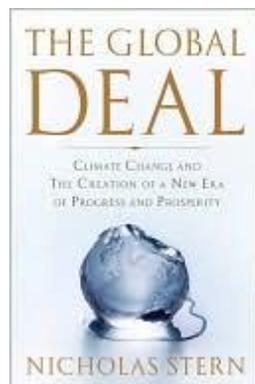


The Global Deal: Climate Change and the Creation of a New Era of Progress and Prosperity

Nicholas Stern

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Introduction

JOANNE MYERS: I'm Joanne Myers, Director of the Public Affairs Program. On behalf of the Carnegie Council, I'd like to welcome our members and guests, and to thank you for joining us on this rainy Monday morning.

Today, our speaker is a world-renowned economist, Nicholas Stern.

Lord Stern is a man of many achievements. But the one that is most relevant to our discussion this morning is his work on climate change. Since the release of the 2006 [Stern Review](#) on the economics of climate change, commissioned by [Gordon Brown](#) when he was the Chancellor of the Exchequer, this seminal document and the ongoing debate on this subject has made Lord Nicholas the man to turn to when questions about the costs and benefits of dealing with global warming arise.

In fact, from what I've read, it seems as if almost every significant discussion of climate change since has drawn heavily on his findings. This report has now been transformed into a book for the general public and is entitled [The Global Deal: Climate Change and the Creation of a New Era of Progress and Prosperity](#).

In focusing on the economics of climate change, Sir Nicholas shifted the debate away from polar bears and unseasonable summers and reframed the argument in the cold language of the balance sheet. In *The Global Deal*, Lord Stern evaluates our economic future and the essential steps we must take to protect growth and reduce poverty while managing climate change. He is guided by three principles, those of effectiveness, efficiency and fairness. By proposing green technologies, international emissions trading, and financing to halt deforestation, he lays out the technological and economic foundations for new industries by which he believes we can avert a catastrophe.

At the heart of his work is a simple calculation, which is if the science of climate change is right, the transition costs incurred by switching to low-carbon economy will, however daunting, be a fraction of what we will face by averting disaster. In other words, the cost of doing nothing about global warming would be very high, while the cost of transforming our energy system would be relatively low.

Climate change is often an awkward issue for governments to address, as the costs are immediate, while benefits only accrue in the future. Even so, understandings will be vital this year, as the world's nations and their negotiators count down toward a UN climate conference to be held in Copenhagen in December. This is a target day for concluding a grand new deal to replace the [Kyoto Protocol](#), the 1997 agreement that reduced carbon dioxide and other global warming emissions by industrial nations.

While we may be a planet in peril and the global financial crisis could distract us from the bigger task of tackling climate change, Lord Stern sees global warming as an opportunity to bring forward investments in low-carbon technologies. In the long-term, these efforts could provide sustainable and well-founded economic growth.

Please join me in giving a very warm welcome to a very distinguished guest. We are honored to have you with us.

Remarks

NICHOLAS STERN: Thank you very much, Joanne. That was a very kind introduction. And thank you all very much for coming today.

Since the *Stern Review* was published two and a half years ago, much of my time has been spent, since I'm back in academic life, arguing with my fellow economics professors about the best way to look at these issues. And we're doing all right with that. They're starting to understand just how big this is and what that means for the kind of economics that they have to bring to bear. So I sort of went back into academic life and wrote academic papers, which you wouldn't want to read unless you're heavily into mathematical economics.

But the other part of what I've been doing is working with people around the world, particularly in developing countries, which was the big part of my professional life before I got involved in climate change. In Europe, my own country the U.K., still part of Europe, and the U.S., for two years or so, I've been intensely involved in these discussions. And these have shaped, in large measure, the structure of the book, and indeed, my motivation for writing the book.

So what I want to do in the time I've got is to explain something about the global deal. How would we come to an international agreement to tackle climate change? What would it look like? What principles should it be built on? But before you can do that, you have to understand yourself why it is that you need such an agreement. But also, the quantitative analysis of why you need such an agreement actually shapes the agreement itself in very large measure.

So what I want to do is to begin with the logic of the problem, why it's so important, the scale of what we have to do, because that shapes everything else. The scale shapes everything else, and the logic of the problem itself, because it's a risk management problem, with long time lags. That also shapes the kind of agreement that we should be putting together and the difficulties in putting it together. So let me explain, from the beginning, in a very simple and fast way, I hope, the basic science, how that shapes the economics you should bring to bear to analyze the problem. And then on the basis of those things, what the global deal should look like.

I know that most of you are not economists. There's a lot of economics underlying what I will say. I won't go into it in any detail. The fact that you're not economists is your fault. Most of you would have had the opportunity at some point in your life, and you didn't take it. But I am not going to dwell on that. But those of you who are economists will recognize that there's quite a lot of difficult stuff underlying what I have to say.

So here is the problem. It starts with people and it ends with people. People, through their lives, their production consumption, the way they live, emit greenhouse gases. They emit more greenhouse gases than the earth can absorb. And therefore, the amount of greenhouse gases in the atmosphere rises. So there is a flow stock problem. And that's critical to the logic of the whole thing. The flow of emissions, because they're not fully absorbed, adds to the stock.

The next link in the chain is from the increase in stocks of greenhouse gases to temperature increases. That's the very simple greenhouse effect. It's a piece of science that goes back nearly 200 years now to French mathematician and physicist, [Fourier](#). By the end of the 19th century, the gases that were causing this effect were basically identified, and there was some initial quantitative work on how big some of these effects might be.

The greenhouse effect is very simple physics and chemistry. Those of you who have been in a greenhouse will have noticed that it's warmer in the greenhouse than outside. The very good reason is that the glass in the greenhouse prevents some of the infrared energy escaping, and that's how the greenhouse effect in the atmosphere works. It's not mysterious or complex or dubious science. It's just a very basic physics and chemistry effect.

So from global warming, from increased concentrations, increased temperatures, from increased temperatures to climate change. And the language of climate change is the language we should use, not global warming, because it's climate change that causes the problem. And most of it's through water, in some shape or form. Storms, floods, droughts, sea level, sea level rise. The temperature does have a direct effect, in some cases, through heat stress, changing the length of growing seasons and so on. But basically, it's the effect of the increased temperature on the climate that's the issue. And, of course, those effects, storms, floods, droughts, sea level rise, have a very direct impact on people.

So that's the logic of the problem: Key aspects of that chain of events—there were five links in the chain, you were counting, that I just described. The logic of that problem shapes the economics and the politics of it all in a very profound way. First, the atmosphere doesn't recognize where the greenhouse gases came from. It doesn't matter whether it's Los Angeles or Beijing or Johannesburg or London. They have the same effect. It's global in its origins and it's global in its impact. That global feature of the problem is absolutely fundamental.

There are lots of things that we do in life that damage what other people can do. When we take our car out, we

slow other people down. If we emit, as we did in London and many other places, soot from coal fires, we give people bronchitis and heart disease. But you can see, in a very direct way, how these effects are working. They're local, and the effects are fairly observable, and they're fairly immediate. This is a global problem and many of these effects have long legs. So the links in the chain I describe, some of them take years or even decades to manifest themselves. That, again, affects the politics of all of this in a fairly profound way. So by the time you see these effects with their full force, it's actually too late to head many of them off.

So you can see the way in which the logical structure here has a profound effect on what you should do and how you should do it and how you see your relationships with others. Also, this flow stock story is critical because it means the costs of delay are immense. When you have a collapse of [WTO](#) talks, as we do in life, you get together five years later, and it's a pity that you lost those five years, but you resume roughly where you were. This is not the case with climate change, because you would have had those increased flows which increase the stocks. And you're in a more difficult starting point five years down the track.

So this logical structure, the problem, is very important in what you can do in the politics of it all. I'll come back to that in just a moment in one or two respects, although it runs right through what I'm saying in the book. But let me just describe the magnitude. And here, you will need a little bit of mental arithmetic. It's not hard stuff. But it's very important that we get a feel for the numbers.

We start around where we are now, around 435 parts per million of CO₂ equivalent. That's the measure of the stock, the concentrations, at the moment, 435 parts per million of CO₂ equivalent. 380-something of that is CO₂. And then the rest is other greenhouse gases translated into CO₂ equivalent. We're adding about two and a half parts per million a year. And that two and a half is rising. So since the two and a half we're adding a year is rising, averaged over a century, we would be adding, on average, well over three parts per million a year. So a century of that, it's a bit over 300. Add a bit over 300 to 435. If we didn't do much, at the end of the century, we'd be about 750 parts per million.

If we stopped it right there, what would the temperature eventually be within a decade or two or three? It would be about probably around five degrees centigrade, or roughly 50/50 probability of being above or below five degrees centigrade. All of this has to be expressed in probability. This is a risk management issue. What does five degrees centigrade look like? Well, we're not sure because we haven't been there for about 30 million years as a planet. We've experienced five degrees below that quite often. Well, very recently, actually, 10 or 12,000 years ago, the last Ice Age when the ice sheets came down roughly to New York and London, natural benchmarks for latitude.

But where were people? Of course, there were quite a lot of people around 10, 12,000 years ago. People have been around 100—well, it depends how you count people, but 100,000, 200,000, depending on your definition of Homo Sapiens, or depending on your definition of sapiens, I suppose. But 100/200,000 years, humans have been around, we haven't seen five degrees centigrade for 30 million years. At that time, the [Eocene period](#), the world was covered in swampy forests. Very little ice, anyway. Five degrees centigrade below, we have seen, much more frequently.

And, of course, both of these things, five degrees up or five degrees down, transform where people can be. They rewrite the rivers. They rewrite the coastlines. Most of where we are, as humans, is shaped by rivers and coastlines. Southern Europe would probably look like the Sahara Desert. People would have to move. People would move on an enormous scale, just as they moved when it was five degrees centigrade lower. People haven't seen five degrees centigrade higher, nowhere near. Three degrees centigrade 2 or 3 million years ago.

Again, way, way before humans. So we don't really know how we would react to that, other than to be able to say where we could live and how we could live would be radically different. The snows would go off the Himalayas, the big rivers of the world would get rewritten—I mean, the big rivers of the world, in terms of the populations that they present. The big majority of them, not all of them, of course, but the big majority of them arise in a few hundred square kilometers of the Himalayas. Now, if you just go clockwise around from the Yellow River to the Yangtze to the Ganges and the Brahmaputra and the Jumna and the Indus. You're talking about rivers that are the main sources of water for countries with a couple of billion people, with a billion or so or more directly affected by those rivers. You would just rewrite where people would be. Populations would move. Hundreds of millions, probably billions of people would move, and we would have extended world conflict.

This is not Nick Stern, the economist, describing this. This is simply Nick Stern relaying to you what the science tells us in a very direct way. But I'm expressing it in a way that allows us to start thinking about this as an insurance story or a risk management story in what we're ready to pay to reduce the odds. If we held these concentrations of greenhouse gases below 500 parts per million, which we could with strong action, and I'll describe what it is and what it would cost, if we held those concentrations below 500 parts per million, that 50/50 probability being above five degrees centigrade would come down to something like 3 percent. And that's a huge insurance gain, a huge rich risk reduction, if we did manage to hold it below 500 parts per million.

We can't hold it below 450. We will be at 450 in about six years. I mean, we're adding two and a half a year, and six times two and a half is 15. Add that to 435. You know, in six years, we're at 450. But we *can* hold below 500. And we can also be thinking about how we bring it on down from there. It takes a while to do that, and even 500 is a very dangerous place to be. Far, far less dangerous than 750, obviously. But we could work out how to bring it on down from there.

What would it cost us? Very roughly speaking—I could have told the story in three, four, five, six degrees centigrade, but just to be specific and to cut down the time, I told it in terms of five. But it's the whole distribution that counts, not just one particular temperature like five degrees centigrade. What would it cost us? Well, relative to business as usual, we would probably have to take out about 65 gigatons of CO2 equivalent. What do we have to do? We have to get down from the over 50 gigatons that we emit each year at the moment. We have to get down to about 20 gigatons by 2050. That's, roughly speaking, the path associated with holding below 500. In 1990, we were at 40 gigatons. So getting down to 20 gigatons in 2050 is cutting by 50 percent, relative to 1990.

So globally, the kind of path I described of holding below 500 involves getting down to about 20 gigatons as a flow. 500 is the stock. Getting down to about 20 gigatons is a flow by 2050. And that involves —depends on how you define business as usual, but taking out around 65 gigatons. And now you have to do another piece of arithmetic. It's only multiplication. It's not hard. 65 gigatons. We could probably do that at an average, and an average costs about \$30 a ton. So \$30 a ton times 65 gigatons. Well, you've obviously got 195 in there or 1.95 or 19500, however you do the numbers, and, of course, you've got to get your decimal points in the right place when you do this sort of thing. You've got to remember that giga is billion. Scientists like giga. Economists like billion. But giga, billion, same thing. So it's actually, when you multiply 65 gigatons or 65 billion tons by \$30 a ton, it's 1.95 trillion, 2 trillion dollars, close enough.

What will world income be in 2050? It's a bit over 50 trillion now. If we're sensible and follow good policies in climate and elsewhere, it could easily double. I mean, not if we don't, but it could easily double. That makes the arithmetic and the percentages easy. We're a bit over 50, so a bit over \$100 trillion in 2050. So two in 100 or so is around 2 percent. So you can build this up through boring old economic models and so on. But it's very important to get a feel for why these numbers are what they are.

So for around 2 percent of GDP—I picked that for the year 2050, but it might look something like that for a while, for the next few decades—you buy this enormous reduction in risk. You make the difference between probably destroying the planet, as far as it is a place for life in any sense for humans, as we know it—that's if you do nothing—but if you act sensibly and pay this very modest insurance premium, you can reduce the risks to levels which are probably manageable.

So that's basically the story. What does it look like if you try to do this? Well, in the first place, a properly constructed green recovery would help us to get out of a recession. That's the very, very short run. For the next two or three decades, we will create a technological revolution similar to, probably bigger than, the railways, electricity, the motor car, or IT. We will create a, those of you who like your economic history, we will create a [Schumpeterian](#) technology innovation investment-driven story of growth for the next two or three decades. When we get to low carbon growth, we will have something—because it's the next three, four or five decades that's the transition to that story—but when we get there, we will have a form of growth which is cleaner, more energy secure, quieter and more biodiverse.

And if we run the clock forward just a bit more, we will have reduced the risk of the transformation of the planet, which would occur as I just described it. This is a no-brainer. I mean, you've got the short run returns, you've got the driver of the technological story for the next two or three decades, you create a form of low carbon growth that's much more attractive, and you drastically reduce the risks of major transformation of the planet. It's just good sense, basic economics.

The wise investors and the wise business people are already out there seeing where this is going. And it's even getting detailed. I mean, in Korea's green recovery, they say, well, if the U.S. is going to build a smart grid, smart grids need smarter plants, they're going to be made here in Korea. And people are already running through this story, seeing the opportunities.

But what we can't do is pretend that there are no investment costs in this transition. There *are* investment costs in this transition. They're serious. But they're manageable. And they will happen, provided that the governments of the world set the right kind of framework for this to happen. And it means economic policy. It means a price for carbon, through attacks or a trading scheme or a bit of each. It means regulations. It means regulations on emissions. It means doing what we've just done in the U.K., announcing that there won't be any more coal-fired power stations without carbon capture and storage. These are the kinds of policies it needs. It needs public, private partnerships in helping develop new technologies. It needs strong and clear policies to get there.

But basically, here we are. We know the kind of scale that we have to act on. We know the kinds of areas where we have to act, energy efficiency, low-carbon technology, and stopping deforestation. We know the economic instruments that we have to use. "Know," in this sense, means have a good idea of. But we know enough to set off down the road. And we're going to discover and learn like mad along the way. So we know the scale, we know the areas where we have to act, we know the kind of economic instruments. It's now a matter of political will. And it's this year that is absolutely crucial for putting that political will together.

I've already described, actually, one way or another, many aspects of the global deal. But let me now just pull out the global deal, from what I've said.

- The global deal, if it's going to be agreed and sustained, will have to be effective on the scale that's necessary. I've already described that.
- It will have to be efficient. That will be crucial because there will be serious costs of investing in the transition. It's crucial to keep those costs as low as possible. If people think we're wasting money pursuing those policies, then those policies will become politically fragile.
- And it's got to be equitable. Because otherwise, the different countries around the world, the different groups in the population will not support it or would not stay supporting it.
- It has to be led by the rich countries. The rich countries, in terms of early action and I think it has to be led by the poor countries in terms of design. Because it's the poorer countries of the world who are affected earliest and hardest, although we're all affected, in the story I just described, in a very profound way.

But it's the rich countries who have to take the lead in action. Why? Because they're responsible, the 1 billion, out of the 6.7 billion, who live in rich countries, are responsible through their economic history for something like 60 to 65 percent of the greenhouse gases in the atmosphere now. They're largely responsible, through the pursuit of high carbon growth; but this is a very difficult starting point. We really wouldn't have wanted to start from here. But we are where we are. And it's the rich countries who are largely responsible through that pursuit of high carbon growth in the past. Of course, they're better off, and they have the better developed technologies. So I think the responsibility for early and strong action clearly lie there.

Where do we have to go to in terms of what each country should look like now? Well, I've already said we've got to get down to 20 gigatons, and I've explained why. In 2050, there will be 9 billion of us, roughly speaking, plus or minus a few hundred million. There will be 9 billion. So if we're emitting, as a world, 20 gigatons, and there are 9 billion of us, remembering again that giga and billion are the same thing, 20 divided by 9, you can all do that, even on a Monday morning, is just over 2. So we've got to be down to 2 tons per capita as well, roughly speaking.

Where are we now? Well, Europe, Japan is 10, 12 tons per capita. So to get from 10 to 12 to 2, divide by 5, cut by 80 percent. There's nothing mysterious in the idea that rich countries should be cutting by 80 percent. 1990 to 2050, it just follows from the arithmetic.

Now, the United States is over 20 per capita. And [Barack Obama](#) said we'll cut by 80 percent, 1990 to 2050. He *really* meant 90 percent. Because, you know, to get from over 20 down to 2, you've got to divide by 10, right? But never mind, we're a very tolerant lot in Europe. The basic thing is if you set out strongly down the right road, a lot of the arithmetic, a lot of the technology is going to sort itself out later on.

We shouldn't get overly hung up about exactly 80 or 90 percent. It *does* matter to have a strong view of where we're going. And it *does* matter to set off down that path in a strong way. I mean, that's what's crucial. So when we get to Copenhagen, the 2050 will be the anchor for the arithmetic. There's going to be some very hard bargaining, and there should be, over 2020. Because 2020 is surely an indication of whether we're serious about getting to where we want to go in 2050. And that's going to be where, I think, hard stuff is going to come. And it's already coming in Copenhagen. The [Waxman-Markey Bill](#) talks about 7 percent reductions by 2020, relative to 1990 for the U.S. That's a tough ask, actually, for the U.S., because they're already 16, 17 percent above 1990. So to get back to 7 percent, below 1990, by 2020, as in Waxman-Markey, means taking off about a quarter in a decade.

Now, this is where the politics of this is going to get tough. Because there are two ways of looking at 2020. I'm sure there are many ways of looking at 2020, but here are two. 2020 is the midpoint between 1990 and 2050. They're arithmetically unexceptionable. And 2020 is 10 years after 2010. Again, we can't quarrel with the arithmetic. But the perspective is fundamentally different. Because in countries like the U.S. and Canada, and I was in Canada a couple of days ago talking to environmentalists and others, and there it's a good deal higher in the U.S. relative to 1990. So to get, say, the U.S. as in Waxman-Markey, I take out of 25 percent in the next ten years is going to be tough.

But then, you know, sitting in India or China or Indonesia or Brazil or South Africa, you're saying, "I see, you're going to cut by 80 percent, 1990 to 2050. And at the halfway stage, 80 percent you're going to take out in six

decades. And after three decades, you've taken out 7 percent?" How serious does that sound?

So you can see why these two different perspectives on 2020 matter. And I think as a world, we have to recognize we've only been serious about this for two or three years. And we are getting serious about this. And that's what makes me more optimistic about getting a global deal. So that's going to be hard bargaining and very difficult. But I hope we can get there. It's going to need a lot of mutual understanding.

But here it is. I more or less described the global deal. It's 50 percent reductions overall, 1990 to 2050. If people keep going on about percentages, just bring them back to the 20 gigatons in 2050, because that's what really counts, and the path to get there. 50 percent reductions overall, 80 percent reductions for rich countries.

None of this is going to work unless the developing countries are absolutely at center stage. 8 billion out of the 9 billion people in 2050 are going to be in currently developing countries. If the rich world was emitting precisely zero in 2050, then the average for the developing world would have to be not 2, but 2 1/2 tons per capita. This cannot work unless the big majority of people in the world are involved.

So that's essentially a story which says that over the next ten years, the developing world will embark on climate change action plans. China described a climate change action plan two years ago, India one year ago, Brazil and South Africa at the end of last year. They're starting to develop serious engagement in working out how to cut emissions. Now, where I see the global deal working out is the developing world explains to the rich world, these are the conditions. This is conditionality of the developing world on the rich world.

Take those 80 percent cuts you're talking about. Be credible over the next decade. Develop the technologies. Share them with us. We'll be developing technologies. We'll share them with you also. The biggest producer of photovoltaics is in China. One of the biggest windmill producers for electricity is in India. They will be sharing technologies both ways. But develop the technologies, share them with us, help us with the finance, help us with adapting to climate change, because it's really happening and it will happen, and we need to invest to protect ourselves against what's going on and to pursue development in a more hostile climate.

You do all of these things, those are our conditions, and we will commit now to taking on targets, say from ten years time. In the meantime, here are our climate change action plans. Please help us with those, because the more you do, the more we can do. This is the way in which this discussion is starting to move, and I think it should move. But building on the kind of commitments, the rich countries are already indicating that they'll take on.

Trading will be very important, both to bring the costs down, and to allow flows from rich countries to poor countries. The sharing of technologies, I've already described. We need explicit mechanisms for doing that. And I'm very happy to discuss those in questions. We have to stop deforestation. It's responsible for 20 percent of emissions. There's no way we can achieve these targets without stopping deforestation. China is reforesting, it's not deforesting. India has declared for a target of 33 percent of the area forested. I think it's about 22, 23 percent now, isn't it? So if India makes it, that's a big change too.

But, of course, it's the tropical forests which really count—Brazil, Indonesia, Malaysia, Congo, Central America, and so on. Those are the big things that really count there. We have to stop deforestation. That has to be a battle which is integrated into the whole development story. You can't tackle deforestation in Indonesia, Malaysia, and Brazil unless you help those governments create alternative opportunities, more productive agricultural opportunities outside agriculture, improving the ability to develop and enforce property rights and so on. It has to be integrated in the development story. So you've got to stop deforestation.

And we need to look, again, at the challenge of the [Millennium Development Goals](#) and beyond about financing for development. Because when we did those calculations—and I am partly responsible, it's a shared responsibility, for not building climate change in as we should have, because I was Chief Economist at the World Bank when the UN had its [Financing for Development Conference in Monterrey](#) in 2002, and I led the writing of the [Report for the Commission for Africa](#) in 2005. And in each case, we understated the challenge of climate change for development. But we have to face up as a world to the extra costs of meeting development goals in the context of a changing climate.

So there you are. That's the global deal. The targets, the trading, the technologies, the finance, the deforestation, and the adaptation story. Huge amounts of detail to work on. But it's the framework that really counts.

Will we get there? I don't know. But if we say it's all too difficult, then nothing is ever going to work—and the U.S. is not going to give up its big hydrocarbon cars, and the British are too lazy to do anything, and the Chinese always cheat—you can tell, I can sit in a bar and tell the story. It's very easy to do. But if you believe that, what is the consequence?

Well, you can't wiggle out of the science. I mean, it's basically clear and there. So if that's what you really believe, you're saying, well, we've got another 50, 100 years to go in terms of the kinds of life that we got used to leading. And we will, over that period so transform the planet, so that we'll be living actually in very different and much more difficult ways. So if you're negative and pessimistic about all this, it's self-fulfilling. We won't get there if you all say it's all too difficult. And the consequences will be very severe. We must be honest about those consequences. So, buy a hat, some suntan lotion and write a letter of apology to your grandchildren. If you really want to push the negative part of the story. So the challenge is not, is it ever going to work? Yeah, it's all too difficult. The challenge is what do we have to do to try to make it work?

Will we succeed? Of course there's no guarantee that we'll succeed. But we can see the way in which we have to try and the way in which we have to work together. And we can see the kinds of scale of activity. We can see the kind of technologies. We can see the kind of economic instruments. We know enough to embark down this road with purpose. If we don't get a strong agreement in Copenhagen at the end of this year—not all the details, the details can be worked out later. But if we don't get the basic framework, I would really worry about whether we'll be able to put it together. Because it falls apart, people go away, and, you know, it might take a long time before we get back together again.

In the meantime, you've done a lot of damage in terms of increased concentrations. In the meantime, confidence in the markets that are going to sustain these kinds of investments would have been undermined. So not getting an agreement in Copenhagen, with the basic outlines, not all the details, would be very, very damaging. So this is a crucially important few months for the world really in terms of decision making.

And there's no way that—you can't negotiate with the basic scientific processes. You can't negotiate with the concentrations in the atmosphere. They will be what they will be if we're neglectful.

I'm much more optimistic than I was two or three years ago because you can see and hear the way in which the understanding and commitment on this issue has changed, whether it be in China or India or the United States or elsewhere. You can see the way that's changed. The pace of change of technology has been quite remarkable. It's impossible to give a talk like this to business people without going away with a pocket full of cards if somebody's got some great idea about how to reduce emissions, how to pull the greenhouse gases out of the atmosphere. If one tenth of these ideas work that are just sort of bubbling through, we can have a whole range of ways of acting, all of which will cost a bit, probably, but, you know, some will be more successful than others.

So in terms of the changing politics, in terms of changing technologies and investments, I'm much more optimistic than I was two or three years ago. I think we're going to get there in Copenhagen. And the months that follow, I really don't know. But we've got a chance there that we can blow now. And, you know, human beings are not bad at messing up opportunities. But there is an opportunity now to mess up. And one of the reasons I wrote the book was to reduce the probability that we might. Thank you very much.

Questions and Answers

QUESTION: Lord Stern, thank you so much for a great talk. Are we being maybe even too optimistic? You paint a pretty bleak scenario, if we don't do this. Should we have contingency plans in place that would suggest that we need not \$30 a ton, but maybe \$75 by 2015? Because what we are now seeing with the positive feedback loops, positive in a scientific sense, particularly the change in the Arctic, much more emissions of methane from both the tundra, undersea, et cetera, all of these things, which you know, which would suggest that the window we have to get this done may even be shorter. And therefore, we should be, contingency-wise, at least prepared intellectually to pay a higher cost because the time to get it done is perhaps much shorter than we think it is?

NICHOLAS STERN: These positive feedbacks, things like the melting of the permafrost and releasing a lot of methane, the collapse of the Amazon, which could well happen around three degrees centigrade, which we might be at in 50, 60 years, the decreasing acidity, so the increasing acidity of the oceans which decreases the absorptive capacity, all of these things actually are usually omitted from the formal scientific models. Complication, grounds, difficulty in quantification, but they're very real possibilities. So it actually does look more worrying than when we were writing two and a half years ago, although all of the basic line of argument is the same.

I think that the description that I gave of cutting by 50 percent as a world, 1990 to 2050, is actually quite unambitious, relative to science. And indeed, many scientists will tell you very loudly what you're doing, you're telling me to cut by 50 percent? It should be 80 percent globally by 2050. Although, of course, it is quite ambitious in the point of view of the economics. And many people would draw the conclusion that you drew, that we should be acting faster and more strongly. And therefore, you would be thinking of higher, high costs. Because the faster you do it, the more it costs. So I think that relative to the magnitude of the real scientific problem, I've erred on the side of caution.

I've erred on the side of caution on the economics. I've erred on the side of recklessness, if you like, on the

science. So if I were to be pushed to shift in a direction from the one I just articulated, I would certainly go in the direction that you described, that we should be stronger than I am describing, not weaker. And you can make that case, and perhaps you should. I should emphasize, I am talking about average costs. A lot of the costs of what we do actually are negative. I mean, if we're sensible about a lot of the energy efficiency options we have, we save money. But it won't all be negative costs. And on the margin, it will be, of course, a good deal higher.

QUESTION: One problem we face seems to be that we are locked in by the present technology that exists in the U.S., in China, in Europe. Every week, on average, a new coal-fired power plant is being opened in China, with the effect of about 1,000 megawatts. And it's calculated for over 25 years. And today, as we speak, China is (inaudible) based on clean coal. If they continue to run these, according to their business plan, we will be far off the mark that you have indicated that we need to reach.

So those, the owners, the countries and the private owners of these plants seem, to me, to be unlikely to close down these plants without compensation or to retrofit them. And just imagine what it would cost to retrofit the power of coal fire power plants of this world with carbon capture and storage. It would also increase the energy price by today's standard by, let's say, 40 percent. This is, of course, site specific. So what we seem to need is a new set of economic incentives, which means going steps further from the Kyoto mechanisms, which provided some incentives which have worked in some countries, and to provide a larger global scheme that gives the developing countries where the emissions will increase the most, like China, positive incentives for change. And I haven't seen, so far during the run-up to the Copenhagen, any proposal in pretty language which provides that scene and which links a positive cash flow with achieved reduction targets. I would like to hear your comment on what needs to be done in that direction.

NICHOLAS STERN: I think the ballpark you're talking about, 40, 50 percent increases in prices of electricity around the world for a few decades, is probably roughly right. If you take a rich country, something like 4 percent of GDP would be primary energy. If you increase that cost by 50 percent, you get back to the 2 percent of national income I'm talking about. So if we're talking about increasing the price of electricity 50 percent in many places for a while, that is a price that we should be quite ready to pay. And we probably would have to.

My acquaintance with India is much deeper than China. I've been living in India, on and off, for different parts of the last 35 years. But I've been living in China, again, on and off for 20 years. And the change in China in the last two or three years is quite remarkable in terms of their understanding of the issues. And the 11th five-year plan which finishes at the end of next year, had a 20 percent reduction target of energy to output, which they probably will reach—of course, if output goes up by 40, 45 percent, and the energy use goes up by 20 some percent, which is what's happened—but I think the 12th five-year plan, which starts in the end of next year, beginning of the year after—and they're already working on it and preparing an energy strategy, which would actually precede the 12th five-year plan—I think is likely to have emissions targets rather than energy targets. This is all discussions over the last few months and weeks. But I think that's where it's going.

Will countries like China, in terms of growth ambitions, energy ambitions, will they achieve the kinds of transformations we're talking about without substantial sharing of technology and substantial finance? The answer is no. I described briefly some importance of sharing technologies. But let's look at the kind of schemes of the trading finance for RT that could do it. Some of you will know about the [Clean Development Mechanism](#), which is a project by project trading arrangement. It's designed under the Kyoto Protocol, but mostly driven by the [European Union Emissions Trading Scheme](#), whereby a firm that has to meet a target under the European Union Emissions Trading Scheme, can buy a reduction in a developing country. But it's organized on a project basis. And the firm itself in the developing country, which is selling it to the firm in the rich country, has to show and has to be approved by various committees at the country level in Bonn and so on has to show that it will be cutting its emissions relative to what it might have done.

"What it might have done" is counterfactual. You want to know what I might have done? Well, here is what I might have done. You know, it's quite difficult to work with this kind of apparatus. And it's very, very heavy. What we're going to need for a while, I think for ten or 15 years, possibly more, and we do have to negotiate this at Copenhagen, is a successor to the Clean Development Mechanism, which is one-sided trading, in the sense that you get rewarded if you go down. But you don't get penalized if you go up. Which can work on a wholesale way.

So the Province of China decides under its program that it's going to have no further investment in coal-fired without carbon capture and storage. Then we can identify quite clearly the kind of reductions that would involve much more easily than the project by project scheme. And what we should be envisaging is wholesale funds, which arise from the ambitious kind of caps we've got in Europe and I trust we will have in the U.S., so that firms combined that fund, and that fund could take a slice of this Province of China that's embarking on this program.

So I think if we replace the Clean Development Mechanism with something that's much more suitable for wholesale, that's programmatic, as opposed to project-based, then we could envisage financial flows. And we've been modeling them a bit. And they probably would be of the order of somewhere between 100 and 200 billion a

year by the 20s under these kind of trading arrangements. That's the kind of financial structure, trading structure that we would need for a while to support these kinds of investments. And we've got to be quantitative and open and direct about what's involved. There's another story, of course, in proving that these carbon capture stories technologies work on a commercial scale. And that's something we have to embark on again, as a world where different countries do different things. The Australians are doing a few, there are a few in the U.K., I'm sure. Canada is doing a few. I'm sure there will be more than a few in the U.S. So at the same time, as we work on the finance, we have to work on the sharing of the technology as well. But that's exactly the kind of detail we have to work on. And we have to be frank about the scale of what's involved.

QUESTION: Thank you again, Lord Stern, for that magisterial performance, which doesn't surprise any of us. But since I suspect you're largely preaching to the converted here, I wonder if I might ask you to rebut two of the more persuasive arguments being made by those who disagree with you and with the global warming, simply so we can get those arguments knocked down. And I hear them all the time.

The first is from sort of the view of the [Bjørn Lomborg](#) School of the skeptical environmentalist, who essentially sidesteps the case you're making by saying that even if what you're saying is true, with the expenditure required to deal with it now is excessive in relation to how much more good you can do to the world by spending a fraction of that money dealing with other things like Malaria and AIDS and development to stop poverty, and drinking water and things like that, and that this is, therefore, a misplaced sense of priority.

And a second argument is broadly what one might call the American conservative argument that says that expecting the world to organize itself today to impose costs upon itself now for possible dangers 100 years down the road is essentially politically irresponsible, that the technologies will find solutions before things ever get that bad. And in the meantime, we should leave well enough alone and let us take care of today's people, who, of course, happen to be today's voters, as well. You are going to be imposing short-term costs on people who are not going to necessarily see visible benefits for the costs and pain you're inflicting upon them. I think those two arguments do require some sort of response from someone like yourself. And I'd love to hear it.

NICHOLAS STERN: I think the response is actually implicit in what I already said. But the challenge you've drawn out is absolutely right because this is what we do here. I know Bjørn Lomborg reasonably well. And he's a rather engaging fellow. But I think he's more of a stand-up comic than a serious contributor to this. And he's not an economist or a scientist.

But that's by the by. Let's take the argument. What's the argument? That there are better ways of investing. There's a whole collection of mistakes in the argument. The first one, and in many ways, the most important, is to treat these as separate projects. The two defining challenges of our century are overcoming world poverty and managing climate change. I've spent the big majority of my professional life on the former. One of the reasons I feel so strongly about climate change is that is for the reasons I described, it would undermine the progress that we've made and reverse it. We succeed or fail on these two defining challenges together.

As I described it, most of the effects of climate change and their damaging form on human lives come in water in some shape or form. They're inextricably interlinked. It is just a simple failure in logic to treat the problems of development and water management separately from those of climate change. So when you set it up as sort of separate investment projects with the internal rate of return, you're just making a basic analytical mistake in relation to the logical structure of the problem. So the argument is just deeply flawed and deliberately misleading.

He also, very deliberately, understates the magnitude of the problem. And he takes lower estimates. He takes means. He doesn't look at distributions. And he doesn't look beyond the end of this century. So within that overall structural logical mistake, there are all kinds of subdiffusions of cooking the books along the way. It's a kind I just described. Deliberately taking lower estimates, deliberately taking means and not looking at distributions, when this is a risk management problem, and deliberately curtailing the time period. I could go on. I mean, there's mistake after mistake in there, including the discussions of discounting, in the context of a future that depends on what you do now in a very big way. Most of economics, when it discusses discounting, looks at some assumed growth path and thinks a little (inaudible) associated with investment projects around that path, which, again, is an analytical mistake of huge importance in this kind of context, when what the future looks like, including whether or not we're better off, depends profoundly on what we do now.

So I could go on. But as I say, Bjørn tells a very good case, and he's a very engaging guy, actually. You ought to listen to him, it's worth going to, but just remember, he's wrong.

The conservative story, as you portrayed it, is partly answered by what I've just said. Because implicit in the plausibility of that story is the notion that these effects down the track are not that big. So you're saying, why should we give up what seems to be a lot now in return for something which, you know, is a bit uncertain and accrues to people who are going to be much richer, much richer than us? And more to the point they don't have a vote.

Well, the answer to that is that you don't have to give up that much now. And some of it looks very exciting and positive. I don't want to say you don't have to give up anything now. That would be wrong and misleading. You do have to invest now. But it has tremendous returns beyond simply the climate change story, which I described. So I think it's very important to come back first with two things.

One is, that do you realize the magnitude of the changes that we're potentially talking about here?

And secondly, point to the very positive parts of the story as well. But this is something which requires enormous leadership. When we gathered together as a world in 1944 at [Bretton Woods](#), we had seen 30 years of global warfare and great depression. We could see, in a very direct way, what goes wrong if we don't think ahead and we don't collaborate. The evidence was, you know, in blood in very recent history.

This one, we're having to say, look, this is actually much bigger, in many ways, than these World Wars and the Great Depression. But in 50 years, 100 years down the track, some things much earlier, but in terms of its big magnitude, this is a great test of rationality for human beings. It's not simply that they can get scalded and say, getting scalded is not a good idea, I'll avoid getting scalded. That's the evolutionary approach to learning. This is a big challenge for us, in terms of rational human beings. We've got to anticipate this one. It doesn't make it any less real. But it means it's less real in terms of direct experience.

So that's the great challenge for political leadership. That's why communication is so important. That's journalism communication is so important. I had a long discussion with [Rahul Ghandi](#) about how this can become a current political issue in India. In India, of all places, people understand the consequences of water, storms, floods, droughts. If ever there was a place in the world, no necessity to explain that to people, that they know. But it's linking, linking that to action in India now, linking action in India now to what other people might do as a world. That's the challenge of communication. I think it's enormously important that we take that on.

JOANNE MYERS: I thank you really very much for bringing all of these issues to us today. They're very important. And I want to thank you for making such a strong case. Thank you.

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