Debating “The Skeptical Environmentalist”

Featuring
Bjørn Lomborg
Author of *The Skeptical Environmentalist: Measuring the Real State of the World*
Associate Professor of Statistics, University of Aarhus, Denmark

Fred Krupp
Executive Director, Environmental Defense

Moderator:
Nicholas Wade
Author and Science Writer, *The New York Times*

Held April 9, 2002 at the Graduate Center of the City University of New York, New York.
Sponsored by the Donald and Paula Smith Family Foundation.

The author of the controversial work of scientific analysis, The Skeptical Environmentalist*, and the head of one of the leading environmental advocacy groups, were both invited to debate the topic “Is Our Environmental Future Secure?” Lomborg and Krupp were each allowed to present arguments for 15 minutes, with time for rebuttals and audience questions afterwards.*

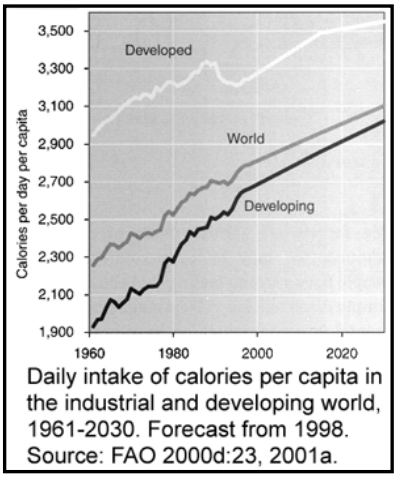
Bjørn Lomborg: Thank you very much. Basically, I’ve been asked the impossible task to tell you in 12 to 15 minutes what’s in my book. Cambridge told me I should always hold up my book, so now I’ve done that. And basically tell you, "So, how’s the world’s doing, how has it been doing, and what is likely to happen in the future?" There’s no way I can do that, but I will try and give you a sense of what is important and what are the main points and try to give you a sense of why what I say at least could be important for the way we understand the world.

Let me just say there are 2 things that I try to say, and these are like the only two take-home points. One is, we need to remove our myths. Nobody can disagree with that, right. But we need to understand doomsday is actually not now. It’s not like we have to act in desperation. This is important, because it means that we can start focusing on making the best possible decisions, or

as politicians love to point out, there's only one bag of money but there's lots and lots of good purposes and the basic idea being here if we feel like we've been painted into a corner, we're desperate and we're willing to do pretty much anything, also making really bad decisions. If people come up to you with a gun to your head and say, "Give me your money," you don't stand around and say, "Oh, or would I like to buy a toaster?" You do what he says. That's the basic point. So, what I want to point out is that things are actually getting better – it doesn't mean that there are no problems – and that means that we can also start prioritizing. And that's what I'll get back to at the very end.

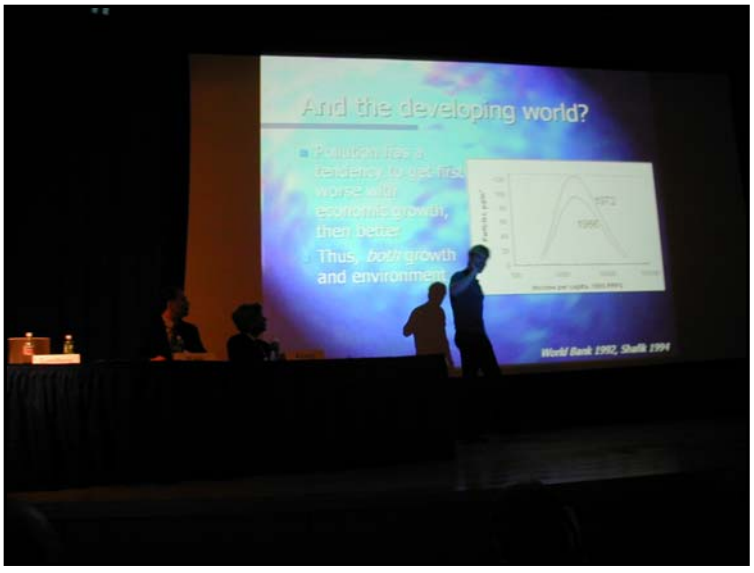
Basically, have things been getting better? Yes, on most of the important points we have actually got more leisure time, greater security, fewer accidents, more education, more amenities, higher income, fewer starving, more food, and a healthier and longer life. And this is not only true for the industrialized world, but perhaps more importantly also for the developing world.

The point here is to say, what I'm basically trying to do is take the best and very uncontroversial data we have from for instance the UN organizations – this is not the only thing there is, but at least it should make you somewhat less skeptical of the data that I have produced. What I've tried to show you here is the calories per capita per day in the world, for both the developing and developed world. What you can't see up there in the developed world is that we have enough calories, right? Because our problem is possibly getting too much. But what is really important is to look at the developing world – I'm going to show you a lot of these graphs, I'm a statistician, I think this is sexy, right? But it means also that it gives you an indication of what is actually happening in the world. If you look at the developing world we've gone from in 1961 which is the first data that the UN makes, 1932 calories per person per day in the developing world, that's on average just a little above what it takes to sustain your life. To in 1998, which is the last data that we have, to about 2650 calories, that's an increase of almost 40% – that's a dramatic increase.



Daily intake of calories per capita in the industrial and developing world, 1961-2030. Forecast from 1998. Source: FAO 2000d:23, 2001a.

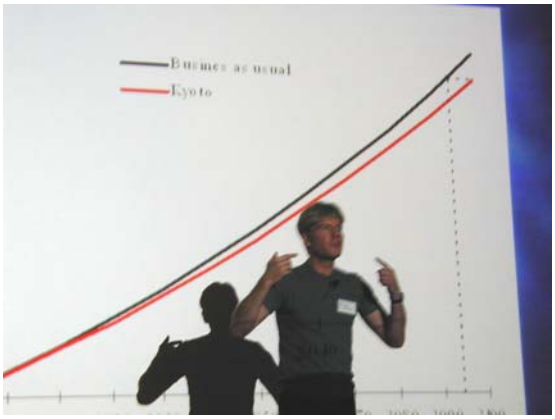
And what I'm saying here, and I'm going to say this again and again, this means things have been getting better. I'm not saying that that means things are fine. There's a very, very big difference. Getting better is a scientific discussion that's basically a question of, is this line going up or down?" Whereas, "It's good enough, they don't need any more"? I'm not saying that. That's a political judgement. I would definitely say they need more, so they can decide themselves whether they want to be fat or not. So the idea here is to say, things have actually been getting better. And also note that the UN actually predicts that despite the fact that there are going to be even more people here on Earth, they will continue to get even more food. So we actually end up in 2030 with a situation where they'll have about 3000



calories per person per day or be at the same level as the developed world in 1960. This means it's better and it's getting even better, but it doesn't mean it's fine. I'm just making the scientific point of saying the data actually moves in the right direction.

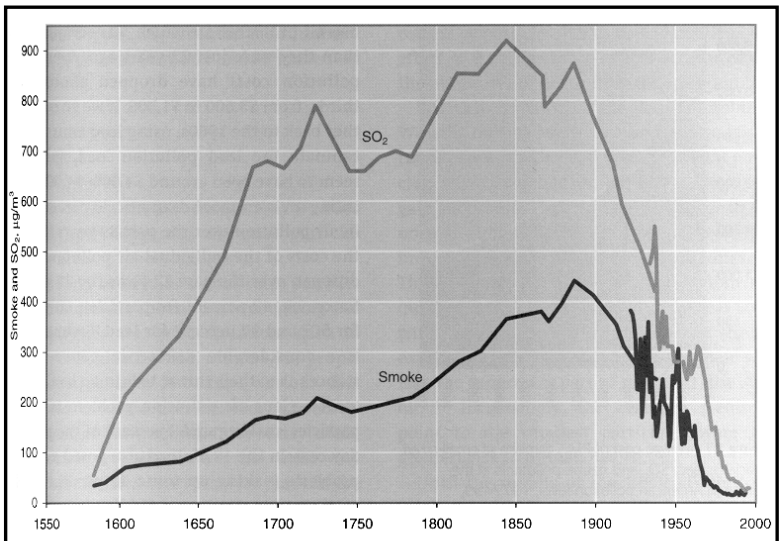
Now of course you've also heard and I hear this all the time, "There are lies, damn lies, and statistics." But basically you also need to understand it's the only way we can understand our world, is to look the statistics. But of course we shouldn't just take a look at averages, because this could actually hide some very important differences. It's very unlikely it's one person eating all the calories, but it could be the middle class that's eating up this stuff, so on average they have much more food but it still could mean that there's a lot of poor people who don't get fed and possibly even more. But that's not the case. The UN made its first estimate of how many people are starving in the third world in 1970; the answer was back then about 1.2 billion people were starving, or the equivalent of 35 percent of all people in the developing world – 35%, that's more than one out of three – today it's down to 18% in 2030; the UN expects it to be down to 6%. This points out both the fact that things are getting better – it's a lot better when it only 6% starving than 35% starving – but it still means that in 2030, there'll be 400 million people starving needlessly, because we could easily feed them. It's only a question of allowing them the possibility to make enough money so that they could actually feed themselves. So the idea here is to say I'm trying to make the complex – or at least for the press the complex – point of saying, things are getting better but we can still do more.

Let me go through some of the other issue areas and give you a feel for this in 15 minutes.



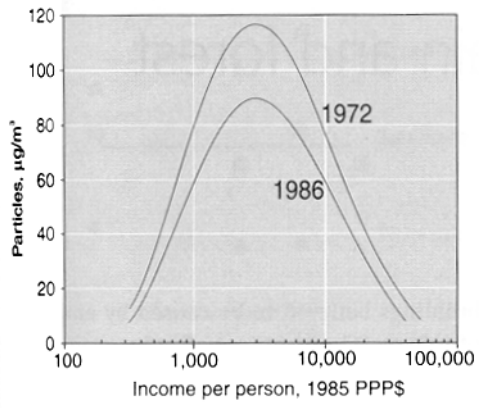
Basically one of the arguments that I very often hear is people say, "Sure, Bjørn, you may be right when you're talking about money, but that's because you're *only* talking about money. But where does that help us if we're really undermining out future and our kids' future with pollution? Basically, oh sure we'll get more and more money but we're going to cough all the way to the bank." That's an important point. But I try and say, let's look at the most important pollutant, namely air pollution. The US EPA estimates that anywhere from 86 to 96 percent of all social benefits that stem from regulating pollution, any kind of pollution, comes from regulating one single pollutant – particulate pollution. That means that's the most important thing of all to look at when we're talking about pollution. Let me just show you this one graph from the UK. What you basically see here, we have the data back from 1585 until today. Of course, we love the fact that there've actually been people out measuring it in 1585. We don't. This is based on models, based on very meticulous descriptions of what was imported into London. But basically this is the best data that we have and most of the EPAs and pretty much all over the world accept this data, and then it's correlated with the data we actually have measured from the early '20s on. If you look at smoke which is by far most important, particulate pollution, you have an increase since 1585 up until about 1890 and from then on a decline down to today, air pollution by the most important factor is down below what it was in 1585. Americans actually believe air pollution is getting worse in their country, it's not true. This is true for all developed countries, things have been getting better at least for the last 30 or 40 years. When we look at the UK data where we actually have data back from 1585, we can actually say, 'No, air pollution is an old phenomenon, and it's been getting better for the last 110 years. The air has never been cleaner in London since 1585, in medieval times.'

That's an important point because it means we're not painted into a corner, it is not such that air pollution is taking over and breaking down the world. However, that does not mean that we shouldn't do something about it. Actually, it turns out that because particulate pollution is such an important problem, cutting this even further is a very good idea. So not only can we say yes, air pollution has been dropping dramatically, but we should do even more about it. One of the very obvious ways especially in Europe where we have lots of diesel cars, and diesel cars contribute by far the most particulate pollution in the UK, they constitute about 6% of the car pool, but make up 92% of all small particles so yes, we should fit them with filters, it's a very cost-efficient way, and it's probably also one of the best investments that we can make at all, not only in the environmental area but in any area whatsoever. So the idea here is again to say yes, things have been declining, we have not painted ourselves into a corner but we can still do even more. But it's important we do it because it's a good investment, not because we fear the world is coming to an end.



Average concentrations of SO_2 and smoke in London, 1585-1994/5. Data for 1585-1935 are estimated from coal imports and have been adjusted to the average of the measured data. Source: Brimblecombe 1977:1161, Elsom 1995:477, QUARG 1996:75, EPAQS 1995:Figure 3, Laxen and Thompson 1987:106, OECD 1985a:28, 1987:31, 1999:57.

Let me point out one more thing – this is true for the developed world; it's is not true for the developing world. If you live in Beijing or Mexico City things are getting worse, but that's really because they do exactly the same thing as we did. This is one of the World Bank's analyses that, they pretty much show up any way you make it, if you put income out this way and then you put problems with particulate pollution out this way, You basically see first it gets worse and then it gets better. Really, it's no big surprise, it's exactly what we saw with London and it also makes conceptual sense, first you don't have industry you don't have pollution but, but you don't have any money either, right? And then you get industrialization and you say cool, I can buy fruit for my kid, give him an education, buy stuff for myself and then never mind our cough. That's what we did. That's what London did. And it's only when you get sufficiently rich that you start saying, "Hmm, it'd be nice to cough a little less," and then we buy some environment. That's what we've got. And it makes good sense. Environment, in this sense, is a luxury good. When you don't know where your next meal comes from you don't care about the environment 10 or 100 years down the line. However if you actually say, "Now I'm sufficiently rich," if we make the developing countries sufficiently rich, they will also start to worry much more about the environment.

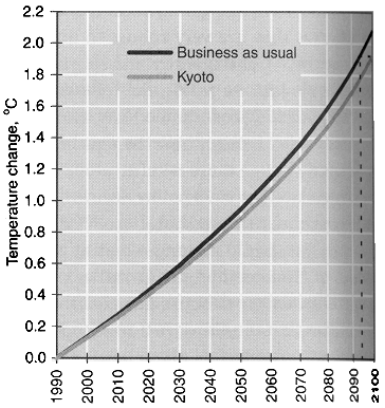


The connection between GDP per capita and particle pollution in 48 cities in 31 countries, 1972 and 1986. Source: World Bank 1992:41, Shafik 1994:764.

So, let me just take two more points here. One is global warming obviously because it's one of the most important areas of environmental discussion and then I'm going to finally talk about what are the consequences of us not prioritizing correctly.

First of all, about global warming, what should we do. There's a lot of discussion about global warming – is it happening, all that stuff. Let's just point out global warming is important. I certainly think carbon dioxide does increase warming and I think we need to take our departure as the best possible scientific data we have from the IPCC, the UN climate panel, and it doesn't mean it's infallible but it's the best we have. Now, the point here is to say global warming, the total cost will probably be somewhere around 5 to 8 trillion dollars. This is not a trivial amount of money. It means global warming will make great damage to the world. You also need to put it in perspective, that the total worth of the 21st century is about 900 trillion dollars, so we're talking about a 0.5 percent problem. There are not many other problems that reach that scale, but it is not going to drive us to the poor house no matter what we do.

We need to say it's an important problem, but it is not a problem that in any way will damage our future dramatically. It doesn't mean that we shouldn't handle it carefully, because it's an important problem. And so the idea is to say how important, what about the future of carbon dioxide emissions and what should we do. Let me just say very quickly that everyone is worried about should we run out of oil, should we run out of gas or coal or all these things. Sheik Yamani, the guy who founded OPEC, loves to say, "The Oil Age isn't going to come to an end because of lack of oil, just as the Stone Age didn't come to the end because of lack of stone. " It wasn't like people said, "Oh God, we're out of flint!" Right? They did it because it made good sense, and we're going to do exactly the same with our energy supply; eventually we'll move to renewables.



The expected increase in temperature with business-as-usual (IS92a) and with the Kyoto restrictions extended forever. Broken line shows that the temperature for the business-as-usual scenario in 2094 is the same as the Kyoto temperature in 2100 (1.92ºC). Source: Wigley 1998.

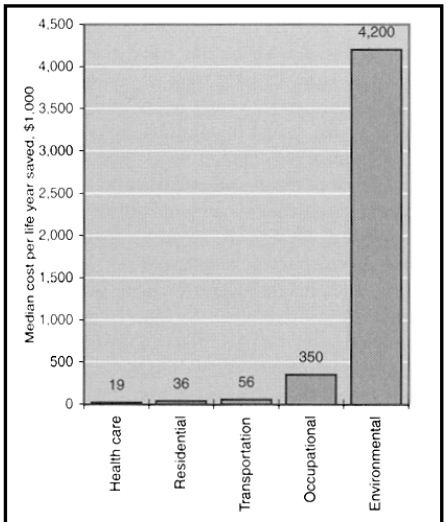
Renewables have been dropping in price about 50% per decade over the last 30 years. Even if they continue at a much lower rate, to about 30% per decade, they'll become competitive before mid-century, and that means certainly we will not be using massive amounts of fossil fuel by the end of the century. It means global warming will be a limited problem, that's not the same as saying it won't be a *big* problem, but it will be a limited problem, probably 2 to 3 degrees centigrade temperature increase. Now at that rate, the main problems will occur in the developing countries. Actually the UN IPCC second summary document said, in what was later mangled by a politician, that it is not going to harm the developed world, it *will* harm the developing world, with a median temperature increase of 2 to 3 degrees. And that's an important part. I'd like to show you all these graphs but basically, let's just point out it's going to harm by far the most the developing world.

And then we have to ask ourselves: Is it really a good idea what we're talking about doing right now, namely Kyoto? Let me just show you this one graph. This is one from the lead author of the 1996 IPCC UN climate panel report, but all models show the same qualitative results, if not the same numbers all in all. Basically what this shows is that from 1990 up through 2100 what's going to happen if we don't do something – that's the black line here – we're going to have a temperature increase of 2.1 degrees centigrade. If we do Kyoto, it's not like it's going to stop global warming, it's going to simply slow it down slightly, it's going to be the red line – this is totally uncontroversial. All models show this. In this model it will go down to 1.9 degrees, or to put it more clearly, the temperature

that we would have had in 2094, we have now postponed until 2100. In other words, we've bought the world six years.

Of course if Kyoto was cheap or something, maybe that would be a good idea, it's something good. But not very good. Basically what we're saying is the fact the guy in Bangladesh, who has to move because his house got flooded in 2100, he only has to move now in 2106. It's a little good but not very much good, right? On the other hand, the cost of Kyoto is going to be anywhere from 150 to 350 billion dollars a year. That's three to seven times the global development aid to the third world. Is that a good investment?

Well actually, all cost/benefit analyses show that it's a very, very bad investment. Just to give you a sense, of the cost of this, the cost of Kyoto for one year in 2010, for just that one year cost, we could solve the single biggest problem in the world, once and for all. We could give clean drinking water and sanitation to every single human being on earth once and for all. It would save 2 million lives each year, in fact, half a billion lives each year. We have to ask ourselves, wouldn't that be a better way of helping the developing world? Actually the UN estimates that for 70-80 billion dollars – much less than the cost of Kyoto – we could permanently solve all the basic problems of the developing world: it could include clean drinking water, sanitation, basic health care and education to every single human being on earth. Wouldn't we do better by doing that? And again the idea here is to say, we should not allow ourselves to be painted into a corner to believe we have to do something. If it actually makes sense, we should do not only something that sounds good, but also actually *does* good.



Median cost per life-year saved for different sections of society in 1993$. Number of interventions for each sector is 310, 30, 87, 36, and 124 respectively. Source: Tengs *et al.* 1995:371.

I'm just going to just basically show you this one study. This was the Harvard Center for Risk Analysis which showed all the data publicly available from the US on all legislation which had as its primary purpose to save human life. Notice a lot of environmental legislation does not have as its primary purpose to save human life – if you talk about saving the Bengal tiger for instance, it probably has the opposite effect! The idea here is to say we're talking about all the costs of the legislation that tries to save human life and then they compare what is the median or the typical cost of saving one human life one year. I'm just basically going to show you the biggest study we have in the world basically saying that in the health area it costs 19 thousand dollars to save one human life one year. You can see the other areas – and what we basically have out here is, the environment area costing $4.2 million to save one human life a year. And that's when the purpose was to save human life. You could call this graph "Spot the bad investment." It's not the same thing as saying there are no good investments to be made in the environmental area. It's simply to say that on average we over-worry about the environmental area – and it does have consequences because if we over-worry about some areas we end up under-worrying about other areas, and that's my last point, that's the reason why we need to focus on what is the real state of the world. Things are actually getting better and better and they're likely to do so in the future. This does not mean that there are no problems and that we don't need to worry, but it means that what we need to understand, the problems are getting smaller, and that means that we have to start focusing and prioritizing correctly, so that we not only make sure that we make a better world, we probably will no matter how stupidly we act, but that we make an even better world for our kids and grandkids and that involves both knowing how the world looks, and how we should prioritize correctly. Thank you.

Moderator: Thank you for that whirlwind talk on world environment in fifteen minutes plus one, though you did get a penalty, but I will ask Fred to keep his talk to 15 minutes.

Fred Krupp: Thank you Nick, thank you for your kind introduction and moderating here tonight and thanks for also mentioning some of the good things Environmental Defense has been up to including our work a decade ago with McDonalds, though I have to say that that was some of our riskiest work – teaming up with a big corporation – and resulted in an article in *Rolling Stone*, no less a journalistic magazine than *Rolling Stone*, which tried to get behind the decision and it turned out that when it came out, it was fairly positive, although it was meant to be an investigative report. Except for a line about me which described me as "slightly nerdy, but persuasive." I handed it to my bride because it was fairly positive about how we got McDonalds to clean up a lot of different things and she got to that sentence and she turned to me and she said, "Fred, you didn't tell me that they interviewed you in person for this piece."

And at the board meeting I remember chastising a board member who's here this evening with us that he could have had a better description written of me since he's partners with the author's dad and he snapped back, "Fred you don't understand: it's thanks to me that the word 'slightly' was inserted." Well, thanks to Donald and Paula Smith's Family Foundation for hosting our discussion here this evening on, "Is our environmental future secure?" And thank you to the Smiths more broadly for your commitment to debating ideas, it's really the essence of our democracy.

I think this debate is timely because now at the beginning of the 21st century scientists have told us that there are some big risks that are posed by climate change, the loss of species and the sorry state of our oceans. It's timely as well because Bjørn has been on tour saying there really is not much to worry about, a message that's been trumpeted in the media throughout the world. This is important because if Bjørn's right, we can all relax, take a deep breath and reallocate our time and energies to other problems, and the news media or corporate and citizen leaders can also reallocate their time and resources as well.

And it's important though, because if he's wrong, such complacency can have a big cost. Tonight I want to stick to the topic of "Is our environmental future secure," and not get into all the graphs and charts that Bjørn has put up. But I do want to point out that others have written articles about those and I commend them to you: *Science*, *Scientific American*, Union of Concerned Scientists, they are all out in the reception area if you would like to bring them home. But basically instead of debating the charts and the graphs, I intend to challenge Bjørn's conclusions. My own answer to this important question, "Is our environmental future secure" is *no*. *Not yet.* It depends on us, on what we do, on the actions we take. If we make the right choices things can turn out OK, but it could also turn out the other way.

I'll support this answer with three points. First, my involvement with environmental policy over the last 30 years, which teaches me that the progress we have made comes not just from the accumulation of wealth and reaching a certain GDP level, but from citizen and government action. Bjørn tells us that progress in the past has come from wealth, and asserts that more wealth will solve any problems in the future. Second, I look to the best scientific assessment and see that yes, important progress has been made. But many important challenges remain that demand urgent attention and good policy choices. Bjørn seems to argue that these problems are largely being solved on their own. Since world scientific bodies and our own National Academy certainly see these problems, I think it's fair, even important to ask why we should rely on Bjørn's views instead. And finally, my third point is that real world experience shows that we can make progress keeping an eye toward keeping cost down, carefully choosing strong scientific standards and incentive-based policies, Given the stakes involved, not to continue to forge ahead on big problems like climate change would be like encouraging my teenage son to go around driving his car without insurance or seat belts. The risks are just too great.

OK. First, my point that environmental progress is not automatic. Others have argued that environmental progress is the inevitable outcome of wealth. Their argument is first we grow, then we clean up. Or as you have just heard, the environment is a luxury good. But this argument neglects to point out the role of citizen and government action in achieving that progress. Take the case that was on the screen of air pollution in London. It didn't just get better; London and the UK passed a series of laws *requiring* that smoke and pollution levels come down. Some of these laws were passed after an infamous inversion that killed many, many folks. Look at the history of air pollution in our own country, or cleaner, high mileage cars. Time and again the prevailing sentiment of industry was against passing a tough Clean Air Act, fighting acid rain controls, and campaigning furiously against cleaner exhaust pipes and higher mileage standards. Opponents claimed each new regulatory proposal would bankrupt them. They haven't.

Regulations to reduce sulfur dioxide pollution largely generated by the burning of coal in power plants were projected by industry to cost as much as $2000 for each ton of sulfur removed from their smokestacks. The nation chose instead a new performance-based approach to cleaning up, giving industry flexibility, but requiring results. And today removing a ton of sulfur costs less than $200, a tenth of the doomsayers' predictions. Reductions of 50% in the annual emissions were required, and so far we've reduced pollution by even more. This happy story was not an automatic happening that was triggered by some level of GDP. It was the result of a campaign waged by many environmental groups (including Environmental Defense) and then of the choices made by our legislators. The victory on sulfur and car exhaust and the Clean Air Act produced much of the air pollution improvements Bjørn points to.

The same citizen and government action was required to take lead out of gasoline, to ban DDT and other pesticides to protect our wetlands, to restore the ozone layer, and to clean up water pollution. Now in addition, other countries really don't need to spend their money cleaning up after the fact when they have the option of doing things right beforehand. China, for example: they don't accept the idea that they need to be consigned to some environmental hell. Their citizens are way down on the ladder in terms of per capita income but they're already demanding a cleanup. And their government is beginning an acid rain control program modeled after our own. Why should they wait?

Second, while I agree that progress has been made on many issues, many important problems remain. It's not true that we're making progress on most of the important problems. Sure, we have made progress on emissions from power plants. But acid rain continues to strip our soils of essential elements and kill our lakes. We need to further cut sulfur emissions. Yes we have cleaned up car exhaust, but with more cars and trucks driving more miles, smog and particulate pollution remain a huge issue both in our country and abroad. Here in this country, 15,000 premature deaths are ascribed by the scientists to our air pollution. And if you look south in Central and South America, 200,000 deaths a year are attributed by the scientists to particulate pollution.

On biodiversity, I think it's fair to say the very web of life is unraveling. For example, let's talk about what happens right before extinction: endangerment. Based on very solid data the World Conservation Union has discovered that of the world's birds, 1 out of every 8 is endangered. The same ratio applies to the world's plant life: 1 out of 8 endangered. These are troubling numbers and they are not the result of natural die-offs. These species are endangered because of what people are doing to their ecosystems here and now. Fortunately, we're talking about endangered species, not extinct species, so there is still time to save some of them. But to deny there's a problem is just plain unscientific.

On the problem of global warming, this needs to be a huge priority because the stakes are so high. It threatens our ecosystem. The parks and reserves that we set aside are at risk, our oceans, our coral reefs. What we know for certain is that the earth is warming, that sea level has been rising partly as a result of this warming, and that human activity has been contributing significantly. Glaciers are melting, the permafrost in Alaska is melting causing power lines and phone lines to begin to topple. And here in New York City we've already seen samplings of the kinds of intense storms and sea level increase that may well inundate some of our own major airports, subways and highways. Our own National Academy has confirmed that this is a very real problem.

Finally, let's get to that question of costs and benefits and buying insurance, with special attention to climate change. Bjørn has told you that it's not worth the cost to aggressively tackle climate change, but the problem will self-correct as renewables magically become competitive. I disagree. Just looking here at the US, as long as we continue to subsidize the burning of fossil fuels by a 3 to 1 ratio compared to renewables, and as long as we allow the true cost of burning fossil fuels, the true cost to our health, and our environment, to basically frankly be borne by all of us, it's not likely that renewables will be able to play the role that he predicts. Without changes in policy, it just won't happen.

Rather than citing theories about what the cost of reducing emissions will be, the truth is we can rarely know with precision what the costs or benefits of the decision will be, but time and time again we find that the projections of costs have been systematically overestimated. In particular the economic models just cited about climate tell Bjørn that we should only be prepared to spend a small amount on this critical problem. But those models don't include the potentially catastrophic but unknown cost of the collapse of the world's oceans' heat circulation patterns, or the episodic events like the flooding of the Mississippi in 1995, or the intense nor'easter that hit New York in 1992. The models don't account for heat waves that have killed thousands of people. And most importantly, the models assign no monetary value to the loss of natural systems.

As for our experience so far in climate change let's look at the facts. Environmental Defense has been working over the last few years with a number of multinational corporations to reduce emissions. The results of those efforts are now beginning to come in. For example, four years ago, BP committed to reduce their worldwide emissions by 10% below 1990 levels by the year 2010. Well just last month, eight years ahead of schedule, they announced that they had already

achieved that level of reduction at no net costs whatsoever. Now not every experience will turn out this way. But this is a real world example, not some theoretical projection.

He says Kyoto will cost too much for too little benefit, but the Kyoto agreement actually is fundamentally structured to minimize cost with flexible mechanisms, incentives for action, and opportunities to invest in reduction strategies like carbon sequestration. And as to the benefits of Kyoto, his graph went out to 2100 showing very little benefit. Kyoto only covers reductions mandated up to the year 2012, and everyone in the process anticipates that then subsequent reductions will be required. As for the benefits again, he hasn't taken into account, the models don't take into account the catastrophic storms that climate change can cause, and moreover, the limited economic models don't calculate in what are called co-benefits, the value of protecting forest ecosystems, coral reefs, and these can make a world of difference in the calculations. Simply put, the idea that we should rely on renewables and put the whole future of our world on the cost of renewables coming down stakes a pretty big bet on faith that that will happen. Doesn't it make more sense that we purchase insurance and make sure we put into place policies that will *make* it happen?

In closing, let me just say that my first point, progress has been the result of deliberate decisions often by government spurred on by nongovernmental groups campaigning for action; second, sure, some important problems are getting better, but several important ones are getting worse; and third, while costs are important and they need to be considered, we need to be very wary of the way cost benefit analysis as it's historically been practiced, systematically exaggerating costs and not reliably totaling up the benefits. Time and time again, these projections have been proven wrong. Will our environment be secure? As I indicated I believe the answer is no. Not yet. We can't be sure our environmental future is secure but we can act to secure it. I'm actually quite optimistic about the outcome. But I try to anchor my optimism in realism; that is, in order to solve problems we have to first recognize them, we have to admit they exist, and then we have to understand what has worked before and aggressively apply it to those lessons. Using this approach gives me cause for both hope and concern, and I think that's the combination that can yield the most progress.

Rebuttals and Questions

Moderator, to Fred: Thank you for a perfectly timed speech! So we now have five minutes of rebuttal for each of our speakers. They don't have to rebut every word the other said; they can say what they like. Bjørn, would you like to start?

Bjørn Lomborg: Thank you. Basically I think it's important to look at what is being said – three points. First of all, it's not GDP, it's about people actually taking actions. Well, the thing you have to – well, this is a little bit of a chicken and egg problem, the question of what came first. The point of course is to say could we really honestly imagine that we would have undertaken the Clean Air Act had we been much, much poorer? Of course the basic foundation is that we can afford to do so, whether it happens ten years earlier or later. I totally take that that is often dependent on individuals making that effort, and I praise you for doing that, and I think that it was good that a lot of organizations pointed out a lot of different problems, I still think that is a good thing. However, it doesn't undercut the fact that if we look around, all the places where we have good environmental legislation are rich nations. That is an important point to make.

And yes, China may be actually trying to clean up, but they are still one of the most dirty countries in the world, simply because they are trying still to get rich. And also there's a slight feeling of first world sentiment here when we say "Oh it's not about riches." One of the most important pollution problems in most developing countries is the fact you cannot afford to use fuels that work. We

use wood or burn high sulfur content coal in your homes, so actually most women and children are exposed to much much higher levels of air pollution indoors, they actually have to go outside to get fresh air which is mind you in Beijing or in Mexico City or somewhere like that. And the idea is that of course you switch to better fuels when you get sufficiently rich. It's one of those points again. So the idea is not China shouldn't wait, of course, but they have lots of other priorities and they are probably likely to focus more on those than on the environment in the first place.

However, You say things are getting better but there are still many things to be done, and then you mention biodiversity and say to deny that there is a problem is simply wrong to somehow implicate that I would deny that. I think that is important to say that there is a problem with biodiversity. However we also look at the endangered birds which you mention are 1 in 8, it's important to say that that does not at all translate into "die out" – actually it was estimated some years ago when they looked at all the endangered birds that very, very few would actually die out, mainly because we actually do something about it. So yes, we can do stuff, and we should do stuff when it makes sense to do so. And that is where we get to global warming which I think is the most important part.

Where you say, listen, we should not only do this, because it may not make good economic sense but we should do it as an insurance and you also mention your son and he shouldn't be driving around in your car without insurance. Of course that sounds eminently sensible, but it's only sensible if the insurance policy is a lot less costly that the house or car we are trying to insure. Otherwise you really have to make sure that your son is a bad driver. If you want to buy very expensive insurance you want to make sure he crashes it within a couple of days. So the idea here is that you don't want to buy insurance that is actually more expensive than the house.

And it's somehow evading the whole question with "It's a good thing, so let's do it." Of course if money were no object, we should do all the good things in the world but my argument is maybe we should try to do worst things first. First deal with the things that are really important, and then go to some of the other problems. And I think you have to sort of address the issue that all cost benefit models, not just some, but all and for very systematic reasons show that it's a very bad investment, basically because global warming is something where we can do very little far up into the future at a very high cost, whereas we can do very obvious things in third world countries right now. And so we have to ask ourselves, why is it we want so badly to invest one place rather than another one?

You talk about catastrophic change? I totally take it, I also discuss it in the book – however, what you failed to mention is that we have of course investigated the possible catastrophic results – both the Gulf Stream, the reverse of the Gulf Stream and the breakup of the west Antarctic ice sheet, and both of them come out right now, as our best understanding is, that it will not happen. It doesn't mean that we shouldn't do more research, but it also means that we should invest according to our best understanding. And we should then say, OK we know now, it will not happen. Of course we should invest in more renewables and that's one of the things I also write in the book, we are right now spending about 200 million dollars on research and development of renewables, we could increase that tenfold and it would still be nothing compared to the cost of Kyoto, and that would probably be a much better investment in the long run.

And of course I also agree with you that we shouldn't subsidize fossil fuels – naturally, we want to get there, and we also want to get there in a market-based way, that would make a lot of sense. But we should still talk about what are the actual costs, and I think you really have to confront that

problem of saying why is it we should do something when all our models naturally show that it is a very bad investment and we could do so much better with our money elsewhere.

Fred Krupp: Well of course I agree we need to set priorities, I don't know anyone who doesn't think we need to set priorities so I think that's a straw man. And as to the cost benefit analysis, that comes up again and again, I think the point is in using cost benefit analysis we need to be very careful. In advance, all of the air pollution regulation that we've done studies looked like it would be far more costly than the benefits. In retrospect the peer reviewed study shows that the Clean Air Act, what we've done so far in this country, the benefits have exceeded the costs since 1970 by a ratio of 42 to 1. So I think we have to apply cost benefit with a big grain of salt.

And we need to remember that some of the benefits of what we do just aren't quantifiable: what's the benefit of toxol derived from a plant and used to treat breast cancer? What's the benefit of having a bald eagle, how do you put a monetary value on that? These analyses systematically underestimate many of the things that make life special.

On the cost per dollar saved of lives, I think I've got a lot of problems with the graph and the study and the center that produced the study, because ascribing the main benefit of these environmental regulations was just to save lives and misses the boat – almost every environmental regulation any of us can think of is designed not merely to save lives but to protect the fabric of life – to protect our ecosystems, to protect the bald eagles to protect the interrelated ecosystems. Morever, the methodology used to determine the value of a life saved, is very interesting. If you have a car accident and you lose your life, your life has a high value; if you get cancer from benzene and you linger on for ten years with a horrible quality of life and then you die, your life is valued – the loss of life – is valued a lot less, because you've lived 10 years longer. It's a very interesting methodology that I have a lot of problems with.

But at face, I think he's questioning the cost of these environmental regulations. He said it's easy to spot a bad investment. The cost of environmental compliance in our country is less than 3% of our GDP – that's less than we spend per year just dining out. I think it's worth it. Drinking water – I think that's another red herring, frankly. Obviously we need to provide drinking water in the third world. But the idea that we need to prevent global warming in our ecosystem OR provide clean drinking water for the third world is a false choice. We need to do both and we can do both if we choose those policies that are least cost and smart. The idea of "Climate change is only a problem to the third world" misses the boat – more than half of Americans live in coastal counties where there are going to be storms that are more problematic. We are not certain that the storms will be more severe, although there's growing evidence to that effect, it's not at all clear that storms will be more intense, but when you put storms on top of sea level that's risen 1 or 2 or 3 feet out into the future, the surges into our subway stations will go farther inland and be far more problematic.

Finally, "Kyoto is a bad deal, Kyoto is a bad deal" – Kyoto is the first step to getting this problem under control. By setting a constraint on carbon emissions into our atmosphere we can begin to have the heightened incentives we need to spur entrepreneurs to develop renewable energy so that this future of renewables actually comes to pass and soon enough so that we avoid the worst of climate change. The catastrophic events I was referring to are not factored into the model, by catastrophic events [I mean] storms, more frequent storms, the circulation of the ocean – these are things that increasingly we know are the sort of nasty surprises that could happen in an

uncertain experiment that we're playing with our world. Is that an experiment we really want to continue playing? Don't we have to get on with fixing it, just make damn sure we do it in a way that makes sense and at the lowest possible cost?

Moderator: I'm sorry, I'm suffering from sensory overload frankly [trying to read] two cross-directed sets of questions to our speakers. I think I'm going to depart a little from fairness here as most of the questions are addressed to Bjørn, but since they are attacks, I'm sure Fred won't object to happily sit there silently. OK, so some of these questions have authors and I'll read the author's name where it's there and some don't. The first one is anonymous, it says "Mr. Lomborg, there's much literature by professional scientists saying that your work suffers from systematic errors and selective use of data. How do you respond?"

Bjørn Lomborg: Basically yes it's true that a lot of people have *said* that they have found errors, but it's surprising – there's an old lawyer saying, "If you have a good case, pound the case, if you have a bad case, pound the table." And if you read most of these peoples' work, for instance *Scientific American* which devoted 11 pages in proving me wrong: there's an enormous amount of table pounding but very, very little actual fact. I discovered two actual errors and I certainly corrected them. I have no intention of saying something that's wrong. But again, if I'm so obviously wrong, why don't they just point it out instead of keeping on making very common attacks and keeping on pounding the table? But it's a very hard question to address. I would certainly be inclined that if I were one of you and I heard a lot of people say "Bjørn is an idiot," to say, "Would I trust this one guy, or would I trust all these people?" It certainly seems like an obvious thing. Basically the only thing I can say is look at my home page, I've actually published all the negative reviews, the ones that I've been allowed to, and also, as well as my answers to them, and I honestly think that most people will find that there's a dire lack of good arguments but a lot of stringent words, which the *Economist* summarized as "lots of angry voices, but very, very little substance."

Moderator: I think we'll stay a little on this theme of the reaction to Bjørn's book. I must say I've read a lot of negative reviews, some of which I thought were less fair than others, and in particular there was one in *Scientific American* where there were four authors who criticized Bjørn and no reply from him, which seems to me a departure from a sort of fair rules of debate. So I'd like to put this question to Fred Krupp that's addressed to Bjørn: It says, "Are you disturbed that *Scientific American* ran four negative reviews of Lomborg's book without a rejoinder from Lomborg. What's that say about the desire for fair play in the scientific community?"

Fred Krupp: Well, I'm here because I believe in free and open debate in the sunshine. I know on our own web site we've been pleased to publish responses to the data. We have a site called Scorecard when industry objects to how a particular facility is characterized, we publish it – I'm not familiar with exactly *Scientific American*'s editorial board or that dispute, but I believe that both sides should be heard. I think when both sides are heard, it will turn out that people conclude that we can't afford to be as complacent as Bjørn wants us to be, that our environmental future is not secure. So I'm happy to have a free and open debate, I think the facts will show that we ought not ignore climate change and work on other problems, that we have got to get on to solving it. I have got the confidence – the scientists have been saying that these are real problems and I think that's what will come out with free and fair debate.

Moderator: We'll keep on this issue. Here's a question from Jerry Olstrom: "Dr. Lomborg, what motivates the vast majority of scientists according to the media to reject your thesis? Is it greed, ego, peer pressure or just plain stupidity? And why don't more of your supporters speak up?"

Bjørn Lomborg: Quite a loaded question, eh? I think most scientists are really honestly trying to do the best also in the environmental sciences. I think however there's also a tendency for any science area – I certainly know, I've done some stuff in a very remote and uninteresting subject for most people – but you know, you tend to think that that's the most important thing in the world. And so obviously somebody comes around saying, well maybe this is *not* the most important thing to do, this is not what we should be doing first, there's obviously a challenge of interest both psychologically and possibly also in the long-term funding. I mean we shouldn't be unaware of the fact that a lot of people are much better funded in for instance climate research now because there is global warming. I'm not saying that's why they're making the models – certainly not. But it's not unlikely to be also that they do worry about those kinds of problems. So basically it's not unlikely to say at least that there would be a certain interest and a certain understanding in saying "My area is the most important." On the converse side I hear a lot of scientists coming up to me personally and saying, "That's really good, you should keep on," and all that stuff. I mean they don't do that in public because hey, what's the advantages of getting shouted out and getting pies in your face and being number two with Lomborg? I mean, I have a hard time doing that, and I could certainly understand why other people wouldn't want to do that – and yes, I would want more people to stand out and they continuously always say, "Good work, do that" but they don't do it themselves.

Fred Krupp: I think one of the things going on here is that Bjørn has made a very strong consistent statement that environmental groups are guilty of one-sided thinking and exaggeration and bias, and yet when I read the book, the chapter on global warming, I think anyone who reads it sees that he argues that basically the lower end of the projected warming will happen, the lower end that the IPCC has said is possible, and points out things like clouds – it's quite possible, in his view, that clouds will mask the effect and slow down global warming. But as the scientists have pointed out, there's a lot of debate about clouds, and in fact clouds at some altitudes probably will slow global warming and at other altitudes will speed it up – it depends on characteristics of their surface, what types of clouds and on and on. Similarly, on the many sections of the book where he talks about environmentalists exaggerating the problems and exaggerating the costs – well, I think an objective book, just like on global warming, an objective book would have pointed out that he was making the case just for one side. Objective discussion of the state of debate would point out that industry has been guilty again and again of exaggerating the costs, and I think the failure to point that out in the presentation today to all of us is really a problem. In essence the idea that OK, if we're going to look at this, let's be objective, by that very standard I think, was it Shakespeare who said, "he's hoisted on his own pitard."

Bjørn Lomborg: I'm not sure I understood the Shakespeare quote. I'll get back to that one.

Fred Krupp: I can demonstrate if you like!

Bjørn Lomborg: That sounds very bad! I can hear that much. No, but basically I think it's incredible to say that the failure to point that out today, I mean the fact that what I was basically pointing out was that we are getting better. I was not talking neither about the environmental groups nor industry, but I totally take your point, industry is also very guilty of underestimating many of the environmental problems. However, the important reason and the reason why this book is incredibly important is that we have a situation where almost nobody trusts business. We have a 1 to 3% trust of business – that's probably very good, because they are interest groups. But most people actually trust environmental groups more than they trust government scientists, and that's a problem because environmental groups are just as much an interest group and there should be also very widespread skepticism to what's said by environmental groups – that's why it's much more important to discuss the environmental groups, because that's what people trust.

Fred Krupp: It would be reassuring, Bjørn, if I could believe that environmental groups are so powerful as you assert; I remember just a few weeks ago, with mileage standards for cars having deteriorated in this country over the last 20 years, and the worse mileage you get, the more greenhouse gases you're putting out, and we have a lot of SUV's and trucks now – that's half the American fleet. Things aren't good and they've been getting worse in the last while. Just last month Senator Lott, working with the auto companies, said "If we bump up these mileage standards, all Americans are going to be out there driving golf carts." The problem is, his side prevailed. So the idea that it's the environmentalists that are too powerful, they're the ones that carry the day, I don't think the facts support that.

Moderator: I like that you're an even-handed audience, your applause seems equal to both sides. This is a question for Bjørn from Nathaniel Store: "Do you think there's any practical worthwhile alternative to Kyoto? Some internationally mandated agreement?"

Bjørn Lomborg: Basically the problem is that it is incredibly costly to cut emissions dramatically. We should certainly, all the models show, we should do two, three, four, five percent, maybe even ten percent emissions cuts. But what we're talking about in Kyoto is 30 percent that we otherwise would have had in the industrialized countries. If we can get the developing world with us on some sort of limit, it would be cheaper – it would still be a bad idea but it would at least be a less bad idea, however it's totally unlikely that we're going to be able to do that, simply because it involves distributing net worth of tradeable rights for over a trillion dollars and that's just very hard to see all the nations in the world sit down and negotiate that. I think the basic point here is to say, a very cheap way of doing it in the long term is to make sure that we have lots of investment in renewables. What we basically see, the reason why they've been dropping dramatically in price over the last 30 years is because of basic research and solid state technology. So it will continue even if we have these meager investments that we have right now. But we could increase that dramatically and that would be a much better investment in the long term than doing Kyoto now. Let me also just say because Fred keeps putting this up, that Kyoto is just the first step. That's entirely true, that is what the argument is – I just showed you what would happen if we do Kyoto,

of course if we do more than Kyoto we will slow down global warming more. However the costs will also be phenomenal, simply because we're basically taking away the lowest hanging fruit, the cheapest cuts in emissions we're taking away now, so we'd end up with much, much worse, much higher costs, and of course all these global cost benefit models also looked at this, and have also said yes, doing the first step of doing Kyoto is actually pretty expensive and not a good deal, and so obviously it seems logical it might not be but it turns out to be that doing even more that just the first step is an even worse idea. And of course we need to have this understanding, still in our understanding of "So where should we prioritize," and let me just do this one last point – you say it's a red herring, this "Drinking water or should we do Kyoto? We should do both" – that's a little bit like saying when Marie Antoinette said, "Let them have cake," and then somebody comes around and says, "Well, you know, it's actually much cheaper to give them wheat." And then you go, "Oh, do both!" It doesn't make the bad idea a good idea just simply because we say, 'Let's bundle it with something else.' I am actually making the argument because basically this is how do we help the third world and I'm asking, how do we help the third world develop very well or very inefficiently, and it doesn't stop with providing clean drinking water – if we are willing to give double the amount to the developing world, there's still health care, there's malaria, there's lots and lots of other things that we can invest in before Kyoto becomes a good way of helping the third world.

Fred Krupp: Well, I'd like to use my five minutes replying by saying, no we'll keep it to three, but what is it about theoretical predictions that's so much in variance with fact? Let's look under the hood at what's happening with this huge oil company BP. They agreed to cut their emissions by 10 percent in ten years – they did it in four. How did they do it? Well, what they did is, they set up a trading system internally. They assigned quotas to each of their 110 business units around the world and told each unit they had to cut emissions by 10% even if those business units were growing. Well, some of the business units couldn't do it so they also set up a trading desk and the ones that were going to have more emissions paid others to reduce by far more than their 10 percent. They didn't just harvest low hanging fruit. They created a dynamic ongoing system to give incentives to people to hunt down the lowest cost reductions. And that hunt still goes on. And if you go to their web site, you need a password from them, and look at the trading desk, these emissions credits are now trading for a mere 7 dollars for every ton of carbon dioxide reduced. I bring this up because that's the real world. These cost benefit predictions have a history of not being reliable. I bring it up because BP is modeling for the world of what the Kyoto agreement is. It's a dynamic, incentive-based structure made here in the United States, modeled after our acid rain law, that will set up a market system to hunt down the lowest cost reductions. The money that is paid by the laggers will go to renewables and other folks, it will speed up the development of those technologies. I find it ironic that some of the conservative think tanks that have aligned themselves with Bjørn's work align themselves in rejection of a market-based idea that was made here in the United States to fit perfectly into our economic way of life, using markets to produce environmental goods instead of just luxury goods.

Bjørn Lomborg: I believe we should trade it, that would make it cheaper, but I think it's ironic that we have a discussion where you produce the fact that BP has actually reduced their emissions for zero, well actually it turns out it must be positive because they're still trading at 7 dollars, but at a very low cost, whereas I'm only producing all the major cost benefit models that have ever been produced in the world. And they all claim that it's going to be pretty expensive. And yeah, I'm just, had I presented data the same way, for instance with IPCC or anything, I would have been called – it's totally invalid to do that. I'm basically saying these are the best models we have and what you're saying is, no, let's go with your intuition that BP is the better example than what these best models are. And it is an important issue because we're basically talking about spending three to seven times the global development aid in the world, we're talking

about spending a lot of money. It's *not* the end of the world, no, we can spend it badly and still do well, but we could do this much better, and that's the important point.

Fred Krupp: The difference is, one is a theoretical model, the other is real world experience. It's $7 a ton but when they calculate in their other savings it's no net cost. That BP is not a little itsy bitsy company. Emissions from our petroleum sector refining and transporting oil are a huge part of the total problem – the fact that they've been able to do it, and that Du Pont has committed to reduce their emissions by 65 percent of their overall greenhouse gas emissions, that Alcan Aluminum, one of the world's two giant aluminum producers, has committed to reduce their emissions – these are profitable companies. It flies in the face of these models, these theoretical projections that are just wrong. The real world experience, companies are doing this; it's not that expensive.

Moderator: Ok, we're now going to throw a three-part question at Bjørn, if he can handle it. All these questions have a common background, the feeling that your book, your analysis focuses too much on economics and ignores the ecosystem – so one question is, "Why do you focus on human beings, what about animals that are dying out every day and are lost forever, these will never come back?" Second question, "Your graph on calories doesn't take into consideration the cost to the environment – it's human-centered. Some might say we are feeding the world more calories at the expense of animals' environment – can you respond?" That from Cathy Newcomb. And the third question, "You're assuming that the biosphere can withstand the development of a great majority of the world in population terms. Given our great lack of understanding of the biosphere's workings, how do you justify this position?"

Bjørn Lomborg: Basically yes, I am using a human-centered approach. I'm making two arguments and I do that very clearly in the book. One is moral – I'm a vegetarian because I don't want to kill animals, so I actually do believe animals have more rights than I think many of you in here do, but that's not the same thing as saying that I don't think humans are morally superior, and they count for more. Yes, that's a moral statement, however you don't need to agree with that but I also say it's a political statement in the sense that it's human beings who decide. When we talk about people, penguins and pine trees, it's people who participate in a democratic position – and it's not clear how in any way we could make the pine trees have a vote, or penguins have a vote. And so the idea here is to say what matters in the world is what human beings value. This is something you can deplore but that's what the political reality is. However, that does not mean that there's not a lot of things that we have in common, interests we have in common. Penguins like clean air as much as human beings like clean air, and we depend on many of these animals and therefore we do also care about them. But yes it is a human-centered approach, and I think that's both politically and morally accurate, and certainly a politically, empirically correct description.

About the calories at the expense of the rest of the natural world, it's true that our increased production has increased pressures on the world, it's unlikely to expect that we can have 6 or 8 billion people on this earth and not change the world we live in. However we also have to realize that many of the things that we've done, for instance the green revolution, has actually made it possible for us to produce many more calories on much the same land. Since 1960 we've increased the land area that we used for agriculture only about 1 percent, we've gone from 10 to 11 percent of land area, we're expected to possibly go up to 12 percent by the end of 2030. Now this indicates had we not used fossil fuels in making fertilizer, using pesticides, using high yield varieties, it would be much, much more, and in that sense our ingenuity has saved much of the rest of the world, and also note where we are actually for instance reforesting in rich countries where we can actually afford to say "We care about the environment sufficiently much that we

want to reforest the area." So again the idea here is to say, in the long run, the only way that it's possible to imagine that we can live 6, 8, 10, even 11 billion people on this earth but only if we are sufficiently rich that we are able to care about the planet at the same time.

The biosphere? It's totally true to say we don't know, this is an unknown experiment in the long run, the only argument here is to say what our experience seems to be is that we have in historical terms certainly overcome more problems than we have created. But we don't know, we're basically sailing on uncharted territory not only in a scientific sense, but in the social sense as well – we are experimenting in many of these areas. The discussion when we talk, for instance about global warming, is exactly that kind of discussion: we're saying we're trying to make the best possible models, and find and look at the data and say, "So where should we go?" And that is of course also why I find it so disturbing for instance, I actually try to present these models, but somehow we hear that the intuition of you, is a better guide than these models. We never accept that when we talk about global warming, we accept the climate models from the IPCC because we believe that yes, there may be problems with these models and all this other stuff but it's still the best we can do. So the idea is to say when we talk about the biosphere, we don't know, but it certainly seems as if, if history is any indicator, that we are basically able to deal with the problems that we find, and also of course free debate is an incredibly important part of that and we are actually able to focus on the problem so that we solve them positively and hopefully before they become too expensive.

Fred Krupp: The question was about people versus ecosystems and I want to talk about people, but first just a word or two about ecosystems. I brought up in my opening remarks the fact that birds, one out of every eight is endangered. We know this [because] unlike other species birds are kind of big and people like to go out and look for them so we've identified almost every bird that exists in the world. If we found a new one it would be quite something. And so the World Conservation Union has gone out and surveyed each and every bird, how many are there, what's happened to their habitat. And so from that extensive study in every country, we've learned one in eight are seriously in trouble because their habitat is vastly shrunk, they are in danger, they are on the verge of going extinct. The red cockaded woodpecker in the southeast United States, only 2 percent of the pine forests that used to exist are now around, so it's an example of a bird in big, big trouble. Now, Bjørn said, "Well, these birds, a lot of them really aren't going to go extinct." And I hope he's right, but I hope he's right in the sense that we do the things we need to do to restore robust habitat, and that they aren't going to be like many of the endangered species that are now on the list that exist merely a few of them, 16 of them, 18 of them, 10 of them in a zoo, some of them in 2 zoos. That's where I get back to people. And what kind of world do we want to leave for our children – a world where to see these species you need to go to a zoo, to see some of the last remaining red cockaded woodpeckers consigned to a cage? A world that exists more like a moonscape than the world that we now know? Is that the world we want to consign our kids to? That's not the world I want to consign my kids to, and I think it's worth a concerted effort to find the least-cost solutions, but not give up on solving these problems. The doomsayers are the ones who say, "It costs too much."

Moderator: I think I better get two last brief questions of my own. Bjørn, in your book one of the main points you make is that the environmentalists are always telling us things are going wrong, you say that they have a litany of doom and disaster-predicting. But given the sort of inertia in our society, isn't it necessary for activists, for advocates, to state their cases as strongly as they can, even exaggerate a little, in order to get anything done? Would you give them a little bit of license?

Bjørn Lomborg: I totally understand why interest groups would want to do that. However the end result is not one we want. Basically if we have a society where all the different interest groups just shout, it's not that we stop prioritizing, we just simply get worse at prioritizing because who are we going to listen to if everybody just shouts? And we end up just prioritizing the people who shout the loudest or have the cutest animals, and that's not a good way to prioritize. We need to focus on the facts, and I totally take it in a sense where the environmental groups are up against a lot of other areas that who also shout – then you can say look, isn't that unfair, I only wrote a book about the environment? And yes, I mean we ought to look critically at all the different areas but I think there's a special problem in the environmental area exactly because – I was not saying that you're more powerful, I was just saying that you're more trusted – and that's what the surveys show. And there's a problem here because most other areas, there's more even trust between the people who are arguing different solutions, whereas in the environmental area it's so clear that you have the moral high ground and business organizations are so obviously liars, everybody thinks so, and that creates sort of a problem.

Moderator: Another of Bjørn's points is that it is all very well for every advocate to put his case as strongly as possible and for the environmentalists to tell us things are getting worse and worse but that this leads to a distortion of priorities, and so isn't that a danger and the more effective advocate you are – and I tend to agree with Bjørn that the environmental movement does have an enormous influence in this country – isn't there a danger of making us overspend on some environmental problems?

Fred Krupp: Well there's exaggerations on every public issue not only on environmental issues and I think they are regrettable. I agree we need to stick to the facts. I became involved in this line of work when a professor of mine named Charlie Walker said, "These problems are solvable if people would just lower their voices." And my organization's hallmark has been, as an organization started by scientists, we shy away from hyperbole and exaggeration, we stick to peer reviewed work and facts. I think exaggeration makes for a vulnerable case and we should stick to the facts. I guess, Nick, I haven't seen vast overspending on environmental problems, I see that it's hard to summon the political will to address a problem like climate change when a lot of the worst effects are 30 or 40 years out, although we're seeing more of them sooner than any of us has thought possible. So I'm not as worried as you perhaps that we're going to overspend on these problems. I worry, can we summon the political will to make a world that folks will be proud to pass on to our children.

Photographs by Jennifer Coleman.