

# ENVIRONMENTAL RISKS – HOW BEST TO ADAPT TO THE IMPACT OF GLOBAL WARMING?

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## ENVIRONMENTAL RISKS: HOW BEST TO ADAPT TO THE IMPACT OF GLOBAL WARMING



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The headline question is “*Environmental Risks - How best to adapt to the impact of global warming?*” Well, how much warming and on what time scale? Are we going to have to deal with an imminent disaster which requires dramatic action regardless of the economic and life style consequences? Are we in effect at war and life as we know it is going to have to be suspended while we solve the problem, or are we going to have time to adjust and pursue longer-term solutions? Lord Stern suggested that the latter is the case although lately he has indicated that his estimates may be optimistic. While people are working on this worldwide, I have not been able to find any validated data that helps resolve this issue.

Estimates of the degree and rapidity of warming vary hugely, which is understandable because they are based upon extrapolations made from temperature data where the signal to noise ratio is only about 2:1<sup>1</sup> and the temperature increase over the last 95 years has been a barely measurable 0.75°C. The retreat of glaciers and the reduction in Arctic ice

are indicators of warming and have been accelerating over the last two decades but as with the temperature data it is difficult to come up with accurate estimates of timescale. The question of whether the warming is man-made is even more uncertain but, to the extent that one can read through the noise in the temperature and ice data, there has been an anomalous increase recently that corresponds with the increase in manmade greenhouse gas production, so intuitively it would seem likely that manmade activity has given rise to the warming.

The evidence has been sufficient for the climate scientists to conclude that it will be all right if we limit the temperature increase to 2°C and take until 2050 to stabilise the situation. I will not discuss the uncertainties inherent in coming to these conclusions, but accept them so that I can answer the other questions.

So in answering the question “*Are we approaching climate change impacts in the right way?*” – I tentatively whisper “I

hope so” – I assume that the climate change impacts are those assumed in the UK Government’s Low Carbon Transition Plan, and that we accept the G8 Leaders agreement that it will be sufficient for us to restrict global temperature rises to no more than 2°C.

We next find the statement that “*The Copenhagen Summit will arouse expectations*” which is followed by the question “*Should this process be subjected to further questions?*”

My answer to this is a firm “yes” and as the latest projections about the advances that are likely to be made at Copenhagen decline, my “yes” becomes even stronger. We are going to have to go on questioning whether we are approaching climate change impacts in the right way again and again over the next decades, while we strive to understand the situation better and can measure the effects of our actions and decide whether they are adequate. This is not an issue where we make a plan, implement it and then go on with business as usual.

Then comes a series of questions the first of which is “*Are there more cost-effective ways of achieving the targets?*” I assume this refers to the ways laid out in the UK report. The answer again is “yes”, but many

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of these ways will be difficult to realise because they rely on changes in behaviour. In the developed world we consume vastly more energy than we need. Many live in large houses generally heating or cooling the entire house while living in less than 20% of it and wearing clothes that bear no relation to the outside temperature. Many drive cars with engines large enough to propel a bus and drive in them when they could easily walk, cycle or take public transport. We consume food that requires more energy than is necessary, and on average consume twice as much of it as is good for us. In the world at large the most effective reduction in energy, food, and water consumption would be realised if we did a better job at controlling population, but stupidly it has become politically incorrect even to say this.

In any case there are innumerable ways to reduce energy consumption that cost nothing, or reduce cost, but it is not easy to persuade people to adopt them. This should become easier in the developed world when there is stronger local evidence that the warming is real. Over the last couple of years, for example, there has been little evidence of warming in the USA. The average temperature in 2008 returned to the 100 year average and this year is only slightly warmer, so the average citizen, especially in the Mid-West, is not convinced, nor even interested in the subject let alone in changing their life styles. Fortunately the President takes a longer view and US investment in climate science and mitigation is large.

Next is the question *"Instead of stress on unreliable renewable energy, are there technologies that will tackle the impact of climate change more effectively?"* Nuclear power is

the simple answer to filling the gap while we make renewables reliable or find new alternatives. Time is also needed to rebuild the grid so that it efficiently handles intermittency from renewables. Storing nuclear waste has been resolved, even in the UK, although we have wasted several years reinventing the wheel. The Canadians, Finns and French worked this out over five years ago. The time we will take to complete the first plant is several years longer than our competitor nations and most of the nuclear plants will be in locations where it will be difficult to use efficiently the 40% of the power that emerges as excess heat. This issue should be discussed with the public even if it is unlikely that people will opt for the benefits of energy saving and of low cost district heating if it means living closer to what they think – in error – is a high risk nuclear power plant.

*"What happens if the targets are missed?" "What are the worst environmental risks?"* The consequences may be serious – droughts, sea level rise inundating low lying communities, changing patterns of agriculture. If we assume the worst case the predictions are dire even if their timing and severity remain uncertain. They are made even worse by the fact that we are going to run out of gas and oil long before we run out of coal, and unless we find cleaner ways to use coal, its use is going to accelerate the warming. In the worst case, hundreds of millions, maybe billions of people will be forced to move to higher ground. The majority of the largest cities in the world are built on coasts, or next to rivers and consequently close to sea level, and will either be flooded, or massive dykes will have to be built to protect them. Others in the arid parts of the globe will have to move if they are not to die of starvation or thirst.

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*"What actions should be taken to avert or mitigate them?"* The first priority is to improve our understanding of the phenomena that lead to climate change so that we can develop more accurate models that will allow us to decide what is feasible. At present we are drawing conclusions from incomplete information and there is little consensus about what is going to happen and hence about the seriousness of the situation. While we wait for this confirmation we have to be cautious and act immediately to reduce the production of carbon. How rapidly we can do this is an economic question, which inevitably becomes a political and social question.

*"In this debt-laden world, will governments be in a position to afford to keep their pledges?"* Probably not. *"Will the public decline to bear the cost?"* Probably "yes" – if they are given the option. They were not given the option to oppose the sums given to the banks on the basis that without them the world financial system would collapse, so perhaps they will not be given the option again as the consequences will be even more serious.

*"Are other technologies going to be available in time?"* The big hope is that fusion power will become feasible around the latter half of the century. Fusion power is the ideal solution because the fuel supply is in effect unlimited and there are

no byproducts that change the atmosphere or need to be stored. However, there is no certainty yet about important aspects of the technology nor about the timescale. For example, the material composition of the blanket that surrounds the fusion chamber and adsorbs the neutrons that produce the heat is yet to be decided upon, let alone have its lifetime assessed. It is also clearly not possible at this stage reliably to predict the cost of fusion energy. There is an intermediate technology combining fusion and fission that may be available on a shorter timescale and which is being pursued by the Chinese.

In the mean time, on a shorter time scale, many of the renewable technologies will become more reliable and lower cost and the distribution problems created by their intermittency resolved. Improved public transport systems and low emission cars should also become available. In addition there is the hope that it will be possible to use solar heat to provide a continuous source of renewable power on a very large scale. Strangely this option has only recently become widely recognised although it is possibly the simplest way to use the power from the sun, and to store the energy so that it is available continuously. One simply heats a fluid and pumps it under the ground into insulated reservoirs where it



remains until it is needed. Some say that sufficient electricity could be generated in the deserts of the Middle East and or Northern Africa to power Europe.

Let me finish by saying a few words about the UK. We have talked a lot about the dangers of climate change in the UK and the subject has been given higher profile by the media than it has in many countries, especially the USA. The BBC coverage has been extensive and its audience worldwide is therefore well informed. The Government published its UK Low Carbon Transition Plan in July of this year, and yesterday published the five volumes of Energy National Policy Statements. The Low Carbon Report explains in some detail the economic measures that are going to be used to provide incentives, such as renewable obligations, national and international credits, and contains descriptions of the various energy, transport and

agricultural alternatives.

Roadmaps are presented that lay out in general terms how emission cuts of 18% are going to be achieved by 2020. The National Policy Statement (NPS) for Energy sets out the Government's policy for delivery of major energy infrastructure and is accompanied by five specific NPSs that relate to the different energy technologies and to the distribution network. The NPSs are mainly do with the guidelines that the Infrastructure Planning Commission will use in making decisions about applications to build generating plants, and what is to be included in the applications.

Neither the Low Carbon Report nor the NPSs contain sufficient economic and engineering detail to assess the overall economic and technological credibility of the plan. The Government seems to be relying on the private sector to provide this and to be willing to fulfill their expectations, but

with the exception of mention of potential suppliers of nuclear plants there is little to back this up. This is disappointing as there is no reassurance that the mistakes of earlier strategies will not be repeated. Some of the past estimates, for example of the rate that off-shore wind could be implemented, turned out to be quite unrealistic. Such mistakes can be avoided if those with experience in delivering large scale energy and transport systems are consulted, but again there is no evidence in the report that such expertise has been sought.

Overall £405 million was committed to low carbon investment in April of this year but little of this seems to have been distributed, and one cannot help but notice that £405 million is less than 1% of the sum found to rescue the banks. The low carbon plan talks of the need to "focus on low carbon sectors where we have a competitive advantage such as wind, marine energy, civil

nuclear power, carbon capture and storage, renewable chemicals, low carbon construction and ultra-low carbon vehicles, and specialist financial and business services." An impressive list if only it were believable. On wind and nuclear, for example, we already seem to have lost the race not only worldwide but even within Europe.

I conclude with two recommendations. Firstly, that the Government talk more with those who will have to implement the low carbon plan and get their reassurance that it is feasible – that is to those with experience in large scale civil, electrical, nuclear, marine, transport, agricultural and geothermal engineering – and secondly, that we stop talking, conclude our plans, and get on with it!

1 See Chart 1 of the Government's Low Carbon Transition Plan [http://www.decc.gov.uk/en/content/cms/publications/lc\\_trans\\_plan/lc\\_trans\\_plan.aspx](http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx)

# RESPONDING TO CLIMATE CHANGE: POLICY AND ECONOMICS



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## THE QUESTIONS FOR DISCUSSION

Are there more cost-effective ways of achieving the Government's targets? Instead of placing stress on unreliable renewable energy, are there technologies that will tackle the impact of climate change more effectively? What happens if the targets are missed? What are the worst environmental risks? What actions should be taken to avert or mitigate them? Are other

technologies going to be available in time? In this debt-laden world, will governments be in a position to afford to keep their pledges? Will the public decline to bear the costs?

## THE ENVIRONMENTAL RISKS

It is clear that societies need both to mitigate and to adapt to climate change, the question is how much of each? It is evident however that the greatest risk is

from runaway climate change. There are at least a dozen tipping points of different kinds involved. The costs and the risks of climate change are greatly increased if global average temperatures rise by much more than 2°C above pre-industrial levels and the current carbon trajectory seems set to deliver a 6°C increase. Hence the best approach seems to be to mitigate climate change by reducing greenhouse gas

emissions and, perhaps, large-scale engineering, as far as possible, and then adapt to what remains. I was very surprised to hear the DEFRA Chief Scientific Advisor saying recently that we should be prepared to adapt to 4°C as I doubt we would know how to do it in the light of some model predictions.

## THE FRAMEWORK OF CLIMATE POLICY

Climate policy is a multi-level affair which needs to be coherent and consistent at all those levels. At the moment they are not, but it is possible they might become so and that is the importance of Copenhagen, in my view. We have not just the UN Framework Convention on Climate Change (UNFCCC). We also have the G20 which is a much more manageable body that has started to consider these issues. We have the European Union 20/20/20 by 2020 Programme, presenting a very well developed climate policy, which is the source of some of the targets we were asked to think about. We have our own Government's policy, most recently expressed in the Low Carbon Transition Plan with a raft of supporting documents including the Renewable Energy Strategy, and I noted in the questions we were set a slight note of scepticism concerning these renewables.

## THE COPENHAGEN NEGOTIATIONS

I think that there are six criteria at Copenhagen that would set the stage for global GHG emission reduction and by which its success or otherwise may be judged:

1. Stiff binding targets for the industrial world, with the Kyoto signatories in particular, with targets set 20-40% below the 1990 levels.

2. Full US engagement and leadership, with legislation through Congress.
3. Commitments from the major developing countries, Brazil, Russia, India and China (BRICs), with energy intensity targets, to be converted into absolute targets in due course.
4. An extra gesture of commitment by China, and I predict that China will commit to a carbon tax on its exports prior to Copenhagen, just in order to diffuse the China Question that emerges at discussions of this kind ("What does it matter what the UK does? What about China?").
5. There will need to be a substantial financing package for developing countries in relation to mitigation/adaptation, with our Prime Minister deserving some credit, having put a number on the table of \$100B. It might not be the right number but we do need to start talking about numbers.
6. Finally, as Copenhagen will not be the last word, we do need a clear joint leadership commitment by the US and China to work through a deal, post-Copenhagen, to see that we *do* get an agreement in the subsequent 12 months.

We should recognise just how far we have come in the last 12 months in this area, when we had a US President who did not believe at all in Climate Change, and a Chinese President who said "It is none of

our business". The US President has changed and does believe in Climate Change and is now doing everything he can to see legislation goes through Congress before Copenhagen. The Chinese President has not changed but, but has certainly changed his tune. There have been very great movements on the international political stage that we should recognise.

## THE G20

I am very encouraged by the G20, the new forum for discussing global issues for both Developed and Developing Countries, although much less coherent than the old G7 and the G8, but which is the body responsible collectively for 70% to 80% of world emissions. If it can agree on what to do about that, then with a unified presentation to the UN Framework Convention on Climate Change, we stand a much better chance of success. The importance of the US and China in that body will be impossible to overstate.

## CLIMATE CHANGE MITIGATION: AN UNPRECEDENTED POLICY CHALLENGE

If we now turn to the Stern Report which was a landmark report, although what the report said that was new was very little. Much of it had been in the literature for quite a while, but it was the way Stern said it, the authority with which he said it as a economist, with great note and standing in other fields; that he was commissioned by the British Government to say what

he said, and who also put their full weight about publicising it, that caused it to have the global impact that it did. He identified three important strands of policy:

1. Carbon pricing: carbon taxes; emission trading
2. Technology policy: low-carbon energy sources; high-efficiency end-use appliances/buildings
3. Remove other barriers and promote behaviour change: take-up of new technologies and high-efficiency end-use options; low-energy (carbon) behaviours

The real problem, however, is to persuade other people to do things that they actually don't much want to do, and that is not easy in a democracy. Before we proceed to the national issues let us review the EU Climate Programme agreed in 2008.

## THE EU CLIMATE 20/20/20 BY 2020 PROGRAMME

This comprises:

1. a 20% cut in carbon emissions (raised to 30% with international co-operation), with
2. a 20% content of renewable energy in final energy demand, and
3. a 20% reduction in energy use (below a hypothetical baseline), with targets rolled out to Member States.

For example: UK 15% renewable energy cuts by 2020;

... Climate change policies can spur innovation, new industries, exports and growth. ...



16% cuts in GHG emissions from 2005 level from non-traded sector. Items 1 and 2 are enshrined in Directives from the EU and it is up to Member States to deliver. These are not options but statutory obligations we have signed up to. Failure to meet these could end up with the UK facing Proceedings in the European Court and potentially quite large fines.

The last fifteen years have been extraordinary years of policy innovation. We have had implemented practically every kind of policy that it is possible to imagine. Pricing Policies, Regulatory Policies, Voluntary Agreements, Labelling and Information Policies, across the board in a bewildering profusion. It has been a wonderful time to be a policy academic, because it is very hard to keep up with all the developments.

## POLICY EFFECTIVENESS

However, the important question is how effective have

these policies been? The depressing fact is "Not very effective". Carbon emissions to which these policies have been directed have not gone down much since 1997 and the Government will still miss its 2010 target which it imposed upon itself and incorporated in two manifestos of reducing carbon emissions by 20% by 2010. Even though it would have had a 7% fall, which it did not seek, from the current recession. We will still not get to more than about 16%. So despite this proliferation of policies, they have not been applied stringently enough. Green fiscal reform is the subject of a major report from the Green Fiscal Commission, recently published and launched in Portcullis House by Adair Turner and three senior MPs. It talks about increasing the prices, especially of carbon and energy in order to meet the targets. As an economist, I must say that unless we increase prices dramatically we won't get

anywhere with carbon reduction. Hence political feasibility is certainly an issue here.

## THE MACRO-ECONOMIC COSTS OF CLIMATE CHANGE MITIGATION

The costs and implications for economic growth are disputed by economists. There are the 'Optimists' who include Lord Stern and probably also myself. The 'Costs' are really investments and can contribute to GDP growth. There is considerable opportunity for zero-cost mitigation. There are a number of low-carbon technologies which are nearly available at relatively low incremental cost over the huge investments in the energy system that need to be made anyway, and which has been sweating assets for rather a long time. 'Learning curve' experience suggests that the costs of new technologies will fall dramatically. Climate change policies can spur innovation, new industries, exports and growth.

Unfortunately we are currently lagging behind the Germans in this important area. On the other hand 'Pessimists' consider that alternative energy sources are more expensive and are bound to constrain growth, while cheap, concentrated energy sources are fundamental to industrial development.

## TECHNOLOGICAL POTENTIAL: THE SO-CALLED WEDGES

I would like to summarise by ending with this famous diagram which addresses the issue of the technologies we might need, and indeed we might need all of them in order to maintain a stable pathway for future carbon emissions. (See [www.scienceinparliament.org.uk](http://www.scienceinparliament.org.uk)).

## IN DISCUSSION THE FOLLOWING POINTS WERE MADE

*Non scientific arguments based on very selective study of the available data, which have been advanced by a very few sceptics and which attempt to dismiss the widely accepted evidence for climate change, are currently based on a study of very small scale variance over a very few selected individual years in relation to global trends measured over decades and ultimately over millions of years and preserved in the geological record. Indeed misinterpretation of data in this manner is clear to anyone with a basis in science but is deliberately used to create confusion among those who may lack the basic scientific knowledge to be able to assess the raw data for themselves. Variance in solar activity interacts with the effect of greenhouse gases to generate a resultant global warming trend which may therefore demonstrate short-term variance reflecting these parameters.*

*With specific regard to Copenhagen, is the Government sensible to agree and try and enforce a specific percentage reduction in carbon emissions, whether or not this is a realistic target, especially as the main risk arises from the exponential increase in the global population? Political parties in the UK have not disagreed about the realistic arguments for climate change. Hence it is anticipated that a future UK Government will be equally bound by existing agreements and commitments. Indeed the next Government will be bound by those targets but if unable to meet them may feel bound to repeal those targets thus generating political discussion. The purpose of models is to try to generate insights into processes. It is therefore important to consider 2050 as an important reference marker which is relatively soon when discussing the time required to deliver relevant*

*infrastructure. George Bush, who is not convinced by anthropogenic global warming, requested the US National Academy of Science to review the science, and not surprisingly, received a view reflecting that of his own and disagreeing with the IPCC. There is always a role for dogged scepticism in science. Regarding excessive global population growth, it is important to ensure that women who do not want large families have full access to the relevant information and contraceptive means to achieve this goal.*

*In politics new strategies have to be kept secret because you want to spring them on the other party and this leads to a lot of trouble because the very act of seeking advice results in leaking of information. Hence some scientists are often rather dogmatic in their views resulting in the generation of "antibodies" which react emotionally to a standard scientific model, leading to further hostility between parties to a discussion. We are particularly bad at dealing with complex large engineering-based infrastructure projects compounded by the lack of engineering advisers to complement existing science advisers. However this is not helped by Ministers signing up to deliverables knowing that by the time they are due they will be long gone! Many of the lifestyle changes required are essentially beneficial such as dietary changes from animal protein to vegetable protein, better public transport rather than private cars. However major projects such as the new Thames Barrier will depend on a much better understanding of the likely climatic impacts on projected sea level rise.*