Carbon Commentary Newsletter #3

A critical appraisal of issues in the move to a low-carbon economy

Monday 15 October 2007

This is the third edition of Climate Commentary, a newsletter that provides informed opinion on climate change, business and society. This fortnight's edition covers topics as diverse as Bjørn Lomborg's new book, BT's energy efficient data centres, and the fiercely argued issues of the Severn barrage and biofuels. I look at the government's main environmental proposals in the Pre-Budget review, saying that Air Passenger Duty will probably remain in its current form. In an article on the problems that the Advertising Standards Authority faces in holding back the tide of half-true green advertising, I confess to complaining about Ford advertising of its Flexi-Fuel cars, only to get hopelessly bogged down in science I barely understand.

As usual, any comments and criticisms are most welcome. Until the end of the year, this newsletter will be free. Please circulate this edition to anybody you think might be interested.

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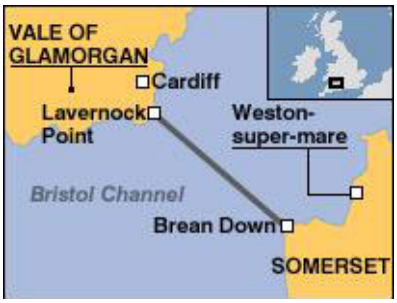
Chris Goodall's book *How to Live a Low-Carbon Life* won the September 2007 Clarion prize for non-fiction.

Articles in this edition

The Severn barrage

Nobody expects a Severn barrage to be built soon. But government opinion appears to be swinging in favour of the idea. The independent Sustainable Development Commission has just brought out a report that broadly supports a barrage. Though the environmental costs will be high, it says that mitigation measures will counterbalance some of the damage.



We now also have a better feel for the economics of the scheme or, more correctly, for both of the two main options for blocking the Severn. The bigger scheme blocks the estuary between Cardiff and Weston-super-Mare. It will cost about £15bn and deliver just under 5% of the UK's electricity. The smaller – just downstream of the Severn bridges – will cost a tenth as much, or £1.5bn, but will provide a sixth as much power as the bigger project.

£15bn to build a barrage that decarbonises less than 5% of the UK's electricity supply is a high price to pay. Scaled up to the whole of the electricity business, this is about 20% of one year's GNP to replace coal and gas power stations. Even over twenty years, this cost is similar to Stern's estimate of the cost of reducing the UK's emissions for the economy as a whole. The smaller barrier delivers much less electricity, but at a capital cost per kWh of little more

than half its larger cousin.

The Sustainable Development Commission acknowledges that private financiers are unlikely to put up the cash for the bigger scheme. The report doesn't really discuss the viability of the smaller barrage but it is much more financially attractive. In terms of total capital cost and expected yearly output, the upstream barrage is very similar to the huge wind farm development called the London Array. The Array will be constructed with private capital. I believe that if the current renewable electricity support scheme remains in place a barrage across the upper Severn can be built with risk capital.

The Sustainable Development Commission thinks that the bigger scheme should be built with public funds. I am not convinced by this. The offshore wind resources around the UK are orders of magnitude greater than the useful energy of Severn tides. If the larger Severn barrage has construction costs of nearly twice the typical figures for offshore wind, wouldn't it be better simply to speed up the licensing of wind farms?

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The schemes

The Sustainable Development Commission (SDC) looked at tidal energy around the UK. It assessed whether tidal energy could fill a substantial fraction of UK energy need. The report shows that the Severn contains a very large fraction of all 'tidal range' energy, and the Pentland Firth between north-east Scotland and the Orkneys had much of the usable 'tidal stream' power

How does a tidal range power plant work? A barrage that generates electricity from the tidal range will let the rising tide in without impediment. As the tide turns, the barrage will start to trap water. As the tide drops outside the barrage, and as the river water is held behind the barrage, a gradient develops. Some time after the tide has turned, the water is allowed to flow through turbines in the barrage. A tidal range barrage is essentially a hydro-electric power station working for about half the day.

Tidal energy is reliable. The output from a tidal barrage can be predicted with high accuracy for decades ahead. Nevertheless, tidal energy is intermittent. Before and just after a high tide the barrage will generate no electricity. It cannot completely replace a coal or gas power station for 'baseload' electricity.

Tides vary in size very substantially during the monthly lunar cycle. The monthly highest tides ('spring' or 'flood' tides) in the Severn have a range several times greater than the smallest 'neap' tides. The electricity that can be generated is a function of the range of the tide and so varies considerably from week to week as well as during the course of each tide. In addition, all tides are highest at around the spring and autumn equinoxes.

I didn't know this before I read the SDC report, but spring tides occur at the same time of day at any given location. So we know that the larger barrage will always produce the most electricity at between 1 and 3 in the afternoon and 1 and 3 at night. The smaller barrage will peak an hour or so later. UK electricity use is at its highest in the early evening at around 6.30pm, meaning that a lower Severn barrage is only moderately useful as a source of replacement power. The upper Severn is substantially better.

The environmental issues

1. Intertidal land: the huge tidal range of the Severn, which is as large as anywhere in the world outside Newfoundland, means that substantial areas of land are under water part of the time and exposed at others. These 'intertidal' areas are not particularly productive in terms of biological diversity but support a range of important bird species.

   Any tidal barrage will reduce the range of the daily tides. A large fraction of the land that is currently intertidal will either always be under water, or always dry. The ecology will therefore change. The SDC report talks of replacing some of the lost intertidal land with new land outside the barrage. The costings for this are incomplete and the likelihood of success is unknown. The intertidal range has substantial international protection but the Commission seems to believe that ways could be found to accommodate concerns.

   Much of the intertidal land is behind both barrages. The smaller scheme does not really avoid any of the environmental problems associated with the loss of tidal range.

2. Fish: both barrages block rivers that contain large numbers of fish. Most fish going through a turbine at the barrage would be filleted. The SDC says that mortality will be extremely high, possibly resulting in a complete loss of certain species. (Friends of the Earth is more optimistic, seeing a 6% death rate.) The bigger barrage blocks the Usk and the Wye, the smaller just the Wye. The smaller barrage is likely to be less destructive than the bigger, but both are bad. The Severn is the principal source of the sea bass stocks of the Irish Sea and other species such as eels need the mixture of salt and fresh water for their breeding cycles.
3. The river will be less muddy: sediment will be deposited rather than being stirred up by the fierce tides. By

increasing the amount of light in the water, the growth of plant and plankton will be encouraged. This may or not be a good thing, but the decreased turbidity of the water will represent a major change.

4. Wave energy will be decreased: there is little commentary of the effect of this in the SDC report.

Environmental organisations have reacted with horror to the SDC's work. The Friends of the Earth criticised the SDC for its support for the larger barrage despite its environmental effects, particularly on birdlife. The vital Slimbridge bird reserve would be behind both the bigger and smaller barrages. FoE also notes the extremely high cost of the main barrage in terms of capital expenditure per unit of electricity delivered.

The alternative plan: lagoons

Environmentalists pushed the SDC to give more support to the idea of tidal lagoons. These lagoons would be roughly circular in shape, just off the coast. They would trap water in the incoming tide and gradually let it out through turbines. Lagoons would not change the tidal range of the river and they could be constructed to avoid damaging most of the most sensitive intertidal areas. They would also leave the flow of the river largely untouched, cause fewer fish deaths and maintain wave heights. They would also probably leave the magnificent Severn tidal Bore largely unaffected.

Friends of the Earth argues that lagoons would create their electricity more cheaply than the larger barrage.

The SDC report is straightforwardly unimpressed by the arguments proposed in favour of lagoons. It points to the lack of detailed cost estimates and says that while barrage technology is well understood, lagoons are an almost completely new idea. The Commission is rather impatient in dismissing the claims of lagoon fans by pointing to the lack of any evidence that they can be built cost-effectively.

Like the Severn barrage, outline schemes for lagoons have been floating around for decades. A developer, Tidal Electric Ltd, is offering a plan to put a lagoon in Swansea Bay, westward from the proposed Severn barrages. The lowish cost estimates make the project seem interesting but I could find no external data to support the company's optimism.

One possible option for going forward would be to combine the smaller upstream barrage with one or more lagoons to the seaward side. Friends of the Earth thinks that this idea is well worth investigating further.

The barrage options: a brief financial appraisal

The only weak point in the impressively thorough SDC report is the quality of its financial appraisal. Its preferred tool for evaluation and comparison is a slightly cumbersome one: the cost per kWh at various discount rates. As far as I can tell, this is the way the calculation is done.

- The project has a capital cost, spread over about 6 years (or slightly less in the case of the smaller barrage).
- It will produce an estimated quantity of electricity per year for over 100 years.
- The amount of electricity generated in each year is discounted by a discount rate, much as in conventional financial analysis except that we are using kWh as the currency. With a discount rate, electricity made in year 10 is discounted slightly more than the electricity from year 9.
- The total discounted total of kWh is divided into the capital cost, creating a cost per kWh.
- I presume that yearly operating costs would then be added to provide an estimate of the cost of each kWh.

Pence per kWh of expected output

Discount rate	2%	3.5%	8%	10%
Lower Severn (Cardiff-Weston)	2.31	3.68	9.24	12.31
Upper Severn ('Shoots')	2.58	3.62	7.52	9.54

This is not a proper financial analysis. All these numbers enable us to do is compare the cost of generating electricity in Severn barrages with other technologies. Most alternatives will be in the 3 to 4p range. The current wholesale price of electricity is about 4.5p.

At first sight these numbers suggest that a Severn barrage, even the smaller one, would only be able to compete with existing technologies if it were able to raise money at 3.5% or below. Currently, of course, this would be impossible. Rather abruptly, the SDC therefore concludes that the barrage should be financed by public, not private money.

I think the argument is somewhat different. The economics of the small barrier are very similar to a large offshore wind farm, such as the London Array, a scheme for several hundred turbines off the north Kent coast. This proposal now has planning permission and appears to be fully financed. In my view, the smaller Severn barrage could attract

financing on similar commercial terms. The financing of the barrage would require confidence that the payments under the Renewable Obligation would continue, but this is as much a risk for the London Array as it is for the upper Severn barrage.

The huge Severn barrage should be looked at differently. It only makes sense to build this structure if we are short of any other projects that could provide large amounts of renewable energy. The UK is not. We have offshore wind resources of at least 50 times the tidal energy present in the Severn. (Since the tidal power of the Severn is several times the level in any other estuary, this conclusion would not be changed if we included all the available tidal range power.)

In sum, therefore, there is no reason to support the large Severn barrage. It is an expensive distraction from the task of getting offshore wind farms all around the coast of the UK. The power of the lower Severn brings us very little we cannot get much more cheaply from the upper Severn and the grossly under-used power of offshore wind.

Bjørn Lomborg's new book *Cool It*

Bjørn Lomborg, a professor at Copenhagen Business School, is the most formidable critic of those who think that cutting climate-changing gases is the most important problem the world faces. He made his name with 'The Skeptical Environmentalist' and his new book continues his drive to get the world to see global warming as just one of the world's important problems.

Lomborg believes climate change is happening, and that mankind's activities are responsible. But he tells that we shouldn't do much about global warming because the costs are very high and the benefits are limited and far-off. Like most books written by partisans in this impassioned debate, much of what he says can be questioned.

Nevertheless, this is an extremely valuable polemic: it stresses repeatedly that taking action to stop climate change may have very high short-term costs. If by clumsy attempts to hold down emissions we stunt the prospects for global economic growth, we may do more harm to the world's poor than would be inflicted by climate change. It needs to be said time and time again that disease and malnutrition are killing far more people today than climate change. We are making progress diminishing the impact of these scourges. Despite what you sometimes read in the newspapers, world food supply and life expectancy are improving. Panic-stricken action on climate change must not be allowed to halt this progress. We need a rational assessment of whether it is best to spend money on slowing climate change or to whether we would achieve better effects from focusing resources elsewhere.

Bjørn Lomborg is an able debater with a passionate interest in his subject. But he overstates his case, focuses on only parts of the issue and avoids any discussion of a possible future acceleration of global warming. Even with these weaknesses *Cool It* needs to be part of the continuing debate on how to respond to the climate threat without crippling the poorest economies of the world.

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To an economist, the climate change issue can be reduced to a single question. Do the benefits of grappling with global warming exceed the likely costs? Cutting emissions growth may be expensive and if the benefits are small and a long way off, it simply may not be worth doing much about climate change. The global economy is growing rapidly and large numbers of people are being propelled out of deep poverty every year. The strains of this growth are showing in many ways – water shortages, desertification, deforestation, overuse of agricultural land, and climate change – but, nevertheless, a smaller percentage of the world's population goes to bed hungry than at any time in recorded history.

We face extremely serious ecological problems but careless action to protect the planet risks causing huge harm to the world's poor. It is an uncomfortable question for greens to answer, but why should the impoverished of today bear the price of halting global warming when the next generation will be much wealthier, and far better able to manage the effects of climate change?

The Lomborg argument
Lomborg's logic is as follows:

- The cost of greenhouse gas pollution is very low.
- Controlling emissions growth so that it is substantially below the level that would otherwise occur is extremely expensive.

- If we spend money in order to temper emissions growth, then we cannot spend it on other worthwhile things, such as public health programmes in the third world. Also, if Kyoto-style agreements reduce the rate of world GNP growth, then we will be slowing the climb out of poverty.

The cost of pollution is low

Lomborg says that the cost of CO2 emissions is very low and gives a figure of $2 a tonne. Put another way, every tonne of global warming gases emitted to the atmosphere causes about $2 of damage. His figure suggests that the world's total 2007 emissions have a cost of about $65bn. Very approximately, this is about 0.1% of global income. For the UK, its 600m tonnes or so of greenhouse gas pollutants have what economists call 'external' costs of about £10 per head, or even less than 0.1% of GNP.

But as a comparison, the cost of Katrina was almost certainly well above $150bn. So if Lomborg's figure is right, the total damage caused by greenhouse gases around the world is less than one very severe extra hurricane every two and a half years. Or look at it in the UK context: the July 2007 floods cost perhaps £2bn, or over three times the 2007 damage figure for the UK's CO2 output according to Lomborg's formula. Many will find the figure of $2 per tonne deeply implausible.

Lomborg hasn't arrived at this figure in a very scientific way. He asked a climate economist for his best guess, and based his entire book on this one figure. (Readers of the book will find this episode described on page 36 of the UK edition.) Many estimates are much higher. William Nordhaus of Yale, who has claimed to be the best respected economist working on the issue, suggests in a recent paper that the right tax to impose in 2007 on carbon emissions is about four times as much, rising sharply to about $55 per tonne of CO2 at the end of the century.

By the way, Nordhaus is not saying that $8 is the amount of damage that a tonne of CO2 causes; this number would be much bigger. Being an economist, he stresses that taxing the full cost of pollution would reduce the value of economic activity more than the benefit in reduced climate change. Nordhaus's 'optimal tax' still sees huge damage from climate change. It's just that it isn't worth trying to stop it. Nordhaus's work doesn't hit the headlines, but it is considerably more rigorous than Lomborg's writing.

Much of Lomborg's new book is given over to showing that the $2 figure is reasonable. He examines the following topics in detail:

- a) Heat-related deaths
- b) Hurricanes
- c) Tornadoes
- d) The Gulf Stream
- e) Sea-level rise and glacial melt
- f) Malaria
- g) Agricultural productivity

- a) Heat-related deaths: Lomborg's main thesis is that human beings are physiologically adaptable to higher temperatures. His evidence is largely derived from various European studies that show that in northern lands, higher than expected levels of mortality are associated with relatively low peaks in summer temperatures. In hot countries, 'excess mortality' only begins to rise at much higher temperatures. In northern Finland, for example, the death rate starts to rise when temperatures exceed a daily average of 15 degrees Celsius, compared to over 24 degrees in Athens. From this he concludes that we will not be killed by higher temperatures, we will get used to them.

  This is probably correct in high latitudes. But Lomborg makes little attempt to assess the position in countries with higher existing temperatures, such as those in most of Africa and some parts of Asia. He also stresses that many heat-related deaths can be avoided by good air-conditioning. This may seem a somewhat tactless line of argument to the 25% of the world's population without access to electricity.

  Lomborg does not weigh in the scales the impact of human comfort or the particularly severe impact of increased temperatures on those obliged to work outdoors.

  His conclusions are far too strong. Nevertheless we should all bear in mind that deaths in higher latitudes from winter cold are currently far greater than those from excess heat in summer. Climate change is cutting deaths in Scotland at the moment, not increasing them, and this will be true for several decades yet. As with many things, there is a considerable germ of truth in Lomborg's polemic.

- b) Hurricanes: Lomborg seeks to show that hurricanes aren't getting any more severe. He says that we take more notice of them because their economic effect is greater than in the past, but that once we adjust for the lower value of the stock of buildings in the first part of the last century, two hurricanes caused more damage than Katrina – Galveston in 1900 and Miami in 1926.

This is one of these many occasions when Lomborg destroys the strength of his comment by careless use of sources. He compares some carefully estimated costs of the Galveston and Miami storms with a guess made about Katrina in its immediate aftermath. More recent figures for the cost of Katrina are far higher. The Katrina-related expenditures of the Federal Budget alone are greater than Lomborg's entire estimate. And when I checked his reference for the cost of the Miami 1926 hurricane, I found he had mistranscribed the figure. His number is substantially higher than is actually contained in the source he used.

More importantly, Lomborg does not properly address the real question, which is whether the warming of the Gulf of Mexico seas is likely to produce increases in the frequency or severity of hurricanes. He has simply gone for the easiest analysis – the economic damage to the US. He makes no substantial reference to the far more severe impact of hurricanes on poorer states around the rim of the Gulf. And when he does, he simply says that if these countries were richer they would be able to afford better protection. He doesn't choose to discuss the fact that single hurricanes can delay development in a poor country by decades. The impact of Hurricane Mitch on Honduras in 1998 is a good example. The country has not yet fully recovered and if hurricane intensity is increasing, this will probably outweigh all progress in development. This is one of the reasons why aid agencies are increasingly passionate about climate change, suggesting it is already overwhelming the benign forces of economic growth, better food availability and improving health.

- c) Tornadoes: Lomborg says that US tornadoes are not increasing in severity or frequency. He may well be right, though 2007 has seen the first category 5 tornado for several years. The strange thing is that few climate scientists ever expected tornadoes to increase in intensity in the US. They are associated with thunderstorms and if the central US is getting drier, which is a probable feature of global warming, we can expect fewer of them. It may be more important that Canada saw its first ever category 5 tornado this year, not inconsistent with climate scientists noting the general northern drift of typical weather events in the North American continent.
- d) The Gulf Stream: we sometimes see frightening stories that suggest a complete shutting down of the Gulf Stream. Lomborg correctly points out that few scientists think that this is likely, even if Greenland melts entirely. But in attacking the news media for only running frightening stories on this issue, and not carrying the more moderate views of most scientists, he ignores the importance of even a marginally slowing Gulf Stream on reducing the amount of heat transported out of the southern Atlantic and Gulf of Mexico. The Gulf Stream carries huge volumes of energy out of the hurricane generating zone and across to temperate northern Europe. It is at least worth discussing whether Lomborg's confidence in his hurricane predictions would be as great if the great ocean conveyor belt slowed.
- e) Sea-level rise: here Lomborg is at his most controversial. He focuses on just one IPCC number for the mean expected rise in sea level this century. All his analysis uses this figure. He ignores the fact that the IPCC states that this number does not fully include the impact of faster than expected glacial melt. The IPCC knows that the faster ice loss is happening; it just cannot yet be confident about its speed. So it omits any figure at all. Lomborg does not mention this.

  He goes on to show that rather than cut emissions the world may well benefit from paying low-lying states to improve their flood protection. To do this, he has conveniently invented a new world order and an institution with the authority to invest in Bangladesh flood protection. In a world that cannot even agree on sharing the Kyoto burden, this seems a piece of sunny optimism and little more.

- f) Malaria: some scientists say that malarial range will increase as a result of climate change. Lomborg says that we simply need to invest in prevention because it will be more productive. Of course he is right. Malaria is largely preventable. He has a sharp point: malaria nets or careful use of DDT would do far more good for the tropical poor than a hundred Kyotos. But he is wrong to focus so much on malaria. Increasing temperatures may well cause a substantial rise in a large number of tropical diseases, and these will affect both rich and poor. Malaria is totemic: a spread into Europe would seem like a flow of the disorder of Africa into the calm of prosperous democracies. This is why the rich countries are frightened and Lomborg is correct to point this out. However, it is not the only insect-borne disease and we can reasonably expect climate change to bring other dreadful tropical illnesses into the temperate zone. This is not mentioned.
- g) Agricultural productivity. In northern Europe, greater fertilisation from increased CO2 and from higher temperatures will generally increase agricultural productivity for some decades (though a Scottish agromonist I spoke to last week disputed my simplistic conclusion). But elsewhere in the world the pattern is different. Lomborg compiles evidence to show that food production will only be marginally impacted for some years to come. This is a complex subject and there is substantial support for the view that the current growth in food production will not be much affected by climate change. But this broadly optimisitic view is difficult to reconcile with the current declines in cereal production because of drought in countries such as Australia. Once again, this is ignored, perhaps in the interests of simplifying the story.

In all of these discussions, Lomborg allows very little doubt about the conclusion he reaches. He has complete faith that the temperature increase this century is going to be no more than 2.4 degrees. He assumes that the scientists

he approves of are correct in their optimism. He has almost unquestioning faith that the climate system is fully understood by climatologists – a claim that none of them would make in a hundred years.

As I said above, he has looked at seven impacts from global warming in detail. On several, he makes some very good points about unwarranted hysteria. On others he is much less persuasive, omitting most science or not properly dealing with the full issue.

What has he missed out? He doesn't cover the following issues in any substantive way:

- a) Changing world weather patterns: nowhere does Lomborg look at the cost of drought, flood and heatwaves outside the richest parts of the world. Where is the analysis of desert growth? On this topic he should have read and extensively quoted Mark Lynas's book *Six Degrees*, published six months before his own. Lynas looks, for example, at the impact of small changes in temperature and precipitation on parts of the US Great Plains, showing how vulnerable they are to desertification. Lomborg couldn't be expected to include this fact, but 2007 is almost certainly the worst year in modern history for weather-related disasters around the world, of which the terrible West African floods are the most ignored example. Lomborg's work is far too biased towards discussing the relatively benign impact of climate change on northern Europe.
- b) Forest die-back: compared even to Lomborg's complacency on the melting of Greenland's glaciers, his treatment of the Amazon is surprising. The rainforest isn't even mentioned. But if there is one thing we know for certain, a drier, hotter Amazon basin is potentially catastrophic for the globe. If the Amazon turns into savannah, as is perfectly possible, we will see changed air circulation patterns across large parts of the world. If temperatures do rise 2 degrees above 20th-century levels, we should be deeply worried that this will happen.
- c) Methane: as with the Amazon, the word methane is not mentioned in the book's index and I do not believe it actually occurs in the text. Any 228-page general discussion of global warming that does not mention methane eruptions from tundra and deep oceans is simply not covering the topic properly. Like Amazon rainforest death, methane eruptions could change the climate significantly within a matter of years. (Methane is a far worse greenhouse gas than CO2.) It has to be seen as a risk but Lomborg doe not include any analysis of the possible catastrophe arising from increased methane emissions from land and sea.
- d) Biodiversity: nowhere is it mentioned that climate change is going to cause a rapid mass extinction. Some people don't care. Others mind enormously. Lomborg should have recognised that species loss is a side effect of global warming, though not one conventionally captured by the calculations of economists.

In summary, Lomborg's figure of $2 per tonne of CO2 seems frighteningly low. By focusing on the smaller direct impacts on the rich worlds of Europe and North America, he has made climate change seem a managerial problem that the world can easily deal with. Very few people share his optimism. A book that doesn't even consider the possibility of runaway climate change should not attract as much attention as Lomborg's text.

The costs of cutting emissions

Lomborg says that complying with Kyoto has huge costs and will only cut emissions by a few percent. Importantly, he repeatedly shows that Kyoto will simply delay warming by a few months or years. Kyoto, with all its inefficiencies and inequities, is an easy target, but the political world saw it as a first step towards long-term restraint on emissions. Lomborg portrays it as an expensive and half-baked final step in emissions control.

He has a point. World emissions growth is still rapid. Countries like the UK that preach climate virtue have not succeeded in stopping growth in emissions. If Kyoto was as costly as he says (about 10 times the damage caused by greenhouse gases) the treaty would look a very bad bargain.

When Lomborg was assessing the value of the damage caused by CO2, he went for a low figure that few agree with. It is the same with the countervailing cost of emissions control. He has taken some high numbers and has repeated them many times in his book. Mere repetition doesn't make them any more persuasive. Nowhere does he suggest that one of the many strengths of modern capitalism is its phenomenal ability to adapt and change. Make carbon expensive and business will rapidly find ways of emitting less, and at less cost than we might first think. Environmental legislation in the past has almost always been far less costly than business has claimed.

In Lomborg's view, people need to look at the respective costs and benefits of emissions control. When they do so, they will see that climate change is too expensive to stop. But, interestingly, Lomborg does not go on to say that we should simply ignore global warming even though this would be the logical corollary of his stance. No, he actually suggests that governments should engage in large amounts of public sector R+D to find lower carbon ways of keeping the economy going.

Somehow I get the impression that Bjørn Lomborg recognises that future climate change may be terrifying and uncontrollable. His book may suggest that we can ignore climate change, but some part of Lomborg's mind sees the dangers from complacency.

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An appendix on Lomborg's research methods

Like most effective polemicists, Lomborg creates a simple argument that supports a point of view. Scientists writing about climate change tend to hedge their conclusions with caution. Indeed the IPCC ascribes probability levels to its main conclusions. Bjørn Lomborg scorns such tentativeness. He turns the IPCC's most carefully written sentences into unambiguous certainties. He uses huge volumes of evidence, but much of it is sourced from a small number of scientists and economists. He does not choose to reflect the diversity and uncertainty of the views of experts.

This is understandable: Lomborg wants to communicate with a general audience intolerant of ambiguity. And most people writing on climate change are guilty of commenting only on sources that they broadly agree with.

What is not forgivable is the laxity of Lomborg's methods for assembling this book. He breaches the standard conventions of academic work. For example, I have noticed instances when he takes whole sentences and large parts of paragraphs from other people's work and has pasted them into his text. (He provides a reference to an endnote, but hasn't told us that he is directly quoting other people's research.) According to Oxford University's code on discipline, this is plagiarism and could be the subject of a disciplinary inquiry in an undergraduate essay. I have only checked a very small fraction of his references, but I have also seen two important instances of him adjusting a research finding to make it slightly more compatible with his own conclusions. Bjørn Lomborg doesn't need to do this and it really weakens what is otherwise an extremely worthwhile but deeply mistaken book.

The Treasury's Pre-Budget review

The Pre-Budget review in early October disappointed green activists. Environmental measures formed a small fraction of the government's initiatives. It doesn't look as though Alistair Darling sees climate change as one of the priorities of this administration. But there were two important commitments: a revision to Air Passenger Duty (APD) and (via BERR) a competition to run a commercial-scale carbon capture project.

The APD proposal attracted most attention. The government intends to change the duty so that it is levied on aircraft movements and not on individual travellers. Commentators, and the two main opposition parties, have long suggested that this would be a sensible change. Carbon Commentary disagrees. The proposed revision cannot be implemented without infringing international treaties on the taxation of air travel. The chancellor's proposed consultation will eventually conclude that APD should remain substantially as it is now.

In the article, we briefly analyse the effects of APD and also show that the duty imposes an effective tax on airlines that is greater than would be levied if air travel were fully included in the European Emissions Trading Scheme (ETS).

The BERR Carbon Capture and Storage (CCS) announcement was worryingly unspecific. It did not even bother to mention a figure for the value of the financial support. It also upset some major companies by only allowing entries for the competition from a limited range of technologies. The government is extremely vulnerable to the charge that it is back in the business of picking winners.

CCS is an extremely important part of any strategy for national reduction of emissions. The UK should be throwing far more money at research and development into the various forms of CCS. The simplest and quickest way to get innovation in CCS would be to include carbon storage as a technology that qualifies under the renewable obligation rules. We need to remove the difference between the financial treatment of renewable power generation and carbon capture. Both achieve the same outcome and both should have the same reward.

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Air Passenger Duty

APD raises about £2bn a year. The government announced that it wants this to rise by about £500m by 2010/11 after it has changed the tax to apply to flights not travellers. Since UK air traffic is rising by 4-5% a year, this means that the average burden per flight will rise by perhaps 10%, or less than £2, by 2010.

The airlines were quick to argue that at today's rates they are already paying the full cost of their emissions. They didn't provide figures but the table below gives some background to their assertion.

Share of UK emissions from aviation	About 6.3%

Total UK emissions including sectors outside Kyoto	About 660 million tonnes
Approximate share of aviation	About 40 million tonnes
Current price of carbon dioxide in European Emissions Trading Scheme	About €20
Total implied cost of UK aviation emissions	About €800m
Total tax raised by APD	About €3bn

The table shows that at current ETS prices the UK aviation industry 'pays' for its pollution. The tax captures almost four times as much money as the industry would be charged if it had to buy permits for all its current emissions. Air travel emits pollutants other than CO2. Many commentators multiply the CO2 by a figure such as 2.7 or 3 to account for these other climate change implications. But even still the APD captures more cash than would be paid under the ETS. No wonder the airlines are lobbying to be included in this scheme.

The chancellor said that he would consult on how best to change the way APD is levied. At the moment it is added to the ticket price by the airlines. Many agree with Chancellor Darling that it would be better to charge per flight. Airlines with high seat occupancy would pay less per person so it would incentivise the operators to fill every seat.

Our view is that the government will not be able to adjust the basis of the tax. The reasoning is as follows:

- The tax must be fair and roughly tied to the emissions generated by each flight. So the government will have to set a tax figure for each journey. Heathrow to Rome will have a benchmark charge.
- Aircraft differ: a 120-seat plane will have different emissions to a 200-seat plane. So the Heathrow to Rome benchmark must have an adjustment factor to reflect this variation.
- Establishing the benchmark sounds simple. It is not. Eventually the calculation will have to be made using typical fuel consumption figures. So the Rome benchmark will be, say, twice the Paris figure largely based on the average fuel usage to each city.
- Calculating the adjustment to allow for the different sizes of aircraft flying a particular route will also be complex. A 120-seat aircraft may or may not have a fuel cost of about 60% of the 200-seat plane. Which of these two options forms the benchmark?
- Eventually, policy-makers will reach the conclusion that the only way to change the tax in a fair way is to base it on the fuel consumption of the airplane from Heathrow to Rome. Nobody can really argue about this. It is transparent and obviously measures the emissions generated on each flight.
- Our view is therefore that any reasonably fair 'per flight' tax must eventually be designed in a way that makes it indistinguishable from a per litre tax on kerosene fuel.
- Law-makers will then be reminded by the airline industry of the several hundred international treaties that prohibit the levying of a tax on fuel for international air travel. After a court tussle, the plans will be dropped, and we will revert to a per ticket levy.

Is APD working? The government says it has a 'valuable role'. The Pre-Budget review repeats earlier figures that suggest that policy-makers think that it will cut 2.75m tonnes from aviation's emissions by 2010. This is about 6% of the likely CO2 output from air travel at this date, less than the extra emissions coming from likely air travel increases between now and the end of the decade. At current levels (£10 for a European flight), it is clearly doing very little to alter the price competitiveness of air travel. If the government were serious about reducing air emissions, it would double the tax again next year, rather than leaving it unchanged in this PBR.

Carbon Capture and Storage

There are many ways to stop the CO2 produced by the combustion of fossil fuels entering the atmosphere:

- The CO2 can be caught after it is produced and then either stored or used in another chemical or biological reaction ('post-combustion'). The gas can be stored in underground reservoirs such as depleted oil fields.
- The fuel can be broken down *before* it is burnt. In the case of natural gas, which is mostly methane (CH4), it can be split into hydrogen and carbon monoxide by forcing a reaction with water in the absence of air. The hydrogen can then be burnt as fuel and the CO taken off and reacted with oxygen to make CO2. (These techniques are called 'pre-combustion'.)

The government asserts that its analysis shows that it should only support 'post-combustion' techniques, combined with geologic storage and at a substantial power station. It has therefore declared that its long-promised 'competition' should only be open to these technologies. The form of the competition is unclear and the government

only says it will 'support' one pilot commercial project over the next few years.

As we understand it, the entry conditions reduce the number of potential competitors to a small number of existing large coal-fired power stations, led by Scottish Power's Longannet, which sits over a disused coal mine into which the CO2 can be pumped.

This was the wrong decision on a number of counts:

- We do not know which route is the cheapest way to capture the CO2 from a power plant. All the technologies are in infancy.
- If Longannet wins the competition, the money may be wasted. Scottish Power would possibly carry out the investment anyway. It certainly has already flagged its intention to use geologic storage for the CO2.
- Some possible post-combustion technologies need to be proven at a smaller scale first. American Electric Power, a big coal-fired generator in the US, is installing an Alstom scrubbing technology on part of one plant. It may be that the Alstom technology is also right for the UK, but no subsidy is offered.
- It is completely unclear that geologic storage is right or necessary. The most exciting carbon capture technologies in the world are using CO2 to make biomass. If the Carbon Commentary mailbox is any guide, the most promising technique is to use CO2 as a fertilizer for algae growth. The algae can then be squashed for their oil to make biodiesel fuel. Algae are far better at capturing CO2 than plants, and a surprisingly small area of land is needed to deal with all the emissions from a large power station.
- Using algae to swallow CO2 is still at a very early stage of development, though large amounts of US venture capital have already swung behind the technology. Perhaps readers will be surprised to know that using tomatoes to capture CO2 is more advanced. A series of huge glasshouses at Immingham on the north-east coast collects CO2 from a fertilizer plant and uses it to encourage tomato growth. Sainsbury's buys the output twelve months of the year. In theory, the CO2 from a power station could be used in a similar way. But the terms of the competition disqualify such a technique.
- Most importantly, the competition doesn't allow entries from pre-combustion methods of carbon capture. We shouldn't be surprised. The proposed BP plant near Aberdeen, which would have split methane prior to burning and then disposed of the CO2 into an oil field was cancelled early in the summer of 2007 after the government refused to support it. Perhaps it was clear to BP six months ago that civil servants had already made up their mind against any technology that split the CO2 before burning. If there was economic logic behind this decision, we need to be told.

BP itself has said that pre-combustion CCS imposes a relatively small cost penalty on the generation of electricity. When we say 'relatively small' in this context, we mean that it approximately doubles the cost of electricity. This may seem an outrageous increment to pay. But the Renewables Obligation is currently subsidizing electricity generation technologies, such as the burning of energy crops, by approximately twice the amount of the BP CCS cost penalty.

This is irrational: if BP can capture the carbon from burning gas at a cost of £40 per MWh, its plant is at least as worthy of subsidy as E.ON's energy crop power stations. To state the obvious: the UK isn't supporting renewable generation because it is inherently better but because it reduces CO2 emissions. If a CCS power plant does the same thing, we should support it to the same level. Government policy must treat CCS as equivalent to renewables.

26m servers in data centres use 2% of world electricity

BT's green credentials are well established. It is the largest commercial buyer of renewable electricity in the UK, emphasises the importance of carbon reduction across the organisation, and pushes voice and video conferencing at an unconvinced customer base. In any international ranking, BT's sustainability measures get high marks.

But BT has the same problem as many other organisations: its server farms are growing in number and size. The increased power consumption in its data centres explains why the organisation's electricity demand is growing. Eventually, its brand image will suffer as critics suggest that its public stance on green issues is not matched by its internal behaviour.

BT's electricity use is about half a percent of the UK's total, and its server farms represent over 10% of its energy consumption. BT says that data centre use is rising at 40% a year, and the company's emphasis on growing video businesses, such as BT Vision, is likely to increase data storage and transmission demands into the foreseeable future.

BT's response has been to attack the power use of the server with radical measures that set best practice elsewhere

in the world. Its new data centres use fresh air cooling, not air conditioning, and the company runs its machines at much higher temperatures than used to be considered possible. Since cooling servers uses at least as much power as running them, this is an important step. The second major innovation is to run the farms on DC power, cutting the very significant losses in the multiple AC to DC conversions in a conventional centre. Better 'loading' of the computers helps as well. A well-utilised machine uses only a little more power than an intermittently under-employed server. BT claims that these measures can reduce the typical power consumption of a server farm by 60%.

Across the world, data centre energy consumption is becoming a bigger issue. The world has about 26m servers pumping out data day and night. Estimates suggest that they use about 2% of all electricity produced and global growth is probably around 15% a year. BT's innovations may be a useful model for others to follow. But the unfortunate fact is that at current growth rates the maximum efficiency gains will be wiped out in less than four years.

In an intriguing trend, some companies are dealing with apparently unquenchable growth in data traffic by beginning to move away from thousands of servers based on PC technology towards huge single computers with lower total energy costs. Who said the mainframe was dead?

* * *

The energy problem

A generation ago, computer engineers would often speculate that software would eventually become more expensive than hardware. Their prediction turned out to be accurate. Today, similar people talk of the time when the hardware will cost less than the electricity to operate it. Perhaps that day has already arrived. A cheap server uses about £150 of electricity a year and you can buy one from Dell for £200. The lifetime electricity cost is far more than the purchase price.

The 25m or so servers in the world use an average of more than 200 W each. But running the machines is only about one third of the total power used in a data centre. The servers need to be cooled, and the incoming AC power needs to go through two separate conversion processes to DC and back. Many data centres are over-equipped because IT people are terrified of the top management fury when machines fail. Highly excessive levels of redundancy are often built in. Poor knowledge of how to configure air conditioning systems means that large amounts of cooling power are wasted. IT infrastructure managers are very rarely responsible for the electricity bill, so energy efficiency is bottom of the list of priorities.

Concerns over the power use in data centres first arose in the 1999 internet boom. The worry was not driven by cost or by climate change fears. It arose because in some parts of the US the power companies simply didn't have enough spare electricity. This continues to be a problem in America and elsewhere and Google has even talked of building its own generating capacity for the half a million servers it owns.

But attention is now moving to concerns over the likely long-term rise in the price of electricity and its impact on the cost of running data centres. However, we shouldn't over-estimate the financial incentive to improve. BT's centres cost about £20m a year to power. Google's might take £75m or so. It is not small change, but the economics of these businesses do not depend on cutting power use in data centres. The climate change argument is more impressive. At the average carbon content of UK electricity, BT's farms put out about 100,000 tonnes of CO2 a year. (BT can claim that this is an unfair point since it buys electricity exclusively from renewable sources.)

Electricity use in BT

In its 2007 sustainability report, BT says that the electricity consumption in its networks was 1,992 GWh - just over half a percent of the UK total. Unusually, the report does give comparable figures for last year. Instead BT says, 'Our investment in energy management has helped us to keep our energy consumption relatively unchanged'. A look in the archives suggests that this is perhaps a slightly questionable summary: electricity use in the networks and data farms has risen by about two and a half percent, a somewhat higher figure than for the UK as a whole.

No one could be surprised at the growth. BT's underlying business is growing at least as fast as this. Slightly more surprisingly, BT's use in its offices rose by almost 3%. As in most businesses, increased personal computer power and an increasing number of office peripherals probably drove this figure upwards. But office use is little more than 10% of its total electricity demand. Focus will be on the networks, including the data centres.

According to the company, data centre electricity use is currently rising at about 40% a year as broadband gets into more and more UK homes, and businesses store and retrieve more data. Total electricity use last year was 230 GWh. Although this figure is only about 12% of BT's electricity use outside its offices, the figure is rising so fast that it will wash away any energy use reductions the company makes elsewhere.

The tactics for energy use reduction in data centres

In its new data centres BT is making some radical changes to the way it does things:

- Wherever and whenever possible it is avoiding the use of air conditioning.
- It is running the data centres entirely on DC power.
- It is making use of what is called 'virtualisation', enabling one server to emulate two or more. This consolidation means that a smaller number of boxes are needed.

Avoiding air conditioning
In a traditional data centre, keeping the temperature to 20 degrees or less uses more power than running the computers. An analysis from the Green Grid, a new industry information sharing group, suggests that only about one third of the power going into a data centre is actually used by computers.

The Green Grid figures are as follows:

Chilling	33%
De-humidification	3%
Computer room air conditioning apparatus	9%
The IT kit	**30%**
Power distribution	5%
Power supply and battery storage	18%
Switchgear and generator	1%
Lighting	1%

BT has decided that it can run its data centre at much higher temperatures than used to be considered conventional. At a presentation to analysts, it told us that the wisdom that IT equipment has to be run at 20 degrees is backed by little data. In fact, the company said that the standard was set by IBM a generation ago. Early IBM storage devices used magnetic tape. Apparently the tape stretched unacceptably at temperatures higher than 20 degrees and air conditioning was needed. The conventional wisdom remains, even though tape drives are no longer in use.

BT claims that its servers can now run at 40 degrees with no observable impact on failure rates. It has achieved this better performance partly by obliging its suppliers to design and manufacture their kit to work reliably at these higher temperatures. A top limit of 40 degrees enables BT to shift to fresh air as it main coolant in its new server farms.

Blowing coolish air over the servers from the outside will keep the boxes under 40 degrees for a very large fraction of the year. BT mentions an 85% reduction in air conditioning costs. It intends to go further and says it will be encouraging suppliers to design products that work well at 50 degrees.

Not using air conditioning has the side benefit of minimising the need for dehumidification. Air conditioning can produce condensation on equipment which needs to be wicked away by dehumidifiers.

Running on DC power
Most data centres buy AC power, turn it into DC for battery storage (uninterruptible power supply) and then convert back to AC before the final switch to DC to power the processors. Each transition loses some energy, though the amount will depend on how modern the equipment is. In total, the losses can be almost as great as the cost of running the servers themselves.

Changing the electricity to low voltage DC inside the building means conversion losses are minimised. Moving from AC to DC or the reverse creates more heat that has to be evacuated from the building, so BT's move to DC only in new data centres is helping reduce the demand for air conditioning.

'Virtualisation'
Creating more than one virtual server inside one box is an effective means of decreasing energy use. It means that each physical box can typically be used to serve more data. In effect it improves capacity utilisation.

In total, BT believes that it can shave 60% of total electricity demand in a new data centre, reducing typical electricity use to 3.2 MW. (Such a centre would still take all the power from one of the largest wind turbines working at full speed.) The electricity cost will still be over £2m a year but BT claims a payback period of less than 18 months on the extra investment in temperature resilient hardware.

The Green Grid
BT is a member of the rapidly growing Green Grid, a US-based organisation dedicated to spreading best practice in data centre energy use. Interestingly, Green Grid is initially focusing on far less radical steps to reduce power use:

- More effective use of air conditioning rather more than completely avoiding it. US summer temperatures will generally be much higher than in the UK, but data centre operators still have scope for using fresh air cooling for a large portion of the year.
- Ensuring that the equipment is the correct size and capacity for the job. In effect, it is saying that data centre managers are only ever measured on the percentage of time the centre is working properly ('uptime') or on response times to data requests. This is generally resulting in large-scale over-engineering of most data centres, at considerable cost in electricity and capital expenditure.
- Green Grid also focuses on ensuring that servers can be used for multiple tasks ('virtualisation'). The logical extension of this policy is the rebirth of the mainframe, one piece of physical hardware that can allocate parts of its capacity to different tasks, allocating processing capacity as required. If electricity gets really expensive, we may see machines in our data centres that look suspiciously like modern versions of the IBM mainframe computers of the 1970s.

Much of the global data in this article comes from the extremely impressive analysis of Jonathan Koomey at http://enterprise.amd.com/Downloads/svrpwrusecompletefinal.pdf.

If biofuels are the answer, we are asking the wrong question

Many agricultural crops can be turned into fuels. Diesel substitutes can be made from the oil in seeds. The sugars in cereals and tubers can be fermented into ethanol.

At first examination, biofuels look as though they might significantly reduce carbon emissions. An agricultural crop takes carbon from the air through the photosynthesis process. When the harvest is processed, and the output used as a fuel, the carbon returns to the atmosphere. Proponents sometimes said that agricultural crops make 'carbon-neutral' fuels.

Over the last two years, this simple optimism has been eroded. Two further blows have fallen in recent weeks:

- Nobel winner Paul Crutzen and his team showed that we may have been underestimating greenhouse gas emissions from using fertiliser. The work suggested that emissions of nitrous oxide may be far higher than previously thought.
- Richard Doornbusch, who is attached the OECD, wrote a paper which said: 'The conclusion must be that the potential of the current technologies of choice – ethanol and biodiesel – to deliver a major contribution to the energy demands of the transport sector without compromising food prices and the environment is very limited.'

The balance of evidence is that biofuels produced from crops grown in **temperate** climates save very small amounts of emissions. Moreover, the land used for biofuel crops could be used for food or biomass for energy. In **tropical** lands, biofuel crops may save carbon emissions. But the energy policies of richer countries may be incentivising tropical farmers to cut down forest to grow fuel crops. The effect of this almost certainly outweighs any emissions reductions.

Despite the increasingly prevalent view that biofuels are little or no improvement on fossil fuels, both the EU and the US are obliging retailers to increase the percentage of motor fuels derived from agricultural sources. This is a mistake.

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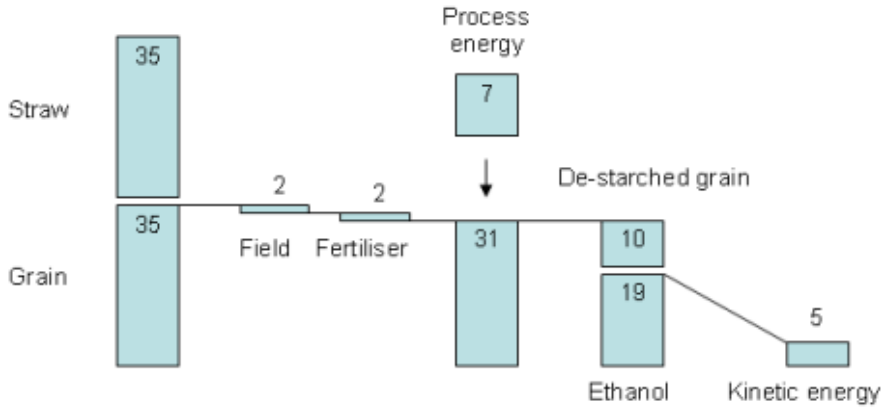
The fundamental problem with biofuels
When a temperate crop such as wheat is grown for fuel, only a small portion of the energy in the harvest turns into useful energy. The crop requires fossil fuels in the form of fertiliser to grow, and the ethanol factory needs significant inputs of energy to turn the grain starches into ethanol. Typical figures for UK wheat are shown in the chart below.

Energy value: thousand kilowatt hours per hectare*



* Please note that these are approximate figures.

The energy value of the whole crop is about 70,000 kWh per hectare. But half of the calorific value comes in the form of straw. Energy needs to be expended to get the grain to grow (fertiliser and tractor diesel) and the net value of the grain delivered to the processor is about 31,000 kWh per hectare. To turn wheat into ethanol, the grain needs to be processed and then fermented. This requires heat. The energy value of the ethanol coming out of the plant may be only 19,000 kWh per hectare. This is before the deducting the 7,000 kWh of energy that has been needed for the conversion process. In a car engine that is only 25% efficient, this converts to about 5,000 kWh of motion.

Put simply, biofuels only use part of the calorific value of the crop, need a lot of energy to process and are then burnt in a very inefficient internal combustion engine. We get 5,000 kWh of useful kinetic energy in return for spending 81,000 kWh (the energy value of the crop, the amount of heat needed to ferment the grain, and the energy used to grow the crop). This is a very bad return, made only slightly better if we include the energy value of the de-starched grain, which can be fed to cattle.

Compare this with simply taking the straw and the grain off the field and burning it to generate electricity. At a power station efficiency of 30% (admittedly quite high) we would get 20,000 kWh of electricity, many times better than for liquid fuel, and without any energy costs for processing. Turning temperate agricultural crops into liquid fuels makes little sense from the point of view of energy balance.

(Why do we stress temperate crops? Because tropical crops such as sugar cane have significantly better energy balance. It is mad to use prime East Anglian agricultural land for wheat to turn into ethanol. From an energy balance viewpoint, the same conclusion may not hold for unfertilised sugar cane grown on Brazilian savannah.)

Climate change and biofuels

The previous paragraphs have looked at the poor return from using agriculture as a source for liquid fuels. Whether biofuels help reduce carbon emissions is a separate question. And please be in no doubt that this question is complex and that the answer is much disputed. Estimates of the benefit from using ethanol (from sugarbeet or wheat)or biodiesel (usually from the seed of the rape plant) vary enormously but are generally quite low. The new paper from Crutzen and colleagues suggests that there is a actually a climate change cost.

However calculated, the climate change benefit of using biofuels tends to be much lower than expected because agriculture has substantial emissions of methane and nitrous oxide as well as CO2. Methane comes from livestock and anaerobic decay. Artificial fertilisers add nitrogen to the soil (which is vital in helping photosynthesis). Nitrous oxide comes from the breakdown of nitrogen compounds, either in the field or in local watercourses.

Calculating the amount of nitrous oxide coming from agricultural soils and watercourses is difficult. We also know that the amount of fertiliser ending up as N2O varies substantially according to the weather when the fertiliser is applied. In addition, certain soil types appear to throw off more nitrous oxide than others.

Broadly speaking, the most optimistic figures suggest that 1 litre of temperate bioethanol might produce savings of about 40% over the greenhouse gas emissions of petrol or diesel. Pessimists, including senior people in the biofuels industry, think the maximum number is much lower, and may be as little as 10%.

What extra do the new studies show?

Paul Crutzen won the Nobel prize for chemistry for his work on the depletion of the ozone layer. He has recently turned his attention to climate change issues. One paper looked at geo-engineering (covered in Carbon Commentary Newsletter #2). This latest work gives new – and much higher – estimates for the nitrous oxide output from agricultural processes.

Crutzen and his colleagues show that previous estimates of the amount of N2O coming from agriculture may be too low by a factor of almost three. Nitrous oxide from fertiliser use (and from the breakdown of farmyard manure) is the

single most important greenhouse gas output in the biofuels process. Tripling the average amount created per tonne of grain or seed will almost certainly make bioethanol or biodiesel worse for climate change than conventional motor spirits.

The Crutzen paper makes some assumptions that are open to question. Some other academics have suggested flaws in the paper, but so far the general view is that the work is solid. If it does hold up under prolonged scrutiny –unusual in climate change debates – this paper alone should force political re-examination of the unthinking drive to increase biofuel use in the rich world.

Dr Dave Reay, an Edinburgh colleague of Keith Smith, one of Crutzen's co-authors, published a comment on the results. He says that if the results stand up it will mean that the Bush administration's legislative push towards the expansion of corn ethanol will add about 6% to climate change emissions from transport. We will see similar figures in Europe if the EU policy of getting 10% biofuels mixed into petrol and diesel continues.

No one pretends that the Crutzen paper is the final word on the issue. But it is yet another blow to the proponents of biofuels.

The Doornbosch and Steenblik critique for the OECD Roundtable on Sustainable Development
This long paper is a devastating critique of current biofuels policy. It does not represent the official OECD position, but should surely influence policymakers towards reining back the policy of encouraging biofuels.

It has several clear findings:

- EU production of biofuels is never likely to provide a significant fraction of total motor fuel demand. The amount of land available is simply not large enough.
- Biofuels save small amounts of greenhouse gases. The other environmental impacts of using agricultural crops as sources for fuel make substitution even more unattractive.
- Biofuels grown in temperate lands are expensive. They require subsidy. The cost of saving a tonne of CO2 by growing biofuel crops may be $500. (In this edition of Carbon Commentary we look at Bjorn Lomborg's view that the costs of damage caused by climate change are small compared to some of the policy measures implemented to reduce carbon emissions. Lomborg's point is fully supported by the irrational support of biofuels by the EU.)
- 'Second generation' biofuels will use agricultural wastes as a source – not just the food. However the technologies for turning waste matter such as straw and leaves into ethanol is possibly decades away from commercial implementation.
- It may very well make sense to make ethanol from tropical crops such as sugar cane. At the moment, high import duties make Brazilian sugar ethanol an under-exploited source. But if blocs such as the EU throw open their markets it will encourage tropical countries to produce biofuels and there will be an inevitable incentive to convert forest land to agriculture. The climate change impact of deforestation would be severe.
- Biofuel production will tend to increase food prices. (The authors are slightly more tentative than I suggest, but I think their conclusions are robust.)

Likely impacts on future policy
Agriculture and oil refiners support government policies on the use of agriculture to make liquid fuels. Agriculture likes biofuel crops because they have secure markets and because they help keep prices firm. The oil industry sees investment opportunities in refining crops. BP has just announced a new ethanol refinery in Hull, for example. But in the medium term the disadvantages of the rush into biofuels are utterly and unavoidably transparent. Increasing food prices, higher petrol costs, tropical deforestation and zero impact on emissions will eventually turn the tide against using temperate agriculture for liquid fuels. We have to hope it happens soon.

Holding back the unstoppable tide of green claims

The Advertising Standards Authority is struggling to hold the line on the advertising of environmental benefits. In June, the Authority put out a series of instructions trying to impose clearer conditions on advertisers. But it continues to have to adjudicate on a series of difficult decisions. Last week saw a wind power developer taken to task for over-estimating the carbon savings from turbines. The Authority had to decide which type of power station would produce less power as a result of a new wind farm – coal or gas. It took advice from the National Grid and proceeded to tick npower off, even though the power company was following rules previously set down by the ASA itself.

In at least one other country, the advertising regulator has thrown in the towel and told some advertisers simply to

stop advertising green claims. Reuters reports that Norway's Consumer Ombudsman has told car advertisers that 'We ask that…phrases such as "environmentally friendly", "green", "clean", "environmental car", "natural" or similar descriptions not be used in marketing cars.'

We cannot be far away from this sort of rule in the UK. Green claims are almost invariably contentious and difficult to prove. We simply don't have an accounting system that can deal yet with carbon. Advertisers are going to be forced to avoid any but the most clear-cut and well-documented savings.

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The ASA June guidance

The Authority's stance on green advertising is expressed very clearly:

- Get your facts right: advertising claims should be backed up with documentary evidence.
- Knowledge is developing all the time. Don't present claims as being universally accepted if the science is inconclusive.
- Don't use pseudo-science, or terms that will not be generally understood by the readers of your advertisement.
- Avoid sweeping or absolute claims such as 'environmentally friendly' or 'wholly biodegradable'. It's unlikely that you will be able to prove your product has no environmental impact.

Taken at their face value, these guidelines should stop most green advertising. It will still be okay to say that a new refrigerator reduces electricity consumption, but anything more complex should be banned. Nevertheless the stream of spurious claims continues unabate

It is not entirely the advertisers' fault. The npower wind farm decision last week illustrated how difficult it will for advertisers to stick within the guidelines. npower had used a figure for the average carbon content of grid electricity when saying that a new wind farm would reduce emissions by 33,000 tonnes. It based its calculation accurately on previous guidance from the Authority issued in response to a previous complaint. The old decision had allowed a renewables company to claim big carbon savings because wind power replaced coal. *'Aha!'* said the ASA, *'Haven't you people at npower noticed that these days coal stations are used all the time and it is the gas-fired stations that provide the marginal generating capacity? You should have used the much lower savings from replacing gas as a fuel for your wind power figures. In future, work out the emissions from the marginal electricity generator (the one that gets turned on last when electricity demand rises) and use that number.'*

It made this decision based on advice from the National Grid. But the relative prices of coal and gas change every week. Any conscientious advertiser will now have to avoid claiming anything other than the minimum savings from renewable power.

The Authority's tougher stance should also cover advertising of the carbon savings of other products. But an advertiser determined to avoid criticism from the ASA can throw huge amounts of evidence into the battle and delay a final decision. In April 2007, I complained to the Authority about an advertisement for the Ford Focus 'dual fuel' car, which can run on 85% ethanol. The company claimed that the car could save 80% of the carbon from petrol. In effect it was therefore saying that the 85% ethanol had virtually no fossil fuel overhead. As the article on biofuels in this newsletter shows, this is a highly questionable assertion. In fact, the 80% figure was much higher than 40% the company had claimed in a press release the previous month.

After a couple of months, the Authority issued a draft decision agreeing with my complaint, but for reasons other than the ones I had specified. The Authority claimed, quite correctly, that the 85% was spurious because the fuel buyer can only get 85% ethanol in a handful of petrol stations in the UK. Unless one drives in circles around small areas of East Anglia or Somerset, you would have to fill up the car with ordinary petrol, saving nothing.

Ford complained. The ASA hadn't 'upheld' the complaint I had actually made. It had invented another one. The car maker sensibly insisted we argue the issue I had initially raised. Since June, Ford and I have been exchanging vigorous letters through the ASA debating whether it is theoretically conceivable that the Focus Flexi Fuel could save 80% of carbon emissions. The Authority is growing ever quieter as the discussion drifts into whether the straw output from a wheat field should be included in the energy balance for ethanol production. I am out my depth, I know Ford is, and I suspect the ASA is too. This debate will probably go on until one side tires, and I have to admit it will probably be me.

Results like this probably aren't good for consumers or for advertisers. A cynical public will grow increasingly suspicious of ever more outlandish claims. The ASA should simply copy the Norwegians and require a much higher standard of proof. If this restricts green advertising, so be it.

Companies mentioned in this newsletter: Scottish Power, BP, Sainsbury's, BT, npower, Ford.
