

## Daily News

### GovNet News

Digital champion to promote inclusion 'coming soon'

'21 years left' to mitigate climate change effects on global population

**Professor Sir John Beddington's Speech at SDUK 09**

Technology "vital" in battle against MRSA

Ed Miliband urges world to unite on climate change

### Professor Sir John Beddington's Speech at SDUK 09

Professor Sir John Beddington, chief scientific adviser to HM government, speaking at the GovNet SDUK09 event.

I spoke here last year at about the same time about the issue of the food crisis and the burgeoning increases in food prices that were being driven by population growth, use of biofuels and so on.

What I am going to be talking about today is that there has been a reversal, but can we be complacent? The first problem here is that we really have a major issue. This graph takes a little bit of explanation; it is the ratio of our reserves to our consumption. What it is showing is that last year is the lowest level of reserves that we have had as a proportion of our consumption in years, since 1970 and actually since records were taken of this sort.

That means that we've got somewhere like reserves of around 14% of our consumption, that implies, give or take, 38 or 39 days of food reserves if we don't grow any more.

As you can see, it's the lowest level that we've actually had. Is that a problem? Well the answer is yes it is going to be a problem. We saw the food spike last year; prices going up by something in the order of 300%, rice went up by 400%, we saw food riots, we saw major issues for the poorest in the world, in the sense that the organisations like the World Food Programme did not have sufficient money to buy food on the open market and actually use it to feed the poorest of the poor.

So this is a major problem. You can see the catastrophic decline in those reserves, over the last five years or so, indicates that we actually have a problem; we're not growing enough food, we're not able to put stuff into the reserves. And so what I expect to occur is significant volatility in food prices with the consequent problems for the poorest.

So, what are the drivers? I am going to go through them now very briefly.

First of all, population growth. World population grows by six million every month – greater than the size of the UK population every year. Between now and... I am going to focus on the year 2030 and the reason I am going to focus on 2030 is that I feel that some of the climate change discussions focusing on 2100 don't actually grip. In 2100, I would be 155 years of age, my grandchildren would be fairly substantial and it doesn't kind of grip. But by 2030 (I won't say how old I will be then but older than I am now by 21 years, the acute amongst you will deduce), I hope my grandchildren will start to have children and I think 2030 focuses it. I am going to look at 2030 because that's when a whole series of events come together.

By 2030, looking at population terms, you are looking at the global population increasing from a little over six billion at the moment to about eight billion. What is actually happening to that extra population?

First of all, there is a second trend which is to do with population, which is urbanisation. Now as you can see (\*refers to slideshow\*) the crossover, for the first time in 2009, the urban population exceeded the rural population. And by 2030 again, looking at this graph, you can see that round about by 2030, the urban population is going to be substantially greater than the rural population: major issues for land use, major issues for providing that large urban population with food, with water and with energy. But the population will be distributed very differently to anything we've seen before. So, urbanisation is the second trend.

Now, the other trend which is actually good and which I spoke about last year and which is still there, is that, despite global recession, significant proportions of the developing world are actually moving out of what would be abject poverty and we are seeing a creation of what you might think of as middle class, particularly in India and China. Now that lifting from poverty is part of the Millennium Development Goals, we wish to see the world out of poverty, but as the world moves out of poverty, consumption patterns change.

I am going to deal with some of those in a little while, but in particular, we are going to see an increase in the demand for food. Looking at the demand for food, you are going to see major changes but particularly in the demand for livestock – meat and dairy. Now, this is not the West that is doing this. This is largely coming from the developing world as they move from very, very simple diets based on very simple agricultural products to more complex agricultural products, including livestock. [These are] perfectly reasonable and legitimate aims for countries moving out of abject poverty.

Quite clearly, there are issues to the individual, within the UK, about to what extent one eats high production diets, for example like large steaks. Someone gave me an indication that a steak meal has used as much carbon as actually driving a large Range Rover from London to Birmingham, so the next time you're sitting down to your steak and chips, ponder that!

By 2030, the demand for food is going to be increased by about 50%. Can we do it? One of the questions. There is a major food security issue by 2030. We've got to somehow produce 50% more by that time.

The second issue I want to focus on is the availability of fresh water. If you're looking at this slightly complicated graph, we are looking at the top left for the moment, which is showing that the fresh water available per head of the world population is around 25% of what it was in 1960. To give you some idea of this; there are enormous potential shortages in certain parts of the world. China for example, two weeks ago, was actually involved in seeding clouds to address a drought in China. China has something like 23% of the world's population and 11% of the world's water.

Looking at the right-hand side of the graph, you can see that the massive use of water is in agriculture and particularly in developing world agriculture. Something of the order of 70% of that. One in three people are already facing water shortages and the total world demand for water is predicted to increase by 30% by 2030.

So, we've got food – expectation of demand increase of 50% by 2030, we've got water – expectation of demand increase of 30% by 2030. And in terms of what it looks like, we have real issues of global water security.

If you look at the graph, the red figures are where there is genuine water stress (this is a prediction of stress in 2025, a little before 2030), so we're seeing it. Look at some of the places you would expect it, I have mentioned China and also parts of India, but look at parts of southern Europe where by 2025 we are looking at serious issues of water stress.

I will come onto the individual a little bit later but the new Obama appointment to the Department of Energy Steven Chu, a Noble Laureate in physics in fact, spoke about 10 days ago about the problems of climate change and water shortage. And he made a statement that I find breathtaking coming from somebody that eminent, he said: "California will not be able to produce agricultural products within 25 years," and that he had serious doubts about the viability of Californian cities in terms of being able to provide water unless there was some serious investment in infrastructure and serious changes in climate change patterns.

So, water is really enormously important. I am going to get onto the climate change interactions with it a little bit later but water is the one area that I feel is seriously threatening. It is so important because a shortage of water obviously interacts with a shortage of food, there are real potentials for driving significant international problems – what do you do if you have no water and you have no food? You migrate. So one can have a reasonable expectation that international migration will occur as these shortages come in.

Now, the third one I want to focus on is energy and, driven by the population increase that I talked about, the urbanisation I talked about and indeed the movement out of poverty, the expectation is that primary energy demand is going to increase. This graph shows that last year, for the first time, the demand of the rest of the world exceeded the demand of energy of the OECD. The shading of green is the rest of the non-OECD and the orange shading is China and India, so you can see the enormous effect that's actually having and you can see the way in which energy demand is actually increasing and going to hit something of the order of a 50% increase, again by 2030.

Now, if that were not enough... those are three things that are coming together. What will the world be like when that happens? But we also have, of course, the issue of climate change. Now, this is a very familiar slide to you all but we are shooting for a target of two degrees centigrade, a perfectly sensible target. There is enormous uncertainty in the climate change models about that particular target. It is perfectly reasonable to say 'shouldn't we be shooting for one degree centigrade or, oddly enough, it is perfectly reasonable to say 'shouldn't we be shooting for three degrees centigrade', the only information we have is really enormously uncertain in terms of the climate change model.

Shooting for two seems a perfectly sensible and legitimate objective but there are enormous problems. You are talking about serious problems in tropical glaciers – the Chinese government has recognised this and has actually announced about 10 days ago that it is going to build 59 new reservoirs to take the glacial melt in the Xinjiang province. 59 reservoirs. It is actually contemplating putting many of them underground. This is a recognition that water, which has hitherto been stored in glaciers, is going to be very scarce. We have to think about water in a major way.

But the climate change agenda is there and we have to think about it, but this is looking to me like it is getting worse.

This is a slide which looks at the Arctic ice. The blue line on the graph is the average as it were of the IPCC assessments. The pale blue shading indicates the variation around those assessments and gives the idea of uncertainty, and the red line indicates the actual recent observations of ice-free levels in the Arctic.

I was at a conference yesterday on Arctic ice at the Royal Society. There was a paper presented there by Wang and Overland which indicated that by 2030, they were predicting, the Arctic was likely to be ice-free in the summer. This would have the most enormous impact on the climate change system, big, big serious issues there.

The other area that really worries me in terms of climate change and the potential for positive feedbacks and also for interactions with food is ocean acidification. This graph is again a little complicated... we are around about here. And around about here is as acid as the oceans have been for about 25 million years. Now, this is not a silly prediction by those who are wanting to argue that we're all doomed. This is actually simple physics and chemistry. Knowing the level of CO<sub>2</sub> in the atmosphere, knowing the level of interaction that will occur with the ocean with that level of CO<sub>2</sub> in the atmosphere, this is what is going to happen. It may be a little bit lower, but

certainly by 2030, you are going to look at an ocean system which is enormously problematic in terms of its acidity.

As I say, it's as acid today as it has been for 25 million years. When this occurred some 25 million years ago, this level of acidification in the ocean, you had major problems with it, problems of extinctions of large numbers of species in the ocean community. The areas which are going to be hit most severely by this are the coral reefs of the world and that is already starting to show. Coral reefs provide significant protein supplies to about a billion people. So it is not just that you can't go snorkelling and see lots of pretty fish, it is that there are a billion people dependent on coral reefs for a very substantial portion of their high protein diet.

So, this is cheerful stuff, isn't it? What I have said, which I guess is why I have been talking to the media a bit, is I have coined the point that we have got to deal with increased demand for energy, increased demand for food, increased demand for water, and we've got to do that while mitigating and adapting to climate change. And we have but 21 years to do it.

And there are still enormous uncertainties remaining. Let me just focus on some of these which are actually relevant to the agendas of food, water and energy security. The Sahelian drought has been going for some time, when will it break? How significant will the CO2 and rainfall changes we know the climate change models are going to predict affect Africa and Asia. The monsoons, hugely important for feeding vast parts of the developing world and making them viable, will they weaken or strengthen? We don't know. What is the effect of glacial melt? We can see some effects of it but we are going to get events which drive major climate events in our world.

These are major uncertainties and we know that the climate change analysis that we have does not enable us to answer these. We need an enormous effort to actually look at that. I was in a meeting this week with the Natural Environment Research Council and the Met Office in which they have started a programme specifically developed to try to move forward to much better and more accurate assessments.

Now, as I say, not exactly an optimistic picture. Are we all doomed? Is there any hope? Whenever I interview, people always mention Thomas Malthus and am I now a second Thomas Malthus\*? Not quite because I am reasonably optimistic. I think the key thing here is we've got to recognise there is a problem and the reason I raise the food, the water security issues is that they are going to be hitting very early. Climate change is there and is a major issue, but we've got to work on these problems in an interrelated way. We talked about biofuels. Biofuels was a reasonable attempt to try and make transport greener. But there are significant problems in the use of food stocks for biofuels on food security issues. We can't ignore that. We can't ignore food, we can't ignore water, we can't ignore energy demands. What the world of 2030 will look like if we don't mitigate these things?

First of all, with demand significantly exceeding supply, the poorest will suffer. Prices of food, prices of energy and water prices will go up. Water in particular is currently a free good. With the urbanisation we are seeing, it is unimaginable that water will be free to the poor farmers of the world. The cities will have more purchasing power and more political power, which will add to the fact that we will move more populations to migrate to the cities due to water shortage and so on.

So are there any grounds for optimism? I think the grounds for optimism are that we recognise we have a problem, we have enormous ingenuity, the ability to generate solutions to that.

Is there any cause for optimism? Well, I think, one of the things that is enormously important is that for the first time, the White House is recognising it. This is Obama's appointments (\*refers to slide\*), you've got Eric Lander, responsible for developing major human genomics work, Harold Varmus, Noble Prize for medicine, John Holdren, an eminent climate change expert who has worked in the whole sphere of climate change, is now the direct adviser to President Obama, Lander and Varmus are part of this advisory team.

Steven Chu, a Noble Laureate, as I mentioned, is running the Department of Energy, and Jane Lubchenco, who is a fellow of our own Royal Society and an eminent marine biologist. These are the people that are running major parts of the American public service: Holdren, Varmus and Lander are direct advisers to the president.

Obama's rhetoric is completely extraordinary. I think that the one I really like is about listening to scientists: "It's important to listen to what scientists have to say, even when it's inconvenient, especially when it's inconvenient," is the sort of rhetoric that, if it is lived up to, will see significant investments in science and technology, recognition at the very heart of the new administration that climate change is happening and a commitment to deal with it – that helps.

In our own way, we've actually signalled commitment to science. The prime minister speaking at Oxford last week indicated the importance of science and technology. This is good.

But actually, there's a downside here. I'd actually contrast the level of scientific advice that you're seeing in America with what we actually get in Europe. In America, there are three senior scientists, two senior scientists in executive roles, a council of advisers for science and technology. In the UK, we've got 17 scientific advisers, we've got a chief scientific advisers group, which I lead, and there's a council for science and technology, including a Noble Laureate or two, advising the prime minister.

Look at Europe. There is no chief scientific adviser to the commission. Apart from Ireland and the UK, there are no chief scientific advisers in the member states. Science advice comes mainly at a working level from advisory committees, the exception is the Joint Research Centre.

I think that what is needed in Europe is a really coordinated group of scientific advisers that can actually say things that are not helpful, that actually are incredibly inconvenient to policy makers. We need that and Europe doesn't have it. We need to move forward in a cooperative way; cooperation and not competition is the way.

I will leave you with some key questions. Can nine billion people be fed? Can we cope with the demands in the future on water? Can we provide enough energy? Can we do it, all that, while mitigating and adapting to climate change? And can we do all that in 21 years time? That's when

these things are going to start hitting in a really big way. We need to act now. We need investment in science and technology, and all the other ways of treating very seriously these major problems. 2030 is not very far away.

Thank you.

\* The Rev. Thomas Robert Malthus FRS (13 February 1766 – 23 December 1834[1]) was an English political economist and demographer.

His main contribution was to draw attention to the potential dangers of population growth: