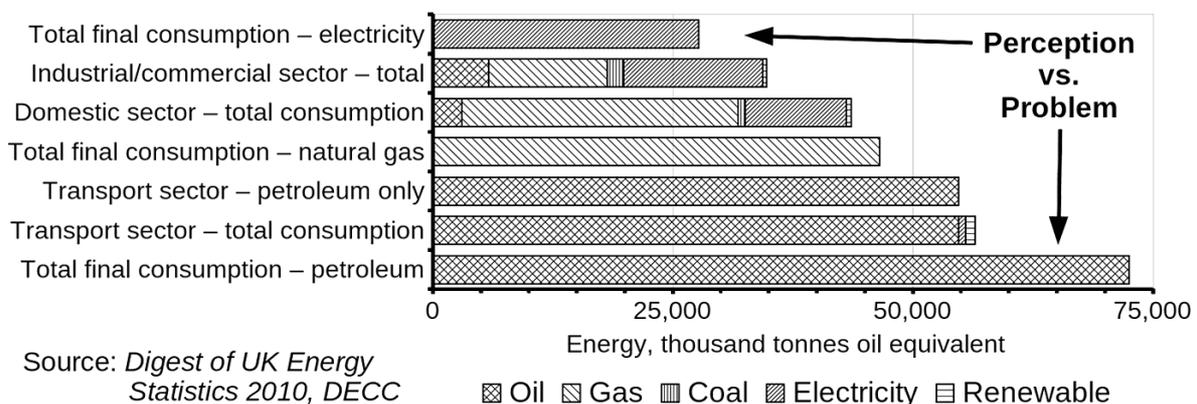
Now of course we mustn't underplay the role of electricity. From telecommunications to pumping tap water, electricity does undertake some important tasks within society. Even so, set against the scale of *total energy use*, the use of electricity for essential services still isn't that great. We directly consume 2.6 times more petroleum than electricity, and whilst power cuts can be crippling, with planning they can be managed; as is the case of many developing nations where regularly failing power supplies are the norm – only in the most developed state are power cuts the exception. And, before you might be tempted to retort that "petroleum is mostly for cars", again, that's not borne out by the data. In 2009, whilst a third of fuel in the transport sector went into cars and taxis, nearly three-fifths went into the [light and heavy goods vehicles](#)<sup>41</sup> that provide our everyday needs.

*...and now, add peak oil into this equation; has the penny dropped?*

Throughout his recent articles, George has asked for the rigorous use of data. In some senses, he is entirely correct – yes, there may be a problem with the way some environmentalists use data, but that's a general trend in society, and not one specific to the anti-nuclear movement. The failure to provide appropriate scale and context isn't a practice within which the environment movement excel; *for that we must turn to the work of the media*. How often do we hear the media use the term "energy" when in fact they mean "electricity" – and thus render the subject at hand either five times better or worse than is actually the case because of this conflation of terminology. For example, picking a recent story at random from the BBC News web site, in February it was stated in relation to a [biomass plant in Southampton](#)<sup>42</sup> that –

The £300m biomass burner would have a 100m (330ft) chimney and would generate enough energy to supply 200,000 homes – twice the size of the city.

UK final energy consumption by sector/energy source, 2009



If you look at the [details of the plant](#)<sup>43</sup> its 100 mega-Watt capacity would generate enough *electricity* for 200,000 homes, but that's only [17% of household electricity consumption](#)<sup>44</sup>; the equivalent level of *energy use* is 33,400 houses – or *one third* the size of Southampton!

George Monbiot is himself capable of taking the value of certain energy technologies out of context by placing so great an emphasis on electricity over other forms of energy. In his controversial article of the 21<sup>st</sup> March he stated –

At high latitudes like ours, most small-scale ambient power production is a dead loss. Generating solar power in the UK involves a spectacular waste of scarce resources.

That's correct – solar *power* is a problem at high latitudes, but that does not mean that solar *energy* is a dead loss. In his subsequent condemnation of the “bucolic vision” of the deep green energy solution he uses this one example to rubbish all other concepts of localised energy production. The problem is, as George is seemingly so fixated with electricity, he's missing the point – renewable energy systems need to be matched with specific applications where they provide the most effective solution. You can't treat the extraction of ambient energy from the environment in the same way that we treat the commodified consumption of coal, oil or gas.

Also, rather like the conflation of energy and electricity, I've had emails where people are misunderstanding George's terminology and thus conflate solar power with solar thermal systems. Yes, solar power is a problem, but that's a general problem with the technology itself; in contrast solar thermal is one of the best renewable technologies a person can install. For example, an ideally inclined solar thermal system will provide about half the thermal load required for hot water heating; and as hot water uses about a quarter of average household energy consumption, that equates to about [12% of average household energy supply](#)<sup>45</sup>. According to the Energy Saving Trust, a solar hot water system can save over [half a tonne of carbon per year](#)<sup>46</sup>.

Rather like George's condemnation of solar power, the present debate over nuclear power assumes so much about our present energy situation that, when we look at the data, isn't entirely accurate. For example, if we look at the [life-cycle analysis of the nuclear fuel cycle](#)<sup>47</sup> produced for British Energy, that flags up the significance of both petroleum and transport to the production of uranium and nuclear fuel. Without the energy input from petroleum, it would be more difficult to produce uranium/nuclear fuels, and as a result the level of supply and thus the price would be very different than it is today. And though I hate to repeat myself again, it is important to highlight this relationship... **add peak oil into this equation – has the penny dropped?**

**In the end I decide that I've had enough sitting, and get up to make way home, down through the woodland on the eastern side of the hill.** I'm pondering George Monbiot's recent articles, in particular [his assertion that](#)<sup>28</sup> –

If other forms of energy production caused no damage, these impacts would weigh more heavily. But energy is like medicine: if there are no side-effects, the chances are that it doesn't work.

That's far too narrow a viewpoint. Often, as we see within the results of life-cycle analysis, the indirect effects of any process are often larger than the simple surface or direct effects that we perceive.

As I clear the trees I look across the panorama of the Banbury “globular cluster”. In the distance I see the lights of the former USAF Upper Heyford airbase – the one from which they bombed Libya in 1986 (I remember it well – I was out walking then too and saw them leave). In the south-east I see the red lights on the masts and [radomes](#)<sup>48</sup> of [Croughton](#)<sup>49</sup>. To the south, much brighter, are the perimeter lights and masts of [Barford](#)<sup>50</sup>. As well as handling a third of US military traffic across Europe, these two bases are also vital way-stations for military communications between the USA and the [Middle East theatre of operations](#)<sup>51</sup>. Consequently, these two bases, glowing passively in this nocturnal panorama, are an implicit part of the maintenance of the western support for the Gulf states upon whom we rely for our present and future supply of oil. In contrast to the lights of Banbury, this eruption of photons from excited sodium and mercury atoms represents more than just electrical power; it explicitly defines the “power” politics of petroleum.

In America it's quite common to hear right-wing political commentators talking about [“putting a terrorist in your tank”](#)<sup>52</sup> – making the connection that oil wealth funds Islamic groups which oppose America. Whilst such things are largely “known” but “unstated” in the debate over oil in the USA, we see the same kind of myopic phenomena over here too. The reason our government allows Barford and Croughton to be here is to enable the US to project military force in the Middle East – in support of undemocratic and repressive states, both in the [Middle East](#)<sup>53</sup> and [elsewhere](#)<sup>54</sup>, who fuel our addictive need for oil products in the West. In turn these interventions, and the oppression they spawn, spawn the militant actions that the West is so concerned about.

There is far more than the emission of carbon wrapped up within our use of petroleum. Our use of petroleum is explicitly linked with both the historic and the present day ignorance of human rights and environmental abuse within those states from which we source these products. If we cared, we wouldn't source petroleum products from these nations; or we would demand that they implement the kind of re-

forms that, ultimately, would probably raise the price of the fuel we're so desperately dependent upon.

On that note, it's important to acknowledge that uranium mining isn't impact free either. There's a long history of ecological and health impacts amongst those involved with uranium mining – most notably amongst the Navajo nations in the south-western USA<sup>55</sup>, who have won compensation for the impacts caused to their land and health. And yet again, the impacts of uranium upon health [raise the same criticisms](#)<sup>56</sup> about dose models that George appears to ignore in his criticism of those who question the official version of the [impacts of Chernobyl](#)<sup>57</sup> – even though the ["official" report](#)<sup>58</sup> on the impacts of uranium cites studies which have not been subject to the peer review that George has so forthrightly demanded from the anti-nuclear movement. Despite such official denial, inquests into the death of service personnel exposed to depleted uranium weapons [have ruled](#)<sup>59</sup> that such exposures are a contributory factor in cancer deaths. We must not forget that the impacts of uranium are far more than radiological – as a toxic heavy metal uranium has other deleterious effects upon the natural environment. For example, studies of [uranium in drinking water](#)<sup>60</sup> found that, below the "safe" level set by the US EPA, uranium has [endocrine disrupting effects](#)<sup>61</sup>.

What's also notable in the current debate over new nuclear is the absence of any discussion about the important ancillary operations in the nuclear cycle. For example, quite apart from the uranium mining issue, what about the [reprocessing](#)<sup>62</sup> of nuclear fuel? If you are a supporter of nuclear energy then you would also have to accept the impacts of reprocessing in order to recover the plutonium, and the use of more hazardous [MOX fuel](#)<sup>63</sup> (which is currently of great concern because of its use in Fukushima Daiichi's reactor 3) in order to extend the production of nuclear power. George Monbiot has yet to come out in favour of reprocessing, or MOX fuel – but it would be an interesting question to ask as you can't really support one without the other.

In his latest article [George states that](#)<sup>64</sup> "nuclear opponents have a moral duty to get their facts straight". The same could be true of George himself, not so much in terms of being pro- or anti-nuclear, but in accepting that there is evidence to raise doubts about the LNT dose model. Likewise you can't accept nuclear power without stating, [explicitly](#), how you would manage the impacts of the associated operations within the nuclear fuel cycle such as uranium mining, fuel reprocessing and waste disposal – which as yet George has not done.

In his original justification for accepting nuclear power, he states that it was the objectionable alternatives that made him [change his mind](#)<sup>28</sup> –

Deep green energy production – decentralised, based on the products of the land – is far more

damaging to humanity than nuclear meltdown.

Personally I can't see how this is can be an "objective" evaluation. What are the specific effects of a "deep green" energy system, and his objections related more to the effect this has on the affluence of those in the West, or is it solely the impacts of the energy technologies concerned? As far as I can see, it's absolutely the former; George is justifying an unwelcome action, supporting nuclear power, because that's the only option that, allegedly, can meet the demands for reduced carbon emissions whilst maintaining our affluent society. In that case, I would refer him to the words of Fritz Schumacher<sup>65</sup> –

No degree of prosperity could justify the accumulation of large amounts of highly toxic substances which nobody knows how to make 'safe' and which remain an incalculable danger to the whole of creation for historical or geological ages. To do such a thing is a transgression against life itself, a transgression infinitely more serious than any crime ever perpetrated by man. The idea that a civilisation could sustain itself on the basis of such a transgression is an ethical, spiritual and metaphysical monstrosity. It means conducting the economic affairs of man as if people really did not matter at all.

Nuclear power is, in these terms, no more ethical than the compromises I outlined in relation to petroleum and political/military interventionism earlier.

And now, we can add another facet to this debate – *the peak of oil production*. The impact of that isn't just on oil supply, or the nuclear fuel cycle, but on the very affluence that George seeks to maintain. Again, with some foresight of our position today, Fritz Schumacher foresaw this too<sup>66</sup> –

There are still people who say that if oil prices rose too much (whatever that may mean) oil would price itself out of the market; but it is perfectly obvious that there is no ready substitute for oil to take its place on a quantitatively significant scale, so that oil, in fact, cannot price itself out of the market.

**As I wander back through one of the more affluent areas of the town, all is quiet; but for the moving silhouettes of the TV's shining on the curtains, you wouldn't know anyone was inside the houses that I pass.** Is this what George and the other "environmentalists" who support nuclear power are trying to preserve? George seeks to protect us from the excesses of "deep green" misanthropy, but really what I perceive is a fear of the "unknown" – the fear that in an uncertain future we must strive to preserve the material possessions that we already have.

When I began reading around the issues of energy and environmentalism thirty years ago, what I

found was a philosophy which I could practically relate to. It saw the world for what it was, and tried to understand that system in terms of the processes that made it function – and how our interventions were weakening those systems. It spoke to the need to change our relationship to the planet, rather than trying to incrementally modify it. It was not a philosophy of accommodation and compromise, but a radical challenge to the stasis that modern economic and political theory represented.

Today, as I outlined in the last *ecolonomics*<sup>11</sup>, the infiltration of market principles has nullified the definition of human ecology within ecological limits. Instead we see the self-appointed environmental cognoscenti promoting “sustainable consumption”<sup>67</sup> and “green consumerism”<sup>68</sup> as solutions – when in fact these are not solutions at all, they’re distractions from the real limits which are biting down upon the human system. Within the portrayal of environmentalism and environmental “solutions” in the media, what I find is not the “green nirvana” that its affluent promoters desire; what I see is the same delusional, short-term economic imperative that drives the rest of the unsustainable economic process. When I try to encapsulate the green consumerist approach in a simple description I always revert to the rather loaded epithet – “green with envy”; green consumerism represents the same consumption driven imperatives that *Vablen identified a century ago*<sup>69</sup>.

This is, and I think always will be, the dividing line between the “fundos” and the “realos” (as they were once called in the Green Party); between a *deep ecological*<sup>70</sup> and a consumer-oriented view of how we reconcile the demands of humanity with the ability of the biosphere to provide it. Peak oil is a phenomena that breaks the preconceptions of the consumer-oriented view of environmentalism; those who, like George’s riling against “deep green energy production”, demand that stasis is more important than change. That François Fillon acknowledges peak oil is, I believe, an act of political reality; when the delegates of the National Assembly are baying for cheap fuel, it’s the lesser of two unwelcome political realities – being honest, or trying to stall in the face of the inevitable outcome.

Just as politics needs to wake up to this reality, so those who profess to talk on behalf of environmentalism need to understand the implications of what peak oil means. How the limitations imposed by a constrained oil supply, both physically and economically, redefine how we will be able to reconcile humanity to the environment it inhabits. The artificial maintenance of affluence as part of this process is not only unrealistic, such expectations are an obstacle to communicating the types of change that we will all, inevitably, have to adopt. Trying to preserve the material trappings of affluence against this trend *will not “save you”*<sup>71</sup> from the inevitable outcome of

the limits on human development.

To conclude, as noted earlier, in trying to communicate difficult concepts I often look at an unrelated book. In trying to resolve this question, of those who want to be green but are unwilling to accept what that means for personal affluence, a few days ago I pulled a book off the shelf and found a term that was obvious but seldom used these days – *bourgeois*. Peak oil is the beginning of the end of bourgeois society; not the bourgeois of Marx, but the bourgeois of Hesse’s, *The Treatise of the Steppenwolf*<sup>72</sup> –

Now what we call “bourgeois”, when regarded as an element always to be found in human life, is nothing else than the search for a balance. It is the striving after a mean between the countless extremes and opposites that arise in human conduct. If we take any one of these coupled opposites, such as piety and profligacy, the analogy is immediately comprehensible. It is open to a man to give himself up wholly to spiritual views, to seeking after God, to the ideal of saintliness. On the other hand, he can equally give himself up entirely to the life of instinct, to the lusts of the flesh, and so direct all his efforts to the attainment of momentary pleasures. The one path leads to the saint, to the martyrdom of the spirit and surrender to God. The other path leads to the profligate, to the martyrdom of the flesh, the surrender to corruption. Now it is between the two, in the middle of the road, that the bourgeois seeks to walk. He will never surrender himself either to lust or to asceticism. He will never be a martyr or agree to his own destruction. On the contrary, his ideal is not to give up but to maintain his own identity. He strives neither for the saintly nor its opposite. The absolute is his abhorrence. He may be ready to serve God, but not by giving up the fleshpots. He is ready to be virtuous, but likes to be easy and comfortable in this world as well. In short, his aim is to make a home for himself between two extremes in a temperate zone without violent storms and tempests; and in this he succeeds though it be at the cost of that intensity of life and feeling which an extreme life affords. A man cannot live intensely except at the cost of the self. Now the bourgeois treasures nothing more highly than the self (rudimentary as his may be). And so at the cost of intensity he achieves his own preservation and security. His harvest is a quiet mind which he prefers to being possessed by God, as he does comfort to pleasure, convenience to liberty, and a pleasant temperature to that deathly inner consuming fire. The bourgeois is consequently by nature a creature of weak impulses, anxious, fearful of giving himself away and easy to rule. Therefore, he has substituted majority for power, law for force, and the polling booth for responsibility.

## References

1. *The Energy Question*, Gerald Foley and Charlotte Nassim, Pelican Books, 1976; 4<sup>th</sup> revised edition, Penguin Books, 1992. ISBN 9780-1401-5683-6 (out of print).
2. *Fuel's Paradise: Energy Options for Britain*, Peter Chapman, Penguin Books, 1975; last 'new' paperback edition, 1979. ISBN 9780-1402-2285-2 (out of print).
3. *Small is Beautiful – A study of economics as if people mattered*, E.F. Schumacher, Blond and Briggs, 1973; latest paperback edition, Vintage Books, 2011. ISBN 9780-0992-2561-4. £8.99.
4. *Voltaire* – <http://en.wikipedia.org/wiki/Voltaire>
5. *Information Age* – [http://en.wikipedia.org/wiki/Information\\_age](http://en.wikipedia.org/wiki/Information_age)
6. *The Age of Paine*, Jon Katz, Wired 3.05, May 1995 – <http://www.wired.com/wired/archive/3.05/paine.html>
7. *First complete reports of meeting on Tuesday 5<sup>th</sup> April 2011*, French National Assembly (in French) – [http://www.assemblee-nationale.fr/13/cr/2010-2011/20110156.asp#INTER\\_8](http://www.assemblee-nationale.fr/13/cr/2010-2011/20110156.asp#INTER_8)
8. *Fillon : la production de pétrole "ne peut que décroître"*, Matthieu Auzanneau, Petroleum blog, Le Monde, 8<sup>th</sup> April 2011 (in French) – <http://petrole.blog.lemonde.fr/2011/04/08/fillon-la-production-de-petrole-%C2%AB-ne-peut-que-decroitre-%C2%BB/>
9. *The Oil Crunch: A wake-up call for the UK economy*, second report of the UK Industry Taskforce on Peak Oil and Energy Security, February 2010 – [http://peakoiltaskforce.net/wp-content/uploads/2010/02/final-report-uk-itpoes\\_report\\_the-oil-crunch\\_feb20101.pdf](http://peakoiltaskforce.net/wp-content/uploads/2010/02/final-report-uk-itpoes_report_the-oil-crunch_feb20101.pdf)
10. *G7* – <http://en.wikipedia.org/wiki/G7>
11. "When the facts change, I change my mind. What do you do, sir?", *ecolonomics* 10, Paul Mobbs, 22<sup>nd</sup>-25<sup>th</sup> March 2011 – <http://www.fraw.org.uk/mei/ecolonomics/01/ecolonomics-010-20110322.shtml>
12. For the location of Crouch Hill see Streetmap – <http://www.streetmap.co.uk/map.srf?X=444015&Y=239257&A=Y&Z=115>; for some pretty on-line pictures see *West over Crouch Hill Farm towards North Newington* by 'andrewsbrown' – <http://www.panoramio.com/photo/46033548>
13. *We're all planetary hospice workers now*, *ecolonomics* 5, Paul Mobbs, 26<sup>th</sup> September 2009 – <http://www.fraw.org.uk/mei/ecolonomics/00/ecolonomics-20090926.shtml>
14. *Standard deviation* – [http://en.wikipedia.org/wiki/Standard\\_deviation](http://en.wikipedia.org/wiki/Standard_deviation)
15. *Table 4.1d. World Crude Oil Production (Including Lease Condensate), 1970-2009*, International Petroleum Monthly, US Energy Information Agency, December 2010 – <http://www.eia.gov/ipm/supply.html>
16. *Table 1.1d. World Crude Oil Production (Including Lease Condensate) 1997-Present*, International Petroleum Monthly, US Energy Information Agency, December 2010 – <http://www.eia.gov/ipm/supply.html>
17. *Europe Brent Spot Price FOB (Dollars per Barrel)* [Monthly], US Energy Information Agency, March 2011 – <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RBRT&f=M>
18. *Oil: Crude oil prices 1861-2009 – Statistical Review of World Energy 2010* (spreadsheet version), BP, June 2010 – <http://www.bp.com/productlanding.do?categoryId=6929&contentId=7044622>
19. *Petroleum* – <http://en.wikipedia.org/wiki/Petroleum>
20. *Natural gas condensate* – [http://en.wikipedia.org/wiki/Natural\\_gas\\_condensate](http://en.wikipedia.org/wiki/Natural_gas_condensate)
21. *Demand destruction* – [http://en.wikipedia.org/wiki/Demand\\_destruction](http://en.wikipedia.org/wiki/Demand_destruction)
22. *High price of oil is 'hitting energy demand', IEA says*, BBC News On-line, 12<sup>th</sup> April 2011 – <http://www.bbc.co.uk/news/business-13047854>
23. Table 2.1/figure 2.2 (p.80), *World Energy Outlook 2010*, OECD/International Energy Agency, November 2010. ISBN 9789-2640-8624-1 (paperback). £145. Summary available on-line from [http://www.worldenergyoutlook.org/docs/weo2010/WE02010\\_ES\\_English.pdf](http://www.worldenergyoutlook.org/docs/weo2010/WE02010_ES_English.pdf)
24. For example, *The 2009 IEA Oil Report & World Energy Outlook – Is the IEA World Energy Outlook Politically Distorted?*, Chris Nelder, Energy and Capital, Friday 13<sup>th</sup> November 2009 – <http://www.energyandcapital.com/articles/IEA-oil-report/999>
25. *2012 phenomenon* – [http://en.wikipedia.org/wiki/2012\\_phenomenon](http://en.wikipedia.org/wiki/2012_phenomenon)
26. *Mesoamerican Long Count calendar* – [http://en.wikipedia.org/wiki/Mesoamerican\\_Long\\_Count\\_calendar](http://en.wikipedia.org/wiki/Mesoamerican_Long_Count_calendar)
27. Paragraph 146, *Epigrams and entr'actes*, Part 4, *Beyond Good and Evil*, Friedrich Nietzsche, 1886; taken from the Cambridge University Press edition, Rolf-Peter Horstmann and Judith Norman (editors), translated by Judith Norman, 2002. ISBN 9780-5217-7913-5 (paperback). £11.99.
28. *Why Fukushima made me stop worrying and love nuclear power*, George Monbiot, Guardian On-line, 21<sup>st</sup> March 2011 – <http://www.guardian.co.uk/commentisfree/2011/mar/21/pro-nuclear-japan-fukushima>
29. *Existentialism* – <http://en.wikipedia.org/wiki/Existentialism>
30. Paragraph 34, *The Free Spirit*, Part 2, *Beyond Good and Evil*, *ibid.*
31. *Radiation hormesis* – [http://en.wikipedia.org/wiki/Radiation\\_hormesis](http://en.wikipedia.org/wiki/Radiation_hormesis)
32. *Increase of regional total cancer incidence in north Sweden due to the Chernobyl accident?*, Martin Tondel, Peter Hjalmarsson, Lennart Hardell, Goran Carlsson and Olav Axelson, *Journal of Epidemiol Community Health*, vol.58 pp.1011–1016, 2004 – <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1732641/pdf/v058p01011.pdf>
33. *Radioecology: relevance to the problems of the new millennium*, F. Ward Whicker, *Journal of Environmental Radioactivity*, vol.50 pp.173-178, 2000 – [http://www.fraw.org.uk/mei/archive/magnox\\_a1\\_02.pdf](http://www.fraw.org.uk/mei/archive/magnox_a1_02.pdf)
34. See George Monbiot's articles index at Guardian On-line – <http://www.guardian.co.uk/profile/georgemonbiot>
35. *Linear no-threshold model* – [http://en.wikipedia.org/wiki/Linear\\_no-threshold\\_model](http://en.wikipedia.org/wiki/Linear_no-threshold_model)
36. *Sodium-vapour lamp* – [http://en.wikipedia.org/wiki/Sodium-vapor\\_lamp](http://en.wikipedia.org/wiki/Sodium-vapor_lamp)
37. *Globular cluster* – [http://en.wikipedia.org/wiki/Globular\\_cluster](http://en.wikipedia.org/wiki/Globular_cluster)
38. *Table 5.6. Electricity fuel use, generation and supply*, Digest of UK Energy Statistics 2010, Department for Energy and Climate Change, July 2010 – <http://www.decc.gov.uk/en/content/cms/statistics/source/electricity/electricity.aspx>
39. *Air travel disruption after the 2010 Eyjafjallajökull eruption* – [http://en.wikipedia.org/wiki/Air\\_travel\\_disruption\\_after\\_the\\_2010\\_Eyjafjallaj%C3%B6kull\\_eruption](http://en.wikipedia.org/wiki/Air_travel_disruption_after_the_2010_Eyjafjallaj%C3%B6kull_eruption)
40. *Table 1.1. Aggregate energy balance 2009*, Digest of UK Energy Statistics 2010, Department for Energy and Climate Change, July 2010 – <http://www.decc.gov.uk/en/content/cms/statistics/source/total/total.aspx>
41. Page 21 ('Demand for road fuels, 1990 to 2009'), *UK Energy in Brief 2010*, Department for the Environment and Climate Change, July 2010 – <http://www.decc.gov.uk/en/content/cms/statistics/publications/brief/brief.aspx>

42. *Biomass power station plan for Southampton*, BBC News On-line, 9<sup>th</sup> February 2011 – <http://www.bbc.co.uk/news/uk-england-hampshire-12402500>
43. For details of the plant see the Southampton Biomass Power web site – <http://www.southamptonbiomasspower.com/>
44. For information on the “average” levels of household energy consumption see OFGEM’s briefing sheet, *Typical domestic energy consumption figures*, Factsheet 96, 18<sup>th</sup> January 2011 – <http://www.ofgem.gov.uk/Media/FactSheets/Documents1/domestic%20energy%20consump%20fig%20FS.pdf>
45. Table 11.4, *Social Trends 40*, National Statistics, 2010 – [http://www.statistics.gov.uk/downloads/theme\\_social/Social-Trends40/ST40\\_2010\\_FINAL.pdf](http://www.statistics.gov.uk/downloads/theme_social/Social-Trends40/ST40_2010_FINAL.pdf)
46. *Solar water heating*, Energy Saving Trust – <http://www.energysavingtrust.org.uk/Generate-your-own-energy/Solar-water-heating>
47. *Carbon footprint of the nuclear fuel cycle*, AEA Technology for British Energy, March 2006 – <http://www.british-energy.com/pagetemplate.php?pid=251>
48. *Radome* – <http://en.wikipedia.org/wiki/Radome>
49. *RAF Croughton* – [http://en.wikipedia.org/wiki/RAF\\_Croughton](http://en.wikipedia.org/wiki/RAF_Croughton)
50. *RAF Barford St. John* – [http://en.wikipedia.org/wiki/RAF\\_Barford\\_St\\_John](http://en.wikipedia.org/wiki/RAF_Barford_St_John)
51. *United States Central Command (CENTCOM)* – [http://en.wikipedia.org/wiki/United\\_States\\_Central\\_Command](http://en.wikipedia.org/wiki/United_States_Central_Command)
52. For example, *NozzleRage: Attack of the Pump* – <http://www.youtube.com/watch?v=zSaZ5v1eW5I>; for further weirdness see <http://www.nozzlerage.com/>
53. *Oil States on the Brink?*, International Affairs Watch, 7<sup>th</sup> March 2011 – <http://www.iaar-gwu.org/node/287>
54. *The Price of Oil: Corporate Responsibility and Human Rights Violations In Nigeria's Oil Producing Communities*, Human Rights Watch, 1999 – <http://www.hrw.org/legacy/reports/1999/nigeria/nigeria0199.pdf>
55. For example see: *Report of the Church Rock Uranium Monitoring Project 2003-2007*, Southwest Research and Information Center, May 2007 – <http://www.sric.org/uranium/CRUMPRreportSummary.pdf>; *The History of Uranium Mining and the Navajo People*, Doug Brugge and Rob Goble, American Journal of Public Health, vol.92, no.9, pp.1410-1419, September 2002 – <http://ajph.aphapublications.org/cgi/reprint/92/9/1410>; *The Sequoyah Corporation Fuels Release and the Church Rock Spill: Unpublicized Nuclear Releases in American Indian Communities*, D. Brugge, J. L. de Lemos, and C. Bui, American Journal of Public Health, vol.97 no.9 pp.1595-1600, September 2007 – <http://ajph.aphapublications.org/cgi/reprint/97/9/1595>
56. *ECRR: Uranium and Health – The Health Effects of Exposure to Uranium and Uranium Weapons Fallout*, Chris Busby, Documents of the ECRR 2010 No.2, Brussels, 2010 – <http://www.earthlife.org.za/wordpress/wp-content/uploads/2011/04/ECRR-Uranium-and-Health-2010.pdf>
57. *The unpalatable truth is that the anti-nuclear lobby has misled us all*, George Monbiot, Guardian On-line, 5<sup>th</sup> April 2011 – <http://www.guardian.co.uk/commentisfree/2011/apr/05/anti-nuclear-lobby-misled-world>
58. p.53, Annex A, *Effects of Ionizing Radiation*, Volume 1, Report to the General Assembly, UNSCEAR, 2006 – [http://www.unscear.org/docs/reports/2006/07-82087\\_Report\\_Annex\\_A\\_2006\\_Web\\_corr.pdf](http://www.unscear.org/docs/reports/2006/07-82087_Report_Annex_A_2006_Web_corr.pdf)
59. *Depleted Uranium Causes Cancer: The coroner's inquest of Stuart Raymond Dyson*, Chris Busby, 11<sup>th</sup> September 2009 – <http://www.llrc.org/du/subtopic/dysonrept.pdf>
60. *Drinking Water with Uranium below the U.S. EPA Water Standard Causes Estrogen Receptor-Dependent Responses in Female Mice*, Stefanie Raymond-Whish, Loretta P. Mayer, Tamara O'Neal, Alisyn Martinez, Marilee A. Sellers, Patricia J. Christian, Samuel L. Marion, Carlyle Begay, Catherine R. Propper, Patricia B. Hoyer, and Cheryl A. Dyer, Environmental Health Perspectives, vol.115 pp.1711-1716, 2007 – <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2137136/pdf/ehp0115-001711.pdf>
61. *Endocrine disruptor* – [http://en.wikipedia.org/wiki/Endocrine\\_disruptor](http://en.wikipedia.org/wiki/Endocrine_disruptor)
62. *Nuclear reprocessing* – [http://en.wikipedia.org/wiki/Nuclear\\_reprocessing](http://en.wikipedia.org/wiki/Nuclear_reprocessing)
63. *MOX fuel* – [http://en.wikipedia.org/wiki/MOX\\_fuel](http://en.wikipedia.org/wiki/MOX_fuel)
64. *Nuclear opponents have a moral duty to get their facts straight*, George Monbiot, Guardian On-line, 13<sup>th</sup> April 2011 – <http://www.guardian.co.uk/environment/georgemonbiot/2011/apr/13/anti-nuclear-lobby-interrogate-beliefs>
65. End of Chapter 9, *Small is Beautiful*, *ibid.* ref. 3
66. End of Chapter 8, *ibid.* ref. 3
67. *Sustainable consumption* – [http://en.wikipedia.org/wiki/Sustainable\\_consumption](http://en.wikipedia.org/wiki/Sustainable_consumption)
68. *Ethical consumption* – [http://en.wikipedia.org/wiki/Ethical\\_consumerism](http://en.wikipedia.org/wiki/Ethical_consumerism)
69. *Thorstein Veblen* – [http://en.wikipedia.org/wiki/Thorstein\\_Veblen](http://en.wikipedia.org/wiki/Thorstein_Veblen)
70. *Deep ecology* – [http://en.wikipedia.org/wiki/Deep\\_ecology](http://en.wikipedia.org/wiki/Deep_ecology)
71. Matthew 19:16-24 (KJV) – <http://www.biblegateway.com/passage/?search=Matthew%2019&version=KJV>
72. *Steppenwolf*, Herman Hesse, 1927; latest edition by Penguin Modern Classics, translated by Basil Creighton, 2008. ISBN 9780-1411-8289-6. £8.99.

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