Newsletter #9

Monday 31 March 2008

Articles in this edition

After a long delay, welcome to Newsletter 9 from Carbon Commentary. My lame excuse for the long gap since the last one is that I am trying to finish a book entitled *Ten Technologies to Save the Planet* to be published in the UK by Profile Books in early autumn.

In this edition we look at recent trends in UK domestic electricity consumption, the adverse effect of the government's active support for nuclear on the prospects for offshore wind, BT's strange claims on the power consumption of its home phones, and the overblown promises of a company raising money to build ethanol-from-wheat refineries. Finally, we report on a presentation given by scientist Roy Spencer to a conference of climate change sceptics.

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Chris Goodall's book *How to Live a Low-Carbon Life* won the September 2007 Clarion prize for non-fiction.

Trends in UK domestic electricity use

In most countries electricity use is rising. The increase is gradual in developed areas, averaging only 1 or 2% a year. In the UK, the pattern was similar but recent years have tended to show declining growth rates, partly perhaps as a result of increasing prices.

One of the most interesting features of recent UK trends has been the flattening in electricity use in the home. This change is somewhat surprising. Improvements in home energy efficiency, through such things as the use of compact fluorescent light bulbs and high quality white goods, have usually been thought to have been outweighed by increases in the number and power use of consumer electronics. Large LCD TVs are, for example, much heavier electricity users than the old-fashioned TVs that they replace. Today's games consoles are much more powerful than ones of five years ago.

So the reasons are not clear, but monthly year-on-year growth in domestic consumption of electricity has fallen to below zero in the last year or so. Is this a temporary change brought about by the steep increases in prices over the period 2005-6, which will be unwound when people get habituated to higher costs? Or is this a real change in household behaviour?

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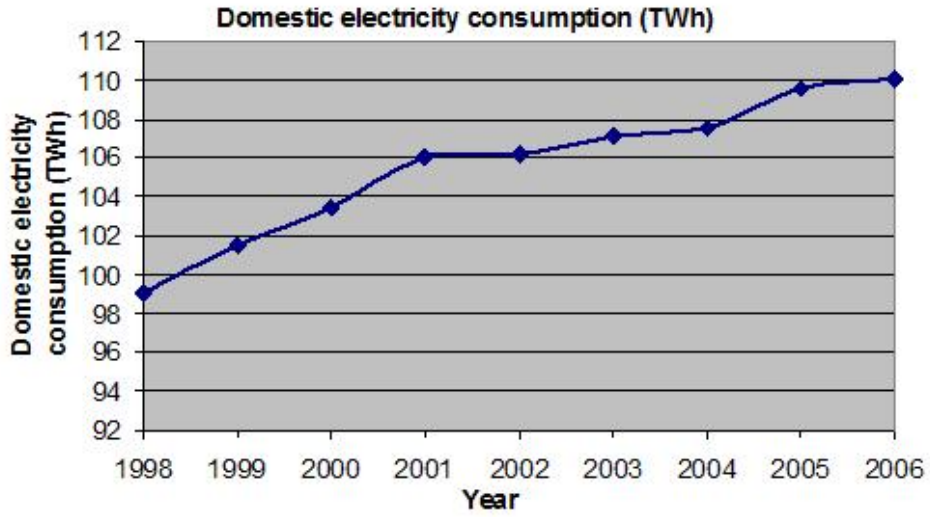
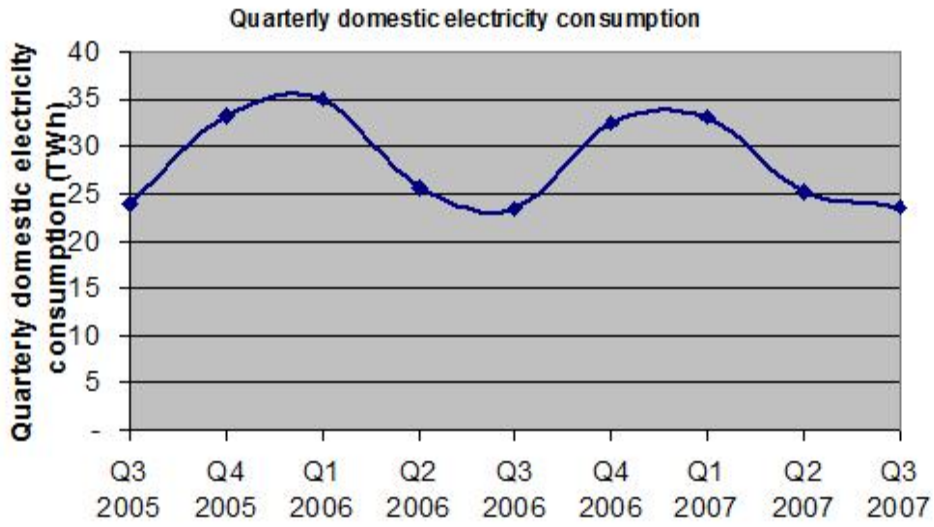
First of all, let's look at the trend over the past few years:



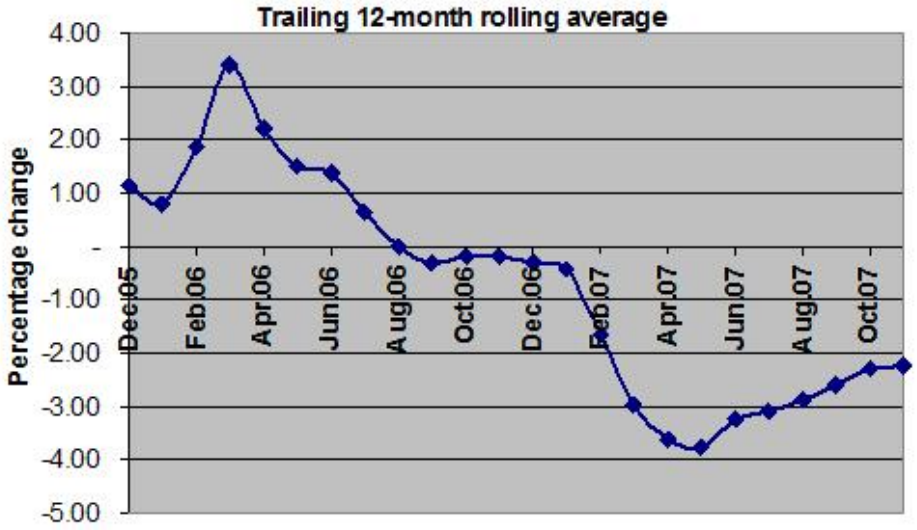
Electricity use rose from just over 98 TWh in 1998 to about 110 TWh in 2006, rising at an average of over 1.3% per annum. The last four years of this period saw a much slower rise of about 0.8% a year.

If we look at the quarterly data over the last two years, the slowdown is even clearer:[*]



There is a strong seasonal pattern in electricity sales to households. Winter consumption is much higher than summer. But almost all quarters are lower than the figure of a year before. Please note that some UK homes are heated by electricity and so overall winter consumption partly depends on temperatures. Summer consumption is an easier guide to long run trends. Summer 2007 was marginally higher than summer 2006 but lower than summer 2005. We can be fairly confident that the quarterly data shows consumption growth trailing off.

The position is even clearer when one looks at monthly year-on-year trends:



For over a year, rolling average home electricity consumption has been falling. Granted, since the middle of last summer the line has been creeping up towards the 0% level but the year to November 2007 was still over 2% lower than the previous year to November.

The evidence is strong that domestic electricity use is beginning to stabilise.

Why is this? Is it a response to the high prices of 2005-6? Did the slight fall in prices in 2007 cause the slight uptick in the second half of that year? It will be some time before we know, but this is one of the first indications that government energy efficiency policies are beginning to work.

Lower rates of growth in electricity consumption don't feed necessarily into reduced carbon emissions. It depends crucially on the fuel mix in the power stations. Coal has been the largest source of power over the last few years, but as many of the coal plants enter the period of restricted annual working hours, there is likely to be a slow switch back to gas. And most of the new capacity planned is gas turbines. This will be good for emissions.

Domestic use is 30% of all electricity consumption, and a higher fraction at times of peak demand. If the trend identified in this note is a real behaviour change, it will be good news both for carbon emissions and for those concerned about whether the UK will have enough peak capacity in the latter half of the next decade.

(All figures in this note are from the magisterial *Digest of UK Energy Statistics*, published by BERR, usually known as DUKES.)

Footnote

[*] Graph updated on Tuesday 17 February 2009 to correct an error with the scale of the y-axis. Thanks to Garth Higginbotham for drawing this to my attention.

More bad news for the poor

Two pieces of news from Tuesday 26 February. A UK investment fund is trying to raise £330m to build two large biofuels plants on the eastern coast of England. And the price of wheat rises to a new high of over $12 per US bushel in Minneapolis (over £220 per tonne) as worldwide shortages force prices ever upwards.

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These two news stories are intimately connected. The biofuels plants will use wheat as their feedstock. Valuable grains will be distilled to produce what is, in effect, industrial alcohol to be used to power the cars of the European Union. When constructed, the UK plants will use about 1.1m tonnes of wheat a year, about 7% of the UK's total production, helping to tighten food supplies yet further. This is madness, utter madness.

About 20% of the world's calorie intake comes from wheat. When wheat prices rise, the price of bread in UK supermarkets increases by a few pence. But in a poor country dependent on wheat, the headlong escalation of prices – which have doubled during the last two months – causes hunger. The UN's World Food Programme, which assists in the feeding of many millions around the world, is already talking of reducing the meagre rations and pushing people closer to starvation. Worried by the threat to the food supplies of their own people, some of the world's major wheat producing countries are introducing bans on grain exports.

This is unimportant to the investors in the new biofuels plants. They will get rates of return of 40% per year, largely driven by the subsidies the UK offers to biofuels. And whatever happens to the price of wheat, they know that they have a guaranteed market. EU legislation requires all motor fuels to contain 5% biofuels by 2010. Although the proposed new plants will take about 7% of the UK's wheat crop, the refineries will only provide less than 2% of our total need for fuel. So there is no prospect of the market being flooded.

Why did the EU introduce this policy (and why did the US do similarly)? The objective was to reduce carbon emissions from transport and, second, to improve the security of energy supplies. As environmentalists have been saying for five years now, the EU policy achieves neither of these objectives.

Biofuels made from wheat grown in the UK do not reduce global warming emissions by much. Even on the best wheat-lands, high yields are dependent on the application of 200kg of artificial fertiliser per hectare. This fertiliser takes huge amounts of natural gas to make. And when it breaks down in the field, it gives off a small amount of nitrous oxide, a far worse global warming gas than carbon dioxide. Recent research carried out by Paul Crutzen, a Nobel prize-winner, suggests that we have significantly under-estimated the amount of nitrous oxide arising from the use of artificial fertilisers. The process of growing wheat also uses copious amounts of energy in ploughing the fields, adding the pesticides and then drying the grain. Finally, when the wheat gets to the refinery, large amounts of heat are applied to break down the grains into sugars, from which alcohol is eventually distilled. Debate continues to rage on the impact of biofuels on carbon emissions, but no one doubts that UK wheat offers very limited savings over simply refining oil into petrol.

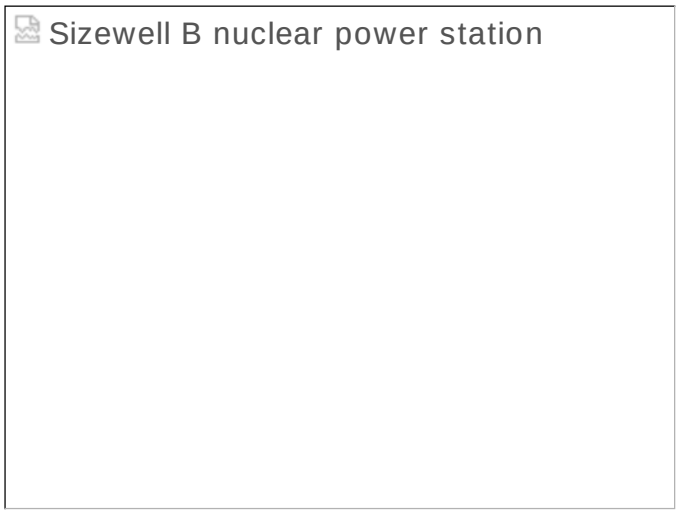
This doesn't deter the promoters of the new biofuel plants. They say that using UK wheat to make alcohol generates a '107%' reduction in greenhouse gas emissions, compared to petrol. This is a truly outrageous claim. In effect, they are saying that their plants will be carbon negative. Although it is conceivable that alcohol made from Brazilian sugar cane might achieve carbon neutrality, no sensible financier could possibly make this claim about a heavily fertilised UK crop. Even the owners of the only other large-scale wheat-into-petrol plant made a more modest claim of 40% savings when they announced their plans. When I spoke to the chief executive of another biofuels company a few months ago, he said that carbon savings could only ever be in the low single digits from using UK wheat.

What about energy security, the second justification for the legislative requirement to use biofuels? If we turned all our

farmlands over to biofuels, we would slightly reduce the oil import bill. But we would be entirely dependent on foreign sources of food. This strikes most people as a deeply unsettling policy.

But this is not the most important point. Using scarce food to make petrol is causing food shortages around the world. It isn't the SUV drivers that are paying the price – they will hardly notice. It is the very poorest who are suffering. And our capacity to increase the threat of starvation is almost infinite. Each of us uses about 2,000 calories of food a day. But UK drivers use the equivalent of 40,000 calories – twenty times more – to power our vehicles. If our deeply misguided policies let rich drivers compete for food supplies with the poor of Africa, we already know who is going to win. The EU biofuels policy is grossly immoral and must be abandoned.

Policy confusion on nuclear and wind



Sizewell B nuclear power station

In the past three months, John Hutton, the UK government minister in charge of industry, has publicly backed an expansion of both nuclear and of offshore wind. Is this good for the UK's climate targets? Possibly not.

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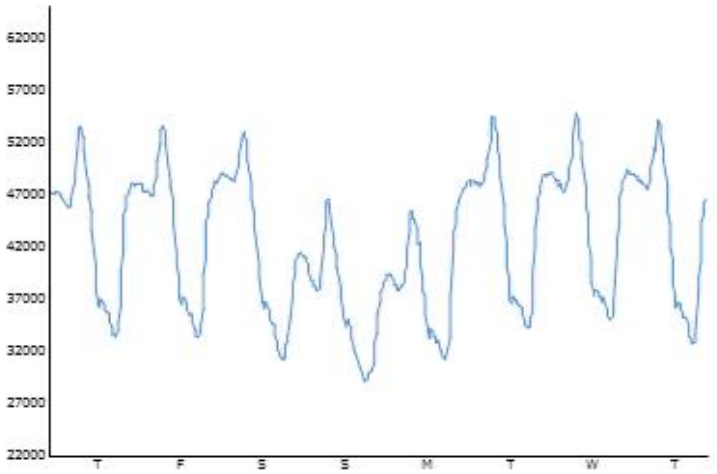
One issue never gets mentioned. Both wind and nuclear need to operate as many hours as they can. For offshore wind to make sense, operators need to be able to sell the power whenever the wind blows. Similarly, nuclear plants need to be 'baseload' and kept running day and night. Other plants, such as gas turbine generators can be turned on and off easily. The majority of their costs are fuel and it doesn't matter very much if they work for ten hours a day, or twenty. They are a good complement to wind, whereas nuclear is in direct competition.

So Hutton's support both for 32 gigawatts of wind and for a substantial increase in nuclear generation over and above today's level is inconsistent. In early mornings, total UK demand for electricity falls to well below 30 gigawatts. Here is the pattern over the last eight days:



During much of this time (early March 2008), winds have been blowing reasonably strongly over the whole of the UK. I

believe that offshore wind farms with a rated capacity of 32 gigawatts would have been producing outputs of 20-25 gigawatts much of the time. UK nuclear plants have a total generating capacity of about 10 gigawatts today, although some are out of service for maintenance. So if we simply replaced the ageing existing nuclear stations, we would have too much power for the early mornings without considering any other generating plants. And John Hutton says he wants much more than this.The implication of this is simply not understood. If we encourage large amounts of new nuclear capacity, we are likely to reduce the attraction of offshore wind to the point where it simply doesn't get built.

A large part of the problem is that the UK is effectively isolated from the Continent's power grid. In a rational world, we would be exporting the electricity from our vast resources of wind to central Europe. It's true we do have an interconnection to France and a trickle feed to Ireland, but the capacity of these links is negligible. If we are to get substantial amounts of offshore wind, we need a substantial new power cable around the coast that can collect offshore wind and then take it to where it is needed, in the UK or elsewhere.

Elsewhere in the world, power grids are being reinforced to enable long-distance shipment of energy. This is a vital part of the infrastructure for a world that will use larger and larger amounts of renewable energy. Renewables are often unreliable and almost always intermittent. So we need more connections and more transmission lines to guarantee that when the sun stops shining in Spain, the wind from Denmark provides the power in Madrid. And when neither source is available, we can take electricity from Norwegian hydro plants which can be turned on and off at five seconds' notice.

But nothing in this government's plans envisages any substantial upgrading of the UK grid, chunky connections to Europe or the establishment of any large Norwegian-style storage reservoirs for hydro capacity.

Last month the Crown Estate published a fabulously detailed and much admired report on the cost of bringing an offshore cable from the wind farms of Shetland and mainland Scotland to London and on to Europe. The cost is substantial, about £1.7bn, (or about the price of half a nuclear generating plant). Although the UK's liberalised electricity market provides incentives to build power stations, including nuclear, no one in the industry can see who could possibly build the east-coast offshore transmission line profitably. There is no similar incentive in place to build transmission infrastructure even though the long-term benefits to electricity consumers (and to our climate change problems) would be huge.

This is a huge and palpable flaw in the UK's electricity market structure. Everybody knows about it, everybody sees it as a problem but nobody can do anything about it without government intervention. But the mantra from John Hutton remains the same: the market will decide.

I think it is true to say that nowhere else in the world does the government assume that a rational portfolio of low-carbon electricity generating stations will evolve without intervention on transmission infrastructure. In this country, the core failing is not the much maligned Renewables Obligation but the inability of the heavily regulated transmission system operator (National Grid) to make substantial investments in upgrading power links and hydro-storage facilities without breaching its obligations to Ofgem. Let me put this as clearly as I can: National Grid would not get permission to build the east-coast link from Ofgem. Without this permission, it can have no guarantee of covering its costs. National Grid is a statutory monopolist, although privately owned. No one else can build large-scale transmission infrastructure in England and Wales. So the offshore power grid won't get built.

Unless we change this, pushing nuclear means we simply won't get much more offshore (or onshore) wind. What's possibly as important, we are also increasing the UK's vulnerability to power shortages in the second half of the next decade. There are many things we need to alter if we are to get real growth in renewable generation, but the crucial task is to invest heavily in transmission infrastructure now.

Energy efficiency of home phones

BT announced that it was bringing out a new range of home phones with much improved energy efficiency. The claim is that 'the new handsets boast power units designed specifically to consume around half the power of previous units'. BT said that almost all its extensive home phone range would contain the new energy-saving technology by mid-2008. Its press release gave very precise figures for the amount of CO2 saved – comparing the savings if all home phones incorporated the new technology to taking '57,000 cars off the road for a year'.

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Conventional DECT ('cordless') phones consume about 2 watts when the battery is charged and 3 watts when charging. The large number in UK homes, all on 24 hours a day, means that even these low power usage figures have a measurable impact on UK emissions. Very approximately, cordless phones in the home add about half a million tonnes a year to UK emissions, or about 0.1% of the national total.

A saving of half of this would be useful. I was also interested in knowing whether the techniques used by BT to gain the claimed 50% saving could be transferred to other consumer electronics. Before making its claims about a 50% energy saving, I assumed that BT had done proper testing of existing phones and had carefully measured the energy consumption of new devices.

I was wrong. Here is the full text of an email interchange between a PR person at BT and me:

> Dear XXXX
>
> Thank you for this. (this refers to the BT newsletter announcing the new phones). Would it be possible to find out the expected electricity consumption, in use and on standby of the new range of DECT phones compared to the models you used as the base case? Apologies for the slightly nerdy question, but I am very interested to see how much electricity consumption you have been able to drive out of the devices.
>
> Many thanks for any help
>
> Chris Goodall
>
> ****
>
> Hi Chris
>
> I have been in contact with my colleague and have been informed that the information you require is not available at the moment. The information is currently being worked out and as soon as it becomes available we will be able to update you.

I am sorry we are unable to assist on this occasion but please do not hesitate to contact us for any other enquiry.

Regards XXXX

So BT made very precise statements to the press and to industry analysts that were simply not backed up by the facts. It made extravagant claims about efficiency gains before it had bothered to do the research to check its assertions.

If BT had made similar statements about financial matters, it would have had a legal obligation to ensure basic truthfulness. It doesn't appear to believe it should extend this rule to boasts about its performance as a good corporate citizen.

BT's behaviour has something of a disappointing pattern. I made similar inquiries in October last year, asking about BT's announced plans to install wind turbines at some of its exchanges. In particular, I asked whether the company had checked to ensure that transmission capacity would be available from the local electricity distribution company. Since the sites were in remote areas with weak transmission infrastructure, this is a key question to ask. Eventually, after several rounds of correspondence, it appeared that no investigation of this issue had actually taken place.

BT uses a large amount of the UK's electricity. Quite reasonably, it is therefore trying to position itself as a leader on climate change issues. But it is acting irresponsibly in making green claims that are not backed up by reasonable evidence.

Roy Spencer presentation to the Heartland Institute conference

The Heartland Institute, a US free-market think tank, held a conference on climate change in New York in early March. It was a forum for some of the climate change sceptics to discuss their research. The conference got very little coverage in the media and was ignored by the science pages of the newspapers.

This seems a mistake. A large section of the population of the US and the UK, and smaller numbers elsewhere, believe that the apparent scientific consensus on global warming is a result of selective coverage by TV and press. The failure to cover presentations by some of the leading sceptics is support for the accusation that global media, and mainstream climate scientists, are refusing to engage with the dissenting views of reputable scientists who do not share the standard view.

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Roy Spencer is one such scientist. He has good scientific credentials and his sceptical book on climate change is selling extremely well in the US. The main theme of his presentation was that climate sensitivity to increases in CO2 is much less than conventionally thought. He doesn't deny the human sources of climate change; he suggests that the standard models exaggerate the impact of greater amounts of CO2 in the atmosphere because they fail to comprehend the true impact of changes in cloud cover. In summary, he says that changes in cloud cover may damp temperature changes resulting from CO2 increases, rather than exaggerate them.

The scientific consensus is that doubling the amount of CO2 and other GHGs in the atmosphere will, if all other things remain equal, increase temperatures by about 1.2 degrees Celsius. In the standard models, this increase is multiplied by two or three because of the effects of changes in cloud cover. These reinforcing effects are usually called 'positive feedbacks'. Other positive feedbacks include higher temperatures decreasing the amount of ice cover, causing less light radiation to be re-emitted to space.

Why is it generally thought by climate modellers that changes in cloud cover will amplify the effect of the CO2 increase? There are two forces at work:

- High-level cirrus clouds act as a blanket around the earth, trapping heat. A generally hotter atmosphere is generally assumed to increase the amount of cirrus cover.
- Low-level clouds reflect the sun's light back into space tending to decrease temperatures. Global warming is usually thought to result in decreased low cloud cover, amplifying the effect of warming.

Sir John Houghton's standard undergraduate textbook on global warming says that 'climate is very sensitive to possible changes in cloud cover or structure'. In other words, if the standard models are even slightly wrong about the nature of the relationship between clouds and warming, changes in cloud cover may amplify or repress the temperature variations induced by greenhouse gas increases.

Scientists often talk about the global warming impact of greenhouse gases in terms of watts (which can be thought of as a unit of heat) per square metre. This measure is usually called 'radiative forcing'. The IPCC analysis suggests that the man-made greenhouse gases will increase the radiative forcing by about 4-5 watts per square metre by 2050. Houghton's book says that forcing by clouds is typically a many times multiple of this. It varies by latitude and by time of year. But the crucial point is that clouds matter a great deal.

As I've said, the standard view is that clouds amplify the impact of global warming induced by CO2. Houghton says that there is 'encouraging agreement' between this hypothesis and actual observations of cloud behaviour. Roy Spencer's presentation asked us to consider two pieces of work from his team that tend to contradict this view:

- A 2007 paper that suggested that tropical rainstorms result in only short-term increases in high-level cirrus clouds that dissipate quickly. (Cirrus acts as a blanket.) Spencer used temperature and other readings collected by satellite.
- A paper waiting for publication that says that the theory that higher temperatures reduce low cloud cover is inadequate. (Low clouds tend to reflect sunlight back into space.) He says that the causality may be different. Perhaps lower levels of cloud cover result in higher surface temperatures, a phenomenon that we might all instinctively recognise? He claims that previous measurements have simply assumed a causality that sees higher temperatures reducing the coverage of low clouds. He says we haven't done the measurements properly to ascertain which comes first, higher temperatures or lower cloud cover.

What if Spencer is right? His work suggests that a doubling of CO2 levels from pre-industrial levels – which will occur some time around 2075 if today's rate of increase persists – will not result in temperatures three or four degrees above pre-industrial levels, as pessimists fear, but perhaps about one degree.

We have already seen about 0.7 degrees, with greater increases in high latitudes. So his theory implies strong negative feedback from now on. As Roy Spencer said in his presentation, the world is engaged in a huge experiment to determine the true sensitivity of climate to changing greenhouse gas levels. His view on the outcome of that experiment is strikingly different to the world's academic consensus and it would be good to have a rebuttal from those who disagree with him.

Note
Dr Spencer was one of the scientists who reported some years ago that the troposphere was not warming. His research findings were undermined by further analysis of the data that his team had collected. Almost all scientists now believe that the degree of tropospheric temperature change is broadly compatible with the standard model of global warming.

Companies mentioned in this newsletter: BT.