



Everything is Connected to Everything Else

101 stories about 21st century Geography

by

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CHAPTER 4

CLIMATE AND ENERGY

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Why won't you believe this is real?

Like so many of the ideas that drive forward science the thinking that led to the idea that human activity could have a direct impact on global climate came from an unlikely source. Guy Stewart Callender (1897–1964) was a power plant engineer concerned with making more efficient electric generators. He also held an interest in weather and climate. Callender fortunately had an advanced understanding of atmospheric physics even though he had never attended university; his father was Professor of Physics at the University of London. He was not coming to this complex subject completely blind.

However, when in February 1938, Callender presented his considered thoughts on the relationship between carbon dioxide levels in the atmosphere and global temperatures to the Royal Meteorological Society, his presentation was not

taken particularly seriously.¹ His observations, based upon a limited spread of data, were questioned as to their reliability. More importantly, the Fellows of The Royal Meteorological Society felt that it was not possible that a single factor – carbon dioxide – could cause climate change when obviously it was far more complex than that. That bit of their critique was true – it is more complex than a single gas – but that gas, carbon dioxide, is a core driver of atmospheric temperature.

Yet, like nearly all scientists, Callender's thinking had not been pulled out of thin air; he was standing on the shoulders of others. He was drawn towards his conclusions by the work of a Swedish physicist, Svante August Arrhenius who, in 1896, demonstrated that changing concentrations of carbon dioxide in the atmosphere as a result of the burning of coal would increase atmospheric temperatures. Arrhenius thought this would be beneficial as it would mediate against the onset of another ice age.² At the time Arrhenius's postulations were warmly received right across Europe and in that he also owed an intellectual debt to the work of pioneering British Victorian meteorologist John Tyndall. In the nature of these things the idea blazed brightly for a while but then interest withered within the scientific community until Callender stuck his unfashionable head above the parapet.

¹ Callendar, G.S. (1938). 'The Artificial Production of Carbon Dioxide and Its Influence on Climate.' Quarterly J. Royal Meteorological Society 64: 223-40

² Read all about this in Hulme, M (2009) 'Why We Disagree About Climate Change. Understanding Controversy, Inaction and Opportunity'. Cambridge University Press p47

It was US President-elect Al Gore's tutor at Harvard, Roger Revelle, who helped set in motion the setting up of two atmospheric measuring sites, one on the summit of the Hawaiian volcano Mauna Loa and the other at the South Pole. It was hoped that these would help to set a baseline for the measuring of the levels of carbon dioxide in the atmosphere. The chief collector of data was the late Charles Keeling (1928-2005) and his longitudinal research remains the backbone of climate science. The experiment started back in 1957. There were 314 parts per million of carbon dioxide measured at that time. This experiment continues to this day.³

May is the peak time for CO₂ measurements at Mauna Loa. With the onset of early summer the rapid growth of vegetation in the northern hemisphere slowly strips CO₂ out of the atmosphere until October. It is this seasonal pattern that gives Keeling's iconic graph of atmospheric CO₂ levels its distinctive saw-tooth pattern. It was therefore relatively predictable news that CO₂ had reached the level of 400ppm on the 9th May 2013. The trend line had suggested that it was a strong possibility in 2013, but nevertheless a media zephyr soon blew up.⁴

When such numerically neat points are reached interest is always piqued. It is a bit like watching your car milometer click past 100,000. However, beyond the usual UK media suspects – The Guardian, The Independent, Channel 4 and the BBC – reporting of this event didn't stir much passion. The Daily Mail, were quick to point out that: 'The extreme rise in CO₂ levels in the atmosphere began before the Industrial Revolution, in the mid-18th century'. So nothing to do with industrial capitalism, growing population and our addiction to fossil fuel generated energy. We can't have anybody suspecting that.

³ A continuous update and full historical record of Mauna Loa carbon dioxide data is available at <http://www.esrl.noaa.gov/gmd/ccgg/trends/>

⁴ BBC News. 'Carbon dioxide passes symbolic mark.' 10.5.2013. Accessed at <http://www.bbc.co.uk/news/science-environment-22486153>

Let's be frank.

The first time that the British public heard about the idea that carbon dioxide levels in the atmosphere could impact on the global environment was in 1969 when Frank Fraser Darling, the Chesterfield born natural historian, was honoured with the 22nd BBC Reith Lecture. His theme was the human impact upon the environment. He worked his way through what he saw as the two most pernicious impacts – nuclear radioactivity and pesticide use – before, during his fourth lecture, he stated:

“There is also a much greater change to which we are contributing, this time in the planetary atmosphere. And our paradoxical friend and enemy, the internal combustion engine, is contributing all the time. I'm alluding to the rise in the level of carbon dioxide in the atmosphere, a rise which coincides with that of the consumption of fossil fuels – coal and oil.”⁵

At the time this was news to all but a few scientists in Britain. This he acknowledged:

“Some scientists are thinking about these phenomena, but not nearly enough data is being gathered or monitoring done. How far, really, do we think for posterity? The carbon dioxide problem is as yet remote.”

This seemingly remote problem in 1969 became a zeitgeist issue very rapidly with a 1972 UN environment conference in Stockholm, the publication of the 'Limits to Growth' report by the Club of Rome in the same year, and a slew of popular science books throughout the rest of the 1970s led by Stephen Schneider's 1976 work 'The Genesis Strategy: Climate and Global Survival'.

The 1970s were also a time when ever-increasing data sets could be processed by embryonic computers. This led to the creation of new climate models based upon the cellular atmospheric model. By the time of the early 1980s 'the greenhouse effect' was finding its way into geography text books and confusing a generation who hitherto had been told that the world was edging back towards a new ice age. It was getting colder; no, it was getting warmer: couldn't these geographers make up their minds.

⁵ BBC Reith Lecture 1969 - Frank Fraser Darling: Wilderness and Plenty. Lecture 4: 'Global changes – Actual and Possible.' Access transcript at http://downloads.bbc.co.uk/rmhttp/radio4/transcripts/1969_reith4.pdf

By 1988 a more definitive position was forming. As Mike Hulme, Professor of Climate Change at the University of East Anglia explains it:

“There was no major new scientific discovery about climate change in 1988. Yet something happened in that year to bring about the idea of anthropogenic climate change into the foreground of public consciousness. What happened was a convergence of events, politics, institutional innovations, and the intervention of prominent public and charismatic individuals.”⁶

The announcement that 1987 had been the warmest year recorded in the past century, the holding of the first international climate conference in Toronto with 48 countries in attendance, the establishment of the Intergovernmental Panel on Climate Change (IPCC) and even the British Prime Minister, Margaret Thatcher, acknowledging, to the learned Royal Society, that she was convinced by the science: all of these things were part of that 1988 watershed. Thatcher put it thus:

“It is possible that...we have unwittingly begun a massive experiment with the system of the planet itself.”⁷

This was still a debate dominated by the western world. The developing world barely had a look-in. The number of articles published in academic science journals about climate change rose from a few in 1988 to over 800 by 2006.⁸

By the time Al Gore released his climate change wakeup call documentary, ‘An Inconvenient Truth’, in 2006, climate change had become part of mainstream thinking. International treaties had been signed – most notably in Kyoto in 1997 – and a promise to ratify this treaty was a central part of Gore’s failed run at the US presidency in 2000. A welter of journalism, reports, political debate and classroom instruction had created out of a marginal idea what some now argued was the most pressing challenge facing earth and all of its inhabitants.

Not everybody thought so.

⁶ Op cit page 63-64 Hulme

⁷ Margaret Thatcher’s speech to Royal Society, London, 27 September 1988

⁸ Goodall, A.H. (2008) ‘Why have the leading journals in management failed to respond to climate change?’ Journal of Management Inquiry 17(4), 408-20.

The logic of climate sceptics.

In October 2009 a letter in the Sheffield Telegraph gave me an idea. Some of my students were studying climate change and an impassioned and superficially reasonable missive from a certain Russell Cavanagh caught my imagination as a way to sharpen their research skills.

Mr Cavanagh was bold enough to set out 16 points that he felt provided evidence to argue that anthropogenic climate change was an “unproven hypothesis”. He was confident enough to state that these were “verifiable through investigation”. Well, there was an interesting research exercise. I set my A level students the task of checking all 16 assertions. They did themselves proud and a month later a rather long and detailed refutation of nearly all of Mr Cavanagh’s arguments was printed.⁹ I doubt if even such a sustained piece of critical reasoning would have swayed either Mr Cavanagh or the very vocal group broadly known as ‘climate sceptics’ of whom he was a fellow traveller.

What is the central position of such sceptical thinking about climate change? Actually this is probably the wrong way to frame the question. After all scepticism – or Popperian falsificationism as it might be more academically posited – lies at the heart of science. Should we not doubt the models, the

predictions, the complex and often arcane science that gets batted around in the climate change debate? Surely that is the scientific way.

But doubt also has limits.

I doubt that my house will burn to the ground. In my neighbourhood such an event is extremely uncommon yet still I insure my house against it happening. I doubt that the odds of me winning the lottery are much different from those of me being struck by lightning (although of course somebody wins and somebody is struck down). We question doubt in a myriad of ways.

In the climate change debate doubt is very important. Scientists are constantly attempting to find fault in other scientists’ work, to challenge it. This is how science moves on. However climate scepticism is of a different order and often is not driven by intricate scientific debate but by blunt ideological differences between different groups and individuals.

So who are the sceptics? Well it would be inaccurate to gather them up into one homogeneous group. Some are outright deniers; others mildly sceptical of some of the predictions of potential impacts of climate change but do not actively deny anthropogenic climate change as such.

⁹ The full text of this letter can be found at <http://www.sheffieldtelegraph.co.uk/community/your-letters/climate-change-in-search-of-evidence-and-scientific-proof-1-457030>. It is worth noting that some of the assertions were of a nature that they were not possible to refute.

The most influential group are those who see thinking about climate change as a challenge to free market hegemony. Such an argument views interventions into the free market as not only a reduction in freedom of choice but also counter to the view that potential economic growth is unlimited and that in some way growth of consumption is disconnected from any – or all – environmental constraints.

These sceptics have a range of approaches to promote their view. They are critical of the science attacking ‘gaffes’, weaknesses and the integrity of the scientists involved. They also emphasise the impact that responses to climate change may have on the ‘quality of life’ enjoyed by the world’s wealthy citizens.

At heart this is an ideological position – a libertarian, free-market ideology that is intrinsically hostile to governance and regulation. No surprises there, as all political positions are ideological to a large degree.

The success of such an ideological approach to denying of climate change can be illustrated by the report that just over a third of US citizens believe that climate change is a hoax.¹⁰ That is to say, all of the science and discussion is part of a huge conspiracy to edge towards some insidious socialist takeover.

Although not wholly the case the vast majority of the sceptic constituency is drawn from the political ‘right’, often associated with a range of other thinking – libertarian, pro gun, fundamentalist about religious doctrine, traditional about gender and confused about the interplay between economic globalisation and national interest. Especially when ethnicity is thrown into the mix.

It is not easy to dismiss such ideological resistance to the acceptance of anthropological climate change. A huge amount of vested interest, funding and media influence is held by such sceptics, whether it is ExxonMobile bank-rolling climate denial groups¹¹ or the influence of Murdoch’s Fox News in the USA which has been shown by recent research to promote climate change scepticism with a high degree of success.¹²

¹⁰ Details of public survey into US attitudes can be found at <http://www.theguardian.com/world/2013/apr/02/americans-obama-anti-christ-conspiracy-theories>

¹¹ From The Guardian 20th September 2006 David Adams, ‘Royal Society tells Exxon: stop funding climate change denial.’ Access at <http://www.theguardian.com/environment/2006/sep/20/oilandpetrol.business>

¹² Hmielowski, J et al (2013) ‘An attack on science? Media use, trust in scientists and perceptions of global warming.’ *Public Understanding of Science* 0(0)1-18

Leading UK sceptic James Delingpole is unequivocal about the real basis for most resistance to climate change. Riffing on the idea of “live free or die”, Delingpole, in a 2010 blog, sets out the context for his seemingly remorseless and predominantly ad hominem attacks on climate science as being part of a wider political movement that of neo-liberal capitalism. He puts it like this.

“I understand that “Environmentalism” is but one strategically significant theatre in a much greater ideological war being waged across the world.”¹³

I couldn't agree more with Delingpole other than I am on the other side of the ideological trenches to him. The science of climate change is the science. We can and should haggle over it – that is how science moves forward, but the reality of what we will do with this scientific debate is an entirely political choice.

There is no re-wind.

Let us settle on one key idea without any obscuring flannel from the climate sceptics or deniers. Climate change as a result of human activity – anthropogenic global warming (AGW) – is a reality. We know this: the evidence is out there. A huge amount of evidence. We have measured the increase in carbon dioxide in the atmosphere and it is rising steadily. We also know that average global temperatures have risen no matter what time frame you start from.¹⁴ Can we link these two observations with human agency? 95% of climate scientists assert that you can. I think it is also easy to accept that no simple intervention or even complex intervention is going to turn the clock back to an optimum global temperature.

In fact it is probably more complicated than that because we would have to come to some conclusion as to what constitutes an ‘optimum temperature’ for the global atmosphere. Generally when we talk about natural vegetation we refer to climatic climax communities: the vegetation and supported wider biotic life that a particular climate range will support. Most commonly this point in the biotic evolution of the British Isles is considered to be the Atlantic period about 8,000 years ago. But on reflection maybe a degree or two warmer might be more

¹³ Delingpole is a reliable source of climate sceptic rhetoric; he crops up all over the media as part of the idea that all views must err towards a 50:50 balance. This quote is extracted from this 2010 blog accessed at <http://blogs.telegraph.co.uk/news/jamesdelingpole/100061751/only-the-tea-party-can-save-us-now/>

¹⁴ For an interesting example of how to play around with data and graphs around the issue of climate change try the TV debate between BBC journalist Andrew Neil and Climate Change minister Ed Davey on the BBC Sunday Politics Show in July 2013. Access at <http://www.youtube.com/watch?v=DQ-u2D-Hb34>

optimal – maybe not for our biome, Atlantic deciduous forest – but for the humans who have already broadly put to the sword most of that natural vegetation that evolved 8,000 years ago.

Furthermore in the long run all of these things are dynamic anyway. We move slowly – some might say glacially slow – from one ice age to the next. We cannot fix our climate forever.

However, this really is not the debate. The issue is the rapidity of change and the ability of life to adapt to that change. What accentuates all this is the erroneous myth that modern life is immutable. What does that mean? That the huge leaps forward in human numbers, quality of life, life expectancy and cultural well-being that have been achieved globally in the past two decades are here to stay and that, if anything, will continue to progress as we march into the 22nd century and beyond. This is obviously conjecture. I'd like to think it is so, that human progress will continue but I am not entirely convinced. It could just be wishful thinking.

The key to all of this is how impactful is climate change going to be? Well the IPCC (even the cautious scientists) provide a range of scenarios and within them, a range of possible generic temperature outcomes by the end of the 21st century. The scenarios work on different population levels, different energy mixes and different political drivers. At their most pessimistic: no political action, increasing use of fossil fuels, high end population outcomes of 11 billion plus – we are looking at a potential 6°C increase globally. At the other end of the scale, concerted global political action, a reduction in the use of fossil fuels and a population of perhaps as little as 9 billion would result in an increase possibly as little as 1.8°C.

Nobody, but nobody – beyond the outright deniers who are at the 'Elvis alive and living on moon' scale of scientific fantasy – thinks that there will be no impact this century. How much is up to us and that is a political decision, a choice. Turning back the clock, reversing the increases to date, is nothing but wishful thinking. There is no rewind.

Your great grandchildren won't thank you.

There is a fundamental problem with increasing levels of carbon dioxide in the atmosphere and our human ability to comprehend its potential impact. This is the time lag between the generation of enhanced carbon dioxide concentrations as a result of hydrocarbon-based industrialisation and when this will actually result in significant climate variation.

We have already set in train anthropogenic climate change and its progress is irreversible.

Today we are feeling the climate impact of the post-war industrialisation period some 50 to 60 years ago. We aren't able, at present, to strip out atmospheric carbon dioxide and store it within the terrestrial biote at the scale and speed required. This happened naturally during the appropriately named carboniferous period about 360 to 290 million years ago. Runaway temperatures on a tropical earth created huge swampy forests that on dying back in oxygen depleted water created the terrestrial hydro-carbons of coal, oil and gas that we gleefully started extracting on a large scale at the beginning of the industrial revolution. The fixing of atmospheric carbon dioxide into stored terrestrial carbon took tens of millions of years. Today we are recycling back a sizeable proportion of that stored carbon back into the atmosphere in a few hundred years. The consequences now and in the future although not

wholly predictable are real. Research by US scientists led by famed atmospheric chemist Professor Susan Solomon of MIT concluded:

Irreversible climate changes due to carbon dioxide emissions have already taken place, and future carbon dioxide emissions would imply further irreversible effects on the planet, with attendant long legacies for choices made by contemporary society.¹⁵

So what our forefathers did is impacting upon the climate today and what we do today will be a legacy that your grandchildren will have to deal with. To really make things awkward even if we enacted just about everything that would reduce global carbon output in both per capita and absolute terms, we would still experience a level of climate warming into the future – although by how much would be up for discussion.

So whatever our generation does, the sacrifices it makes, the restrictions to human activity forced through; none of it is likely to make any noticeable difference in our lifetimes. In fact things will almost certainly get worse, or rather more problematic. Try to sell that point as a politician wrestling with the democratic will of the people. "It is for your, probably as yet unborn grandchildren that you are making this sacrifice. You will probably notice no improvement." Pain today, pain tomorrow. Not a strong basis for a political career.

¹⁵ Solomon S et al (2008) 'Irreversible climate change due to carbon dioxide emissions.' Proceedings of the National Academy of Sciences of The United States of America Vol 106 no 6

If we choose not to accept such a long term perspective it will be interesting to consider how history will appraise our generation. In 2009 the actor Peter Postlewaite, in one of his last roles before his death, starred in the low budget UK film 'The Age of Stupid'. This film is an imagining of a denuded future world ravaged by climate change looking back on the history – the early 21st century 'age of stupid' – leading to that moment.¹⁶ The age of stupid indeed. Or maybe not.

What do you expect me to do about it?

So what to do? This is the tricky bit because all the scenarios that suggest a lower impact of climate change all involve significant interventions and changes from what we currently do. They are in effect ideological solutions, hence the antipathy towards them of those who currently hold economic and political power – the neo-liberal architects of the modern world. An acceptance that we are all in this together, that regulatory oversight will need to be strengthened and made more binding at an international level and that governments do matter are all ideas that need to be made and then acted upon. We have started.

It was on the 11th December 1997 that the Kyoto Protocol to the United Nations Framework Convention on Climate Change was signed. It was a huge achievement given the competing interests of the 191 countries signing up. Broadly speaking the commitment was a cut of 5% from 1990 levels of emissions of key greenhouse gases by 2012 from major industrialised polluting countries but with no such targets for developing nations. Well how did that go?

¹⁶ For a number of years I have used a video remix of The Age of Stupid produced by lightworkerdaz using the soundtrack of The Bombay Dub Orchestra's Beauty and The East (Banco de Gaia remix) Access at http://www.youtube.com/watch?v=NR2Ho5iGn_k

Overall emissions of greenhouse gases are up. Global carbon dioxide rose from 22.7 billion tonnes in 1990 to 33.9 billion tonnes in 2011.¹⁷ Of that increase the largest amount was contributed by China – some 7 billion additional tonnes, that sat outside the targets set in Kyoto.

However in terms of those who signed up to reduce their emissions there is a very mixed picture. Canada and New Zealand are the two worst offenders both seeing their impact increase substantially. Canada has now withdrawn from the Kyoto protocol altogether now that it has wedded its economic future to the extraction of highly polluting oil sands. Elsewhere Russia and many Eastern European countries have made significant progress in reducing their impact mainly as a result of dirty old industry and power generation being replaced by far more efficient technologies.

Of course none of this is the real picture as much of the carbon emissions we generate are embedded into goods that are moved around the world. A groundbreaking report in 2010 attempted to get to grips with this.¹⁸ What it revealed was that much of the increase in China's emissions was a result of goods exported out of China. Or to put it another way a significant proportion of Britain's modest achievement in sticking to its carbon targets was achieved by not producing goods in situ but importing them from elsewhere. For example, China exports

144 million tonnes of carbon embedded in machinery and equipment. That is the easy to measure stuff – industrial goods – but as most of this carbon is embedded in what the report calls 'non energy intensive goods', working out the true picture is indicative rather than entirely accurate.

So although since 1997 we have had good intentions and many countries have vigorously acted upon them we are still going backwards and not forwards. So, certainly as things look at present, our chances of fulfilling the IPCC's best-case scenario look slim. We've got to be in the plus 3°C by 2100 camp at best.

Trying to work out how, globally, we can at the very least reduce per capita carbon emissions is possibly the greatest challenge of our generation. The consequences of our choices will set in motion the environmental realities for generations to come.

How can we as individuals pit ourselves against such monumental decisions? Surely it would be better to leave it to the experts and we will do what they say?

¹⁷ PBL Netherlands Environmental Assessment Agency. 'Trends in Global CO2 Emissions 2012 Report' Access at <http://edgar.jrc.ec.europa.eu/CO2REPORT2012.pdf>

¹⁸ Peters et al (2010) 'Growth of emission transfers via international trade from 1990 to 2008'. Proceedings of the National Academy of Sciences of the United States of America Volume 108 Number 21

Let's discuss this all at a conference.

At the end of November 2012, 17,000 participants gathered in Doha, the capital and the only city in the hydrocarbon desert state of Qatar. The United Nations Climate Change Conference was their calling. The irony of this was not lost on many.¹⁹ Qatar has the highest per capita carbon emissions in the world. It makes \$230million each day from selling oil and gas globally. Electricity is free and petrol is the 4th cheapest in the world.²⁰ What did 13 days of lobbying, back scratching, fevered debate and hand wringing achieve? Well, it was another slow shuffle towards some sort of global governance of carbon emissions but it was certainly no radical step forward and almost certainly it will not result in overall global carbon emissions being lowered anytime soon.

Perhaps the most significant aspect of Doha was the floating of the principle that in climate change the polluter pays. This is known as the loss and damage mechanism whereby nations who suffer negative climate change impacts can be either compensated or supported in putting in place mitigation interventions – like clean energy sources – through capital transfers from rich and polluting nations. But there is no cash on the table...yet. However, we do have a principle that many countries – the UK included – have, in principle, accepted. So that's good. Sort of.

What we needed was another conference to sort it all out and to work out a way that this money is going to materialise and from whom and how much? They were ahead of us. June 2013 the venue was Bonn, Germany. The meeting was *The thirty-eighth sessions of the Subsidiary Body for Implementation (SBI 38) and the Subsidiary Body for Scientific and Technological Advice (SBSTA 38), as well as the second part of the second session of the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP 2-2).*

Got that?

A key conclusion of this 9 day meeting was

"Agreement on the need for at least one additional session in 2014, and a request to the secretariat to secure a venue."²¹

Where do you think they fancy? Well, Warsaw, Poland, Mexico City, Fiji, South Korea, Manila and Siem Reap in Cambodia are all covered in 2013 with UNFCCC meetings already organised. In fact since the 1997 Kyoto Conference 81 different countries have hosted meetings by The United Nations Framework Convention on Climate Change. Canada was very popular for years until they stopped playing ball on climate change.

¹⁹ Fiona Harvey The Guardian 28th November 2012 'Doha: a strange place to host a climate change conference'.

Accessed at <http://www.theguardian.com/environment/shortcuts/2012/nov/28/doha-strange-place-climate-change-conference>

²⁰ Venezuela, Egypt and Saudi Arabia are cheaper, just, but the real cost as a percentage of income is the lowest in the world in Qatar.

²¹ Details of key conclusions of this conference can be found online. Access at http://unfccc.int/meetings/bonn_jun_2013/meeting/7431.php#cu

Bangkok has also been surprisingly popular over the years. To be fair some of these meetings are reasonably small regional affairs. For example the 3 day gathering in Lesotho in April 2013 of the regional *workshop to promote international collaboration in facilitating preparation, submission and implementation of nationally appropriate mitigation action*. However I think that the one thing that can be concluded about climate change conferences is that they are good for global airlines and hotel chains.

This however shouldn't be something that we take a cheap shot at – temptingly easy as it is. Global negotiation is exactly that: global. These are complex issues with a labyrinthine interplay of vested interests, some national and some local. There is of course an irony in the tonnes of carbon expended in facilitating such a programme of meetings and it would be much easier to take if the outcomes of such discussions were more impactful but meetings are important to help us move forward.

So how good could it be?

There is a contrarian view that climate change could actually be a good thing. The problem with such thinking is that it is extremely place-specific in pointing up potential perceived advantages of a bit more rain, or warmer temperatures. I have been caught up in this thinking myself.

I had the notion that I could grow sufficient grapes to make my own (red) wine from my south-facing, steep sloped, micro-plot on the edge of my allotment. A fanciful notion I suspect as far north as Sheffield but I am going to have a go. Pinot Noir grapes (if these things mean anything to you) which basically means if the red can't pass muster I can have a go at making sparkling white – Pinot Noir being a key grape in Champagne making.

It is the faux champagne being produced in southern England that is starting to carve out an international reputation which has been cited as one of the positive outcomes of climate change. A conference (yes another one) held at Denbeis Vineyard in East Sussex in December 2013, discussed the impact of these changes. As Decanter, the self-styled leading wine magazine in the world put it:

“If predictions hold true, producers in traditional sparkling wine regions will suffer if temperatures rise, while areas previously considered too cool may yield quality sparkling wine.”²²

²² Rosen M (2013) 'Big changes' in sparkling wine to be discussed at symposium'. Decanter 6th June 2013.

2013 brought weather events – which although cannot be linked specifically to climate change, have a greater degree of probability as a consequence of climate change - which have already made the point to many French wine producers. Hailstorms in Bordeaux, Burgundy and Champagne, with hail bigger than golf balls, stripped thousands of hectares of vines bare. So serious is the impact – with losses running into hundreds of millions of Euros – that the regional council of Burgundy is exploring ‘cloud seeding’ with silver iodide to address the now yearly impacts of hail damage.²³

These stories neatly illustrate the problem with getting over-excited by the possibilities that climate change may bring to specific peoples and places. Yes it is true that potential biomass production will increase in northern latitudes: Greenland will be greener. In fact we will be able to access these new areas of agricultural potential as the ice that blocked the northern passages of Russia and Canada will be increasingly clear. It will make it easier to exploit what resources exist in both the marine and terrestrial environments of the far north a fact not lost on oil companies. As the sober Economist magazine put it: “climate change caused by burning fossil fuels will allow more Arctic hydrocarbons to be extracted and burned.”²⁴

Of course there are those on the libertarian free-market right who would see an opportunity in any event: earth quakes, floods, drought, war, all can turn a neat profit. Human misery well that is just a new market to exploit. An example of such thinking can be found at the American think tank Property and Environment Research Centre (PERC) who label themselves free-market environmentalists. In the UK the most visible proponent of this thinking is Bjorn Lomborg, the sceptical environmentalist.

PERC have used 2007 research by MIT economists Olivier Deschênes and Michael Greenstone to proclaim that US agriculture productivity will benefit from climate change to the tune of 4% this century.²⁵ The problem is that even these two distinguished academics have rowed back from this mildly optimistic position and now accept after sustained academic criticism that agricultural profitability in the USA will fall by an estimated figure of 13.6% per annum by the end of the century. That is using a median outcome climate model.²⁶

²³ Anson J (2013) ‘Burgundy to revisit anti-hail measures’ Decanter 24 July 2013

²⁴ Astill J (2012) ‘The melting north.’ The Economist June 4th 2012

²⁵ Benjamin D (2007) ‘The Benefits of Climate Change’. PERC Report Vol 25 No 3. The original research paper this is based on is Deschênes, O, and Greenstone M.(2007). ‘The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather’. American Economic Review 97(2): 354–385

²⁶ Deschênes, O, and Greenstone M.(2012). ‘The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather: Reply’. American Economic Review 2012, 102(7): 3761–3773. Access at http://www.econ.ucsb.edu/~olivier/DG_2012.pdf

The fundamental problem is un-certainty. Sure in the UK summers may well be hotter and drier, or maybe hotter and wetter, and this may be good for tourism.²⁷ Of course milder winter temperatures may result in lower energy use and hopefully lower bills. It may even be the case that a relatively benign experience of climate change in the British Isles (maritime influences mediating against both extreme cold and hot events) results in the UK being one of the most attractive locations for increasingly squeezed and mobile global capital. Fanciful I know but I am sure some policy think tank work is nurturing the idea at present.

The actual experience of tentatively trying to work out the climate future of Britain is in the hands of the experts, UKCP09, an amalgamation of UK government departments, academics and The Met Office. And like scientists wrestling with complexity trying to work out what they are saying is as difficult as finding out what the weather will be like a week this coming Thursday: maybe rain, maybe sun, maybe warm, maybe cold.

The forecast is changeable.

When you start to explore the UKCP09 website you fairly quickly work out that a little bit of help is probably required to get to grips with the data that they make available publically. They run training courses for businesses who want to attempt to get to grips with the changing climate in the UK. People like farmers or micro vineyard entrepreneurs in Sheffield. Let's see if my broad generalist grasp of stuff can cope with reams of nuanced detail.

First of all this attempt at predictive climate science is based around models and models work to different assumptions or different measures of different variables. Although we could haggle about the models, in reality we probably couldn't because we would not have the maths and programming skills to even understand the basics of how these models are constructed. I know people who do have these skills, they tend to be substantially better educated than me but probably know less about the history of Jamaican reggae music than I do. It's a play off – you can't know everything – you choose.

Let us accept that the models are the best we can do at present – given the computing power at our disposal. The Met Office's computer has 15 million megabytes of memory and cost £30 million in 2009. They are presently lining up a £100million model to supersede this so things will move on, become more complex, maybe more reliable.

²⁷ Meikle J (2011) 'Climate change could spark UK rail revival and tourism boom: research shows'. The Guardian 28 January 2011. Access at <http://www.theguardian.com/environment/2011/jan/28/climate-change-uk-rail-tourism?guni=Article:in%20body%20link>

So first of all we have to make a choice about overarching future scenarios. The IPCC family of scenarios can be simplified as being broadly:

- **A1:** An increasingly globalised world driven by economic growth and continuing dominance of fossil fuels in the global energy mix. There are a few subtle variations on this model such as A1F1 that has a stronger emphasis on fossil fuel and is seen as the main high emissions scenario. It is the business as usual scenario.
- **A2:** Involves a much more fragmented world, less trade more regional in outlook but with the same old fossil fuel energy mix.
- **B1:** Is the globalised environmental scenario. More governance, treaties that bind, less focus on market solutions and more focus on renewable energy. This is the low emissions scenario
- **B2:** Is the sustainable environment scenario but in a more fragmented less connected world.

The medium scenario chosen by the UKCP09 is a variation on A1 called A1B which has a much stronger emphasis on renewable energies but within a market economy driven by the striving for continuous economic growth – if you think of it as like now, but a lot greener – renewable energy, recycling and electric cars. This seems to my thinking the most likely path. So medium scenario it is.

Go to the Yorkshire and Humberside sub-section of the UKCP09 site and look up the probabilities.²⁸ There are no certain predictions just a range of probabilities so it is difficult for the media to pick out nice, neat numbers.

By 2020 the central estimate of average temperature increase is 1.3°C, within a probable range of 0.5°C to 2.3°C. Summer daily maximum mean temperatures have a central estimate of 1.7°C higher. Say for July where Sheffield's long term average mean for that month is 16.2°C (1955-2013) that means an average maximum mean of 17.9°C. Only 2006 and 2013 have been hotter than that this century. I guess most people would think that would be an improvement especially as no significant changes of rainfall are predicted; there might be a few % less rainfall but it is just as probable there will be a few % more.

²⁸ This is just the web page for the specific Yorkshire and Humberside summary page. Access at <http://ukclimateprojections.defra.gov.uk/22352>

However if we try 2050, when my eldest daughter is the same age I am now, 50, the numbers shoot up. A central estimate of 3.1°C for summer maximum means and that figure reaches 4.3°C by 2080. That would be an August mean maximum temperature of 20.5°C. Sheffield has never had a summer that hot since records began but that would simply be normal. The hot days in July could start to hit 35°C with regularity. Planting vines suddenly doesn't seem so wild an idea, even in Yorkshire.

Being an island will go a long way to making sure that even by 2080 we will not have experienced wild fluctuations in rainfall. Wetter in the milder winters and drier in the hotter summers but overall not a significant decrease per annum although when it rains it will rain with more intensity resulting in a greater flooding risk.

It doesn't sound intolerable. Difficult yes but we could adapt. Yet the problem is that the medium scenario will involve quite a lot of work in getting our carbon emissions down. This means working towards more sustainable ways of living within a broadly capitalist system. However if we let the market rip and embrace the neo-liberal economics of global capital and keep doing things like fracking and driving to big out-of-town shopping malls like Sheffield's Meadowhall then the picture looks significantly different. By 2080 we are 5.6°C above our current July daily mean maximum and it becomes 28% drier on average. That is close to the averages for Sydney, Australia, in April and they can get temperatures up to 38°C, wildfires and droughts.

Again I must state these are average temperatures, the peaks will be very high. There will be cold months, high levels of intense rainfall, droughts that may last months. All told the future is very changeable but the one thing that we can have a high degree of confidence in is that it is getting warmer. Don't take it from me this is what your government on the advice of the best climate scientists, mathematical modellers and atmospheric physicists with the most powerful computers ever built are saying.

Nobody can tell you how bad it could be because frankly that is anybody's guess. However there is a small probability – less than 10% – that summer temperatures in Sheffield could be as much as 9.5°C higher than the current long-term average. If that happens we would be in trouble because Britain is probably going to be one of the least impacted upon areas in the world when it comes to climate change so imagine what would be going on in the rest of the world.

Prove it.

“The so-called “climate scientists” are nothing but paid stooges. Anyone still pushing the AGW fraud is little more than a criminal and needs to be brought to justice.”²⁹

You don't have to look far to find people who don't believe a word that I have written about climate change. The author of the article to which the above comment was attached to is James Delingpole. He is a bit of a media darling. He writes for The Daily Telegraph, is a regular guest on BBC political shows such as Question Time and contributes to that most famous of right-wing UK magazines The Spectator. Yet Delingpole goes further than his supporters he actually suggests that climate scientists and environmentalists should be killed. He is nothing if not succinct on this matter:

“Hanging is far too good for such ineffable toerags.”³⁰

We have a schism. There is a constituency of people, organisations and businesses that simply are not going to buy into anthropogenic climate warming under any circumstances regardless of the evidence presented to them.

Scientists who sit outside of the mainstream of IPCC thinking on climate change are a relatively small number and actually hold a range of objections. Few, if any, would deny that global warming is a reality. However some argue that it is not proven that human activity influences the process. Others argue that it is an entirely natural process whilst a few say why worry it will be a predominantly positive experience anyway. Perhaps the most plausible grit in the IPCC machine is that which comes from scientists who argue that the predictions and thus the models that generate them are wrong.

This seems inordinately unfair on the scientists who prepare the UKCP09 data as their calculations have built in doubt. For example they say about a high emissions scenario that “it is very unlikely to be less than 2.5°C” in respect to summer daily maximum temperatures in Yorkshire in 2080.³¹ Unlikely but not impossible.

Consider this. It is fairly universally accepted that smoking increases the probability of an individual developing terminal lung cancer. Different studies have calculated different risk parameters, they are all relatively high compared to associations with other potentially risky behaviours (living in a heavily polluted city for instance). However, there are all sorts of examples of individuals who have smoked long into old age, centuries even. They are the statistical outliers.

²⁹ This example comes from the comments attached to a James Delingpole article in The Spectator magazine August 2013. Access at <http://www.spectator.co.uk/australia/australia-features/8981081/silencing-climate-change-dissenters/>

³⁰ The Liberal Conspiracy blog 'James Delingpole jokes about deaths of climate scientists' April 7th 2013. Access at <http://liberalconspiracy.org/2013/04/07/james-delingpole-regrets-that-climate-scientists-shouldnt-be-murdered/>

³¹ Op cit

In climate change there are scenarios where there is a probability things will really not be that bad, they are also the statistical outliers. This is James Delingpole. The safest way to stare into the future, statistically speaking is to go for the medium position, the average. The IPCC state that for the A1B scenario, the UKPC09's medium emissions scenario, that the middle point global average temperature rise by 2100 will be 2.8°C (in a range of 1.7°C to 4.4°C).³² Of course this aggregate figure masks significant variations around the surface of the earth as some areas will be higher, others lower.

So beyond the outright deniers (see the opening quote) most academic opposition to climate change rarely denies that it is not a reality. Some might argue that it is non-human agency that is causing the problem so carbon-dioxide omissions do not need to be curbed. Some used to argue that cigarette smoking was not harmful. Tobacco companies used to use maverick doctors to advertise their cigarettes.

A lesson in what's fair.

In 2009 Tanzania had a per capita carbon dioxide output of 0.1 tonnes. By contrast Qatar had an equivalent that same year of 44 tonnes, or 440 times greater. Tanzania's most famous physical feature is Mount Kilimanjaro, at 5,895 metres Africa's highest peak. It is particularly dramatic as its prominence, the distance from summit to lowest surrounding contour line is nearly the same as its absolute height; it soars above the flat plains of the Serengeti. At its summit sits a glacier, noted by the founding father of modern geography, Halford Mackinder, in his macho attempt to establish his exploring credentials by conquering the smaller Mount Kenya in 1899.³³ By 2030 this glacier will not exist.³⁴

The loss of this iconic African image is one of the least problematic impacts of climate change on Tanzania. A report from World Wide Fund for Nature (WWF) in 2006 spelled out an extensive range of impacts from more extreme weather events to loss of agricultural productivity and biomass.³⁵ More recently a British government funded report suggests that in the years leading up to 2030 climate change impacts will have a 2% negative impact on national GDP.³⁶

³² IPCC Fourth assessment Report 2007 'Projections of future changes in climate.' Access at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/spmsspmp-projections-of.html

³³ Mackinder, Halford (1900). 'A Journey to the Summit of Mount Kenya, British East Africa'. *The Geographical Journal* 15 (5): 453–476

³⁴ Thompson LG, Brecher HH, Mosley-Thompson E, Hardy DR, Mark BG (2009). 'Glacier loss on Kilimanjaro continues unabated'. *Proceedings of the National Academy of Sciences* 106 (47): 19770–5

³⁵ WWF (2006) 'Climate Change Impacts on East Africa. A Review of Scientific Literature'. Access at http://awsassets.panda.org/downloads/east_africa_climate_change_impacts_final_2.pdf

³⁶ Watkiss P, Downing T and Dyznyski J. (2011) 'The Economic Impacts of Climate Change on Tanzania' Global Climate Adaption Programme.

The report goes on to observe:

“Any impacts are likely to have disproportionately strong effects on the poor, as such vulnerable groups have fewer resources to adapt to climatic change.”³⁷

Qatar on the other hand is one of the richest places on the earth’s surface, its wealth generated by an immense and fortuitous store of hydrocarbons. Qatar has simply no concept of its carbon footprint, in 2022 Qatar will host, in the summer, the Football World Cup. This, the Qatari’s claim, will be a carbon neutral World Cup. You just can’t make this stuff up.

Qatar has at its disposal a \$115 billion sovereign wealth fund, 2012–13 saw it post a \$10 billion budget surplus and its citizens enjoy a per capita income of just over \$100,000.³⁸ Tanzania is one of the poorest countries in the world: per capita income is \$516, that is \$1.41 dollars a day.³⁹

Climate change is an issue which is significantly concerned with global equity. The global poor have contributed very little to the overall hydrocarbon drivers that have accelerated anthropogenic climate change. They will have to pay some of the harshest prices. They lack the capacity to adapt or to engage in mitigation strategies beyond simply being poor and consuming very little.

Qatar on the other hand funds the world’s largest research project into carbon capture and storage, at London’s Imperial College. The problem of holding a World Cup in temperatures nudging 40°C will be addressed by a \$50 billion investment in a solar powered air conditioning system for all stadiums and external fan areas. All this is very impressive and importantly it is also affordable as the Qatari government’s sovereign wealth fund holds a staggering portfolio of business interests around the world; 12.7% of Barclays Bank, 17% of Volkswagen, 6% of Credit Suisse, a big chunk of Sainsbury’s, Harrods, Miramax films, I could go on.

Tanzania owns a melting glacier, \$7.9 billion of external debt costing 40% of all government spending to service and an agricultural sector that contributes most of its earnings and that is threatened by on-going climate change.⁴⁰

Everything about anthropogenic climate change - its causes, its impacts and the ability to adapt or fund mitigation is framed by global inequality. This may become more obvious to us as environmental refugees search out the best places to survive, places with lower impacts and a greater ability to adapt. Places like Britain.

³⁷ Op cit

³⁸ Ali, J (2013) ‘Qatar’s economy: as best it can be’. Gulfnews Business Analysis. February 2 2013. Access at <http://gulfnews.com/business/opinion/qatar-s-economy-as-best-as-it-can-be-1.1140838>

³⁹ 2010 data accessed at <http://data.un.org/CountryProfile.aspx?crName=United%20Republic%20of%20Tanzania>

⁴⁰ I know people get sniffy about Wikipedia; I don’t but always like to cross check data. The core data is from http://en.wikipedia.org/wiki/Economy_of_Tanzania however more recent data puts government debt at \$8.1 billion and overall debt at \$10.6billion. Find this at online African business news magazine all Africa accessed at <http://allafrica.com/stories/201301282110.html>

Peak energy.

All human development: economy, society, culture, has at its core the processing of energy. More precisely, all life has to live through the laws of thermodynamics. Or to put it simply life exists on our planet because we constantly feed on a free source of energy - incoming solar radiation - and from that we derive all our energy. There are no exceptions.

We have known this for generations. The British Nobel Laureate chemist Frederick Soddy commented way back in 1911 that thermodynamics:

“control, in the last resort, the rise and fall of political systems, the freedom of bondage of nations, the movements of commerce and industry, the origin of wealth and poverty, and the general physical welfare of the race.”⁴¹

One of the world’s leading energy experts Professor Franklin Orr Jr explains the fundamental challenge thus:

“We use about 15 terawatts now. The amount of sunlight reaching the earth’s surface is about 3,000 times that amount. So there is plenty of sunlight but we have to convert it into something that we can use and that could be electricity, it could be heat, it could be mechanical work that makes a vehicle move. And it is the cost of those conversions that really controls what we do.”⁴²

The American anthropologist Leslie A White points out that for most of human existence their power plants were their own bodies capturing energy stored in animals and plants and putting it to work. When we domesticated animals and plants we effectively upped the energy we could sequester from these resources. Our culture expanded to become agriculture.⁴³

Things really began to change when humans worked out how to put to use the hydrocarbon resources - the stored energy of fossilised biotic material – in developing a more complex and technologically advanced society. A single barrel of oil, costing somewhere fluctuating around \$100, can provide the same energy as 25,000 hours of human labour. That is 12 years of 8 hour a days, 5 days a week human labour. That is 2 cents a day if there was pay equivalence to the price of a barrel of oil. Have you ever wondered why oil, gas and coal have been perennially popular sources of energy? Now you know.

In fact the whole industrialisation process is effectively about the utilisation of stored geological energy to do work for human benefit. Beyond the impact that burning such types of energy has on climate we also face a challenge in that the ‘low hanging fruit’ hydrocarbons are increasingly becoming depleted and once they are gone they are gone.

⁴¹ Soddy, F. (1911) ‘Matter and Energy’. New York: Holt. Pp10-11

⁴² Interview with Franklin Orr Jr at 2008 FT Energy Conference. Access at <http://www.youtube.com/watch?v=am6h1Obgsck>

⁴³ See commentary on p32 of Rifkin J (2009) ‘The Empathic Civilization’ Polity Press. P/p 32-33

Globally whether we have reached peak oil is a moot point for a number of reasons. First, there is a great uncertainty as to the reliability of the reserves data published by oil producing countries. Secondly, what we extract and from where depends upon how much we are prepared to pay for oil. The more expensive it becomes the more technologically expensive options for extraction come into play. Finally there may be new discoveries of oil, or gas and coal for that matter, that may in the future result in us having to reappraise our reserves.

However all this is simply numeric push and shove as the reality is that the world will reach peak oil – the point at which use outstrips the discovery of new reserves – sometime this century, probably the first half of this century; possibly even by now. The oil age has a limited shelf life.

Power is energy, energy is power.

Since the development of hydrocarbon industrialisation those entities, be they countries or companies, that control energy production and supply have become the backbone of the global economy. This has been a relatively recent phenomenon. In 2013 five of the six largest corporations in the world were oil companies.

Take British Petroleum (BP), the UK's largest company and the 6th largest corporation in the world. The Fortune 500 list for 2013 reported BP as having 2012 revenues of \$388.3 billion which yielded \$11.6 billion profit.⁴⁴ It paid just shy of \$7 billion corporation tax to the British government. It holds cash reserves of £20 billion.⁴⁵

Although BP is perceived as a British company it is in reality a global corporation whose history, headquarters and corporation tax bill reside in the UK. It has 38% ownership by US interests and 26% by other non-UK interests. 82% is owned by institutions. BP is a powerful entity it has tentacles all over the world from oil shales in Canada, oil fields in the South China Sea, Iraq, India and Russia to name but a few of the countries they operate in.

⁴⁴ The annual Forbes fortune 500 lists the world's largest corporation. The largest in the world is the part UK owned and UK stock market listed Royal Dutch Shell. All data accessed at <http://money.cnn.com/magazines/fortune/global500/index.html>

⁴⁵ BP annual report and financial statement 2013. Available at http://www.bp.com/content/dam/bp/pdf/investors/BP_Annual_Report_and_Form_20F_Financial_Statements.pdf

As a company BP was at the forefront of the development of the Middle East as an oil-producing region. The importance of this was emphasised in 1914 at the beginning of the First World War when the UK government effectively took control of the company by holding two thirds of its ordinary shares. Persian oil was vital to the UK's war effort. This was also the situation in the Second World War. In the 1980s Margaret Thatcher sold off the UK government's entire share holding. There is some irony to this as a Labour Government in 1977 had already sold off 17% of BP to raise some quick money to try to fend off the IMF. This was the first UK government privatisation and it gave Margaret Thatcher an idea.⁴⁶

From whatever angle you look at it oil companies are powerful. BP's revenues in 2012 are about the same as South Africa's GDP in the same year, the 28th wealthiest country in the world.⁴⁷ Their share prices and dividends provide a constant stream of income to support pension investments for tens of millions of people and their influence on political processes goes right to the heart of government, of many governments.

The key thrust of all this display of petroleum power is to illustrate the level of vested interests in maintaining a global economic system which has at its heart control and access to energy. However, even hydrocarbon monoliths have enough of an eye on the future to start kicking around how it is going to manage the downslope of peak oil. BP owns a few wind farms, mainly in the US, produces bio-ethanol fuels in Brazil and even toyed with solar power. BP claims that 7% of its investment is in alternative energy. Seasoned observers have scoffed at this.⁴⁸ BP holds over \$10 billion of investment in the highly polluting Canadian oil sands.⁴⁹

Energy companies like BP – which have no intention of relinquishing their economic power – need to hold a very extensive hand of cards, jokers as well. Their alliances are fluid and rarely underpinned by any sense of the wider global good. They will do business with dictators, despots, brutal regimes and armed gangs. Sometimes they do democracy when needs must.

⁴⁶ Elliott L (2001) 'How Thatcher stumbled on her big idea.' The Guardian 20 March 2001. Access at <http://www.theguardian.com/society/2001/mar/20/5>

⁴⁷ The World Bank GDP (current US\$) 2012. Access at <http://data.worldbank.org/indicator/NY.GDP.MKTP.CD>

⁴⁸ Pearce F (2008) 'Greenwash: BP and the myth of the world beyond petroleum.' The Guardian 20th November 2008. Access at <http://www.theguardian.com/environment/2008/nov/20/fossilfuels-energy>

⁴⁹ BP's own analysis of their Canadian oil sands activities can be found on their own corporate website.

Access at <http://www.bp.com/en/global/corporate/about-bp/bp-worldwide/bp-in-canada/canadian-oil-sands/bp-s-oil-sands-portfolio.html>

Adapt and survive.

One of the key determinants in climate change modelling is what is called the energy mix. It is the element that moves the A1 scenario (high emissions) to A1B (lower emissions) because of a lower fossil fuel element in the mix. A1B is the medium emissions scenario that UKCO₂ use. It is also a credible reality.

The UK signed up to a legally binding target of reducing its carbon dioxide emissions by 15% of 1990 levels by 2012. This has been achieved, bettered even. Stumbling around the barrage of data that envelops this debate it is sometimes difficult to put your finger on what exactly has been achieved.

What is clear is that in 2008 the UK government passed into law a Climate Change Act that put in place a mandatory reduction of carbon dioxide by 80% of 1990 levels by 2050. Ambitious stuff. In June 2013 a new Energy Bill started to make its way through Parliament, driven primarily by the need to put in place clear parameters by which new long-term investment in energy production can be framed bearing in mind those substantial reductions in carbon dioxide emissions that need to be found.

A new economic and regulatory framework is needed for the UK energy market because if nuclear power is going to contribute to part of a low carbon energy mix we will need to get some construction up and running very soon. You can't just knock up a nuclear power station.

In the past, and still in many countries, power generation was something that was generally the responsibility of the state. Ironically, the only nuclear power company still interested in building new nuclear power stations in the UK is Electricite de France (EDF) which is 85% owned by the French state and already produces nearly 25% of all electricity within the EU at a level of carbon intensity far lower than any of its competitors – because it is a nuclear power specialist.⁵⁰ What EDF are currently haggling over is the size of subsidy the British state will pay for it to build 4 new reactors at around £14 billion each.

This is something the market finds difficult to price because long term costs such as the storage of nuclear waste are a long way from being resolved. No local authority in the UK was prepared to put its hand up and say “Hey dump all that stuff, some with radioactive half lives of over a million years under my house, I don't mind.” Rational nimbyism?

⁵⁰ Carbon intensity of EDF's European operations is 135CO₂ per MWh (2009) by comparison Drax which runs Europe's largest coal fired power station in Selby, Yorkshire has a figure of 815 CO₂ per MWh (2009).

The 2013 Energy Bill was another exercise in pitting climate change contrarians, such as Owen Paterson, the UK's Environment Minister, against some serious attempts to try to frame the future in order to achieve our 2050 objectives.⁵¹ Ed Davey, the Liberal Democrat Energy Minister is leading the efforts to squelch through the quagmire of regulation with a mixture of carrot and stick. We are currently in this situation because successive previous governments shied away from making some big strategic decisions about energy generation in the future and we ended up wedded to fossil fuels.

What can we expect in our energy future? It is really a bits and pieces plan: some privatisation of the government's network of storage and pipeline facilities, core infrastructure, a long term stimulus for some new nuclear plants to be built, tight controls on the emissions of fossil fuel power generation but with enough incentives to draw in £110 billion of private sector investment in new low carbon electricity generation, or so it is hoped.

And then there is fracking. Possibly coming to a neighbourhood near you soon. For some this is the saviour of UK energy policy, a resource opportunity too good to miss and whatever way you look at it if you replace a higher intensity carbon fuel – say coal - with lower intensity fracked gas then you can even give it an environmental spin.

Fracking, or hydraulic fracturing, is the technique whereby high pressure fluids are driven into geological formations to release minute particles of hydrocarbon gas. This is the high hanging fruit of energy but in carbon fuel rich UK it sits literally beneath my feet. A report by the British Geological Survey in June 2013 suggested that about 43 years worth of our current annual consumption of gas was recoverable from a shale gas field stretching across Lancashire and Yorkshire, pretty much in the same places we used to mine coal.

This is going to be the environmental issue *du jour* for years to come as it literally will be on many people's back door. The debate about the hazards of fracking has already reached the streets in the level of environmental protest, and this in relatively wealthy and conservative rural areas of England.⁵² However circumstances could prevail. One super cold winter, a run on European supplies of gas, a pipeline failure and gas rationing – don't scoff this sort of stuff happens I lived through the winter of 1973–74 and the 3 day working week to conserve electricity supplies – and the winds of opprobrium that swirl around fracking today may dissipate like gas. Opinion matters.

⁵¹ See the transcript of the BBC Radio 4's Any Question June 2013 where Owen Paterson says "temperature hasn't changed for 17 years."

⁵² The Guardian 27.7.2013. 'Twelve charged over West Sussex anti-fracking protests'. Access at <http://www.theguardian.com/environment/2013/jul/27/twelve-charged-sussex-fracking-protests>

Research consistently shows that the UK public accept that something will have to be done about power generation to address climate change.⁵³ The issues are complex and cover every aspect of how we imagine our futures lives to look. The choices, as always, are also ideological.

Given the ownership structure of UK electricity production, with about 75% of capacity foreign owned and 20% of that by foreign governments financial incentives from central government will be the name of the game as patriotic “for the good of the nation” considerations are probably out of the question.

Anybody for nationalisation of the energy sector? No! Thought not, you like being hassled to ‘switch’ for the best deal, choice is our mantra. Everybody knows the private sector does it better. Hmmm.

Alternative energy. This or that.

In 2008 Sheffield industrialist Andrew Cook, a significant financial supporter to the Conservative Party and an advocate of free market choices, commissioned a report by Sheffield-born academic Professor Ian Fells.⁵⁴ It starts with the bold statement: “Security of energy supply must now be seen as taking priority over everything else, even climate change.” Even climate change, wow. Still, as a blunt Yorkshireman Cook doesn’t mince his words he gives it to us straight declaring:

“The market cares nothing for the environment. It caters for today’s generation not tomorrows.”⁵⁵

Such ideological clarity from his sponsor doesn’t halt Professor Fells from setting out a plan entitled ‘*A Route Map to Energy Survival in the UK*’ which contains a healthy dose of the unhidden hand of the state. It is a serious piece of work mixing up a reduction in government planning constraints, encouraging renewables through the use of feed-in tariffs and accepting that we are still going to be dependent on fossil fuels to generate electricity at least until we can get more nuclear power on stream. Perhaps the most eye catching part of this route map is the renewed suggestion that a tidal barrage across the Severn estuary should be part of that mix. It is a controversial idea but no more so than the present

⁵³ Spence et al (2010) ‘Public Perceptions of Climate Change and Energy Futures in Britain. March 2010’. University of Cardiff/Ipsos-Mori. Access at <http://www.ipsos-mori.com/Assets/Docs/Polls/climate-change-public-perceptions-of-climate-change-report.pdf>

⁵⁴ Educated at Kind Edward VII School Sheffield. Fells went on to become Professor at The University of Newcastle. One imagines that Fells and Cook were contemporaries.

⁵⁵ <http://fellsassociates.awardspace.com/site/LinkedDocuments/Pragmatic%20Energy%20Policy1.pdf>

government's planned HS2 railway line and its ability to provide a huge amount of low carbon electricity with a metronomic regularity is undeniable.

The idea of the Severn Barrage is almost the quintessential geographical problem. Regional scale project, huge cost, potentially huge benefits (up to 7% of UK electricity demand) and a wide range of environmental impacts that would result in human agency being an agent of coastal morphology. What about the birds, fish, sediment, turbidity, tidal range, erosion? This one has got it all and it is not even a new idea, it has been kicking about since the 19th century.

It demonstrates the idea of alternative energy from the perspective of competing alternatives. Meaning; 'do we do this or do we do that'. A brief comparison of EDF's Nuclear plan for four nuclear power stations in the UK – two at Hinkley Point on the Severn Estuary and two more on the Suffolk coast at Sizewell – with a Severn tidal barrage project is intriguing. Both have the potential to generate around 7% of the UK's electricity demand, although of course tidal power is not as flexible as nuclear power when it comes to meeting demand on a centralised electricity grid. The tidal barrage will not come cheap, some high estimates err up towards £34 billion and it depends on how big a barrage you want, whether it has a rail and road connection on it and whether you attach some large

wind turbines to it. However the nuclear option is probably closer to £55 billion, which is without the de-commissioning costs somewhere down the line.

The environmental impacts would be significant both positively and negatively. A lot of very low carbon energy on the plus side for both projects but an extensive list of known and speculative negative risks for both projects on the negative side. You can claim all you like that nuclear power is safe, and it is relatively speaking, to date, but Fukushima in 2011 and uncertainties surrounding the very long run pollution tail of nuclear power make caution a logical approach.

As for the Severn Barrage, the House of Commons Energy and Climate Change Committee considered at 253 pages length the 'A Severn Barrage?' question, again.⁵⁶ Again the answer is maybe but the economic argument isn't being made strongly enough and interestingly both Friends of the Earth – who are against – and the MPs cite a lack of public support for the scheme.⁵⁷ Well like most things it probably depends on the question being asked and the context it is asked in. What this debate does show is that solutions exist, maybe the speed of engaging in solutions is slow but we are not devoid of ideas whether on a grand scale such as a Severn barrage or on a micro scale such as small scale hydro projects on Sheffield's River Don.⁵⁸

⁵⁶ House of Commons Energy and Climate Change Committee 'A Severn barrage?' Second report of session 2013-14. Volume 1.
Access at <http://www.publications.parliament.uk/pa/cm201314/cmselect/cmenergy/194/194.pdf>

⁵⁷ McGrath M (2013) MPs say Severn barrage plan is significantly flawed'. BBC News 10 June 2013 Access at <http://www.bbc.co.uk/news/science-environment-22817378>

⁵⁸ Sheffield Renewables website. Access at <http://www.sheffieldrenewables.org.uk/>

Whatever comes to pass will have to be decided soon. Already things are happening; photovoltaic cells adorn suburban houses, my college has wind turbines on its roof, insulation of homes is promoted, electricity charging points for cars are being rolled out across the country. The government is not short of initiatives. However taking part of the message from Fell's prescription for our energy future - that the things that are going to be most effective are going to be long term, government-led investments that frame and constrain the outcomes of the market – means that we are going to have to move towards a decision-making process that is not just for now but for the future.

Peak stuff as well.

We constantly adhere to the notion that it is a good thing that the economy grows, that the value of all goods and services traded increases per capita. This is the backbone of a capitalist system. Virtually everything we trade has embedded energy both in its being and in the act of mobility that enables resources to be moved from places of supply to places of demand. So the bigger the economy the more stuff we consume and the more energy is consumed producing that stuff.

Maybe not. Firstly we are becoming increasingly better at producing things with a lot less energy. Whether it is cars, washing machines or aeroplanes, not only are we able to produce things with less energy but they use less energy when being used. More pertinent is the hypothesis propounded by Chris Goodall which argues that in a mature economy, like the UK, we have reached a point of peak stuff that is to say we are maintaining our standard of living and maybe even experiencing some slow rates of growth whilst consuming less material resources.⁵⁹

⁵⁹ Goodall C (2011) Peak Stuff. 'Did the UK reach a maximum use of material resources in the early part of the last decade?' Carbon Commentary. Access at http://www.carboncommentary.com/wp-content/uploads/2011/10/Peak_Stuff_17.10.11.pdf and Peak Stuff updated 28 January 2013. Access at <http://www.carboncommentary.com/2013/01/28/2781>

Since Goodall first published his analysis in 2011 it has created quite a stir amongst, well, people who are interested in this sort of thing. In 2013 he updated his figures to strengthen his key position using the total amount of materials used, the weight of freight transported, energy consumption, personal travel mileage and UK consumption of paper. OK so the falls are not dramatic but they are not increases and there is the suggestion of a trend. You might well think that this is only to be expected in a 'mature' ageing population, you consume less as you get older. Also you might like to think about your consumption habits over time.

I buy a lot of music. My first purchase was a seven inch single at Woolworths in 1973. Between then and the late 1980s I accumulated a significant amount of vinyl (an oil based product). They weigh a significant amount. Cassette tapes were lighter but also oil based and I've got boxes of them in my cellar. CDs are about the same weight and along with the plastic is a very thin layer of aluminium. I can just about store my CDs on wall shelves. If I move house I will really notice exactly how much material stuff I have accumulated just to play music.

Today every piece of music I have ever purchased, plus the stuff I download for free and am ever likely to listen to for the rest of my life could be buried somewhere in the lightweight, thin, laptop that I am tapping away on. My children will never accumulate the material stuff that I store music on and they will have even wider access to music than I have. This illustrates how a materially higher standard of living could be achieved without a higher level of material consumption.

Overall energy consumption in the UK has fallen 7% between 1990 and 2011. Virtually all of this fall has come about not because we do less work with energy but because we are much more efficient users of energy.⁶⁰ Notably the most significant progress in improving energy intensity over that time has come from predominantly private sector industrial concerns. Whereas our efforts to make transport more energy efficient over that same period of time has not been positive: small increases in energy efficiency have been offset by significant increases in output – or much more transport movements per person per year.

⁶⁰ UK Department of Energy and Climate Change (2013) 'Energy consumption in the UK' . URN 13D/154.
Access at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/190618/chapter_1_overall_factsheet.pdf

In the context of climate change these moves to towards energy efficiency, expanding the non-fossil fuel element of the UK's energy mix and simply using less stuff all suggest that we are already starting to move in the direction of a more sustainable planet. However, whether this is at a level of appropriate intensity – whatever that might be – and at rapidity that reflects the urgency of the long-term challenges. Well that is something that only history will tell.

What if I'm wrong?

“Our lives are not our own. We are bound to others, past and present, and by each crime and every kindness, we birth our future.”⁶¹

– Sonmi 451, Neo Seoul, the future.

When James Delingpole, righteous debunker of all things liberal and leftish, blurted out on BBC Radio 4's Any Questions in June 2013 that “any child under 16 is being fed eco-drivel by their ill educated teachers” a wry smile spread across my face.⁶²

Of course Delingpole is a preposterous caricature of the right-wing hack. Not quite up to 11 on venom control as some of his US radio shock-jock political compatriots can muster, but nevertheless still a man who if he hasn't served up a dozen ad hominem attacks before lunch probably feels a little out of sorts.

I am the target of Delingpole's abuse. I've spent a quarter of century pedalling eco-drivel to impressionable young minds, although predominantly over 16. It is amazing the government has let me get away with it. In fact most of the time I've been rigorously following what the government wants me to teach. What were they thinking?

⁶¹ Mitchell, D (2004) 'Cloud Atlas' Sceptre London. Sonmi 451 is a genetically engineered worker who challenges the over-aching fascistic corporate culture of a future time in what is currently known as South Korea.

⁶² Op cit

However James will be pleased to hear that I still draw deep from the Popperian well and constantly think: “What if I’m wrong?” The reality is that I am not entirely sure what is ‘right’. I remain innately suspicious of those who proclaim their certainties with unbending conviction, left and right, religious and non-religious.

However such reservations should be the springboard to more thought not a retreat from ideas.

The fundamental schism in thinking about climate change lies in the way that the economic life of society is organised locally, nationally and globally. And how it is organised is rooted in philosophical choices that we make about the very nature of life itself. We can inform our understanding of these choices by observation and experiment but essentially it is concerned with what it is to be human and to live on this planet.

At the heart of capitalism lies the idea of economic man (homo economicus). This abstract concept postulates that human rational behaviour is to maximise utility as an individual in all interactions – if in business to maximise profit; if in love to secure the best mate; if in education to get the highest test results. In the free market economic models all individuals have perfect knowledge of the market at all times which enables them to maximise utility, to get the best value. Capital therefore always moves to the point of highest yield or utility. It is simple stuff really and some believe this to be an objective, value-free science; economists mainly.

Often this thinking is expressed as innate laws, things that we are born to, not some tabular rasa on which culture and empathic values can be learnt. Humans, so the utility theorists argue, are competitive and individualistic with only the fittest thriving and even surviving. We are in it for ourselves. The unsuccessful, the poor are such because they have not worked hard enough, were not smart enough or simply were not born with the right stuff.

I do not come from this tradition. I come from a more empathic tradition where co-operative behaviour, altruism and a bio-consciousness are to be aspired to. It sounds rather grand and it is rather grand as at its heart are ideas of philosophy not simply economics.

Yet what if I am wrong and hyper competitive global capitalism is the default setting of society, that this is the end of history in terms of competing ideologies. If this is the case the rational models of climate change (if they can be attributed any currency) tell us that the scenario that we are most likely to follow is one of great, perhaps even cataclysmic change, the business as usual A1 IPCC scenario. There will be few, if any, winners.

What if the models are wrong and unbridled capitalism solves, via human inventiveness, any challenge thrown at us with a rational market response. Climate too hot, move to the off-worlds! Well if this happens I’ll get my grandchildren to eat my hat whilst James Delingpole’s progeny mock them. I doubt it will happen, probability is with me and the other purveyors of eco-drivel.

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