

## Rowland Panel: Questions & Answers

*This panel was moderated by Kai N. Lee\* and William Clark† and consisted of Jonathan Wiener,‡ F. Sherwood Rowland,§ and Eileen Claussen.\*\**

*Lee:* Thank you very much for your stimulating comments, Eileen. Now, lets take some questions. Our first question is from Bill Clark.

*Clark:* Question one is directed to Jonathan Wiener. This is on lesson drawing. The first observation concerns your comprehensive scheme. I want to ask you to push that a little bit further. Many scientists are skeptically looking back over what lawyers have done to them in environmental policy in this country. I will hark back to the first Clean Air Act when we woke up one morning and discovered that a group of lawyers had invented a set of numbers, relating to how much of a series of pollutants was safe in the air, that were established by law and were required to be backed up by scientific evidence within 60 days. That Act sure pushed a lot of science that got better and better and finally ten years later actually provides some of the necessary foundation. And, it improved the air quality. There is no question about that. But it was a tortuous process in part because the dialogue between the science community and the law community concerning what would be scientifically defensible and measurable did not happen until after the fact. Now, you come in and you give a very compelling case about why

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looking comprehensibly at the greenhouse issue makes sense, and it makes sense for all the reasons you said— even scientists have been saying that would make sense. But, we see in Eileen Claussen's presentation the consequences of, essentially, the legal community giving the scientific community a framework in which the presumption is that the science is up to handling multiple sources and sinks, that the science is up to handling global warming potential, and that the science is up to being able to say it could provide monitoring of actual emissions at a country scale with narrow enough uncertainty limits that you could actually tell, not just for CO<sub>2</sub>, but for nitrous oxide, ozone and methane, how much each country was contributing. Now, there is unquestionably the forcing function of using this approach— that more science is being done on these areas. I would argue, however, that that formulation of the problem, as opposed to the very simplistic, unadventurous one the Europeans were pushing, landed us in the middle of a much higher degree of scientific debate and inconclusiveness than we need to have been in, and may be fueling part of this diversionary fire that Claussen refers to. So, I wonder if you would reflect a little and perhaps go back and forth with your colleagues on whether one of the lessons we might learn is that by bringing some thought to the intersection between what law and economics and what science says, we could deliver more comprehensive solutions and how that might carry forward to whatever the next problem is we have to negotiate.

*Wiener:* The question that you posed, Bill, was explicitly confronted back in the early 1990s. The question is: "Does making the policy more comprehensive to match the ecological and economic system make it so complicated that it cannot be implemented or it cannot be negotiated?" First of all, I think you are right that ultimate comprehensiveness is not the goal, and that there is some optimal degree of comprehensiveness— that there is some optimal degree of designing the legal system to match the ecological and economic system. Trying to get it to the *n*th degree may start to slow down the process of legal reform and legal implementation. We, the legal community, held back on creating law in any number of additional ways that would have made the system more comprehensive. For instance, as Professor Rowland mentioned, sulfur aerosols reflect incoming solar radiation and so exert a net cooling effect. Well, if you want to take account of the net global warming impact of burning coal, you have to look not only at the CO<sub>2</sub> emissions but also at

the sulfur aerosol emissions. There are some studies, for instance by J. Edmunds, that suggest that in the short term—roughly on a 50-year basis—switching from coal to natural gas or even to solar power would increase net global warming because the sulfur aerosol reflective effect of coal is so much stronger in the short term. Over the long-term, the carbon dioxide lasts longer in the atmosphere and has a bigger effect.

Now, we did not do that. We did not go for that in our comprehensive approach, partly because that was being handled under other laws. Another way to look at this is to say that the Clean Air Act's 30-year effort, in the United States, to reduce tropospheric air pollution has had an unintended and perverse consequence for global warming—scrubbing sulfuric aerosols out of the atmosphere. I think that it is not the case that economics and law would say you have to be maximally comprehensive. They would say you ought to be optimally comprehensive—that you ought to address the next ripple in the system to the degree that that ripple generates more benefits than costs and drawbacks. That is what we tried to do.

Now, interestingly, in the early '90s when Dick Stewart and I proposed this comprehensive approach, we were attacked from both sides—both from within the government and from the outside. That is, one side said exactly what you said: "You are making this so complicated, this cannot be done." By contrast, it was attacked almost more vigorously from the other side, that said: "What! This is going to cost less! You are delivering a recipe for action on global climate change that is going to make us adopt a regime when we know we should not be doing it that way!" That was the reaction from, for example, the staff of Governor Sununu who was then chief of staff to the President. So, I do not think that comprehensiveness necessarily cuts against or in favor of action. And I certainly agree with your point that because we designed a legal regime comprehensively, it has stimulated a much greater investment in the science of measuring these other greenhouse gases. If we had used the European approach of just regulating carbon dioxide, those other greenhouse gases would not have gone away. They would still be emitted into the atmosphere—in fact, increasingly so. So, it is no solution to say that comprehensiveness is complicated so let's just regulate carbon dioxide.

*Rowland:* I think I am going to start out by telling an unrelated story that is stimulated by hearing that you were a Harvard debater. What you do is look for the big killer. Back in

1975, there was a debate group at USC and the topic was regulation— whether government regulation of air pollution was required. They adopted the regulation of CFC's as their point, and this was the killer because none of the negative debaters had ever heard of it. Roughly speaking they won something like 98% of their debates when they flipped a coin and got the affirmative— as they did about 60% of the time. But 60% and 98% averages make them very good. The following year, there was another debate topic which could be worked this way, and so, they started out there, and about halfway through the debate season John [Cassinelli], who was the USC debater, came down to talk to me and he actually had a written document. USC was starting to lose because the negatives began arguing that if this— CFC ozone depletion— was really occurring, then industry would just kill me to keep me quiet. And so, he had brought down a document for me to sign— a document that he could pull out in the debate in case of my sudden death. The thing that struck me as surprising was the contention that it was an unbeatable assumption that industry would just kill me. The assumption that industry would eliminate anybody who spoke up was regarded in the college debate circles as being self-evident.

Now we return to the question. I had a call from somebody who was helping somebody at Stanford— they said they were trying to evaluate the amounts of CO<sub>2</sub> and methane emissions, and that they could see that it was easy to calculate CO<sub>2</sub> emissions, but that calculating methane emissions was a problem, and they wanted to know where the data were. Cows are what we have the best data on. There are some more measurements being made, but no one knows how much methane is being emitted from an individual city in the United States. The problem that I have with this is that we can do a pretty good job of measuring CO<sub>2</sub>, especially from fossil fuels because they are burned in a particular place and they are weighed, etc. But for almost all of the other gases, you could make a qualitative statement about how much is being emitted on a global basis, but you have almost no way to measure emissions on a country by country basis. The analogy is to currency trading among countries where you do not quite know how much each currency is worth and you do not know how much is being offered. So, in getting your contributions counted for Kyoto, there all sorts of opportunities for fraudulent science. If you really want to do this on a scale comparable to CO<sub>2</sub>, then there has got to be a far greater international effort toward trying

to put quantitative numbers on the emissions of methane and of nitrous oxide, of sulfur hexafluoride, perfluorocarbons, all of those things, where the exchange rate is not very clear and, certainly, the productivity is not very clear. So, we are in for maybe a decade or 20 years of arguing about how much there is and how much it should be worth and starting to measure it. Somewhere down the line we could start answering those questions, but we are nowhere near it now.

*Claussen:* Let me just say that there are two ways to do this. You can set up something very broad and then implement it on an incremental basis. You can implement a small agreement on something like CO<sub>2</sub>, which everybody can deal with, and then try to broaden it to include all the other gases and all the other issues at a later point. I think the problem comes when you set it up broadly and assume that you can do everything and you set up these kinds of schedules and you rush forward and, in fact, you cannot do any of it. And that is sort of the situation we are in right now. Not, I think, because you could not have done it right with a broad framework, but because people do not tend to do that. They just want to rush forward on everything.

*Wiener:* I do not think the lack of progress on controlling greenhouse gas emissions has any clear connection to the degree of comprehensiveness—that is, in fact, if the comprehensive approach makes it 60% less costly, then we ought to expect faster adoption and implementation than if the regime we adopted was twice as costly. To the extent that U.S. political leaders are unduly averse to restricting greenhouse gas emissions, they would be twice as adverse if they thought it was twice as costly, roughly speaking. The countervailing problem with starting narrow and hoping to broaden, as Eileen suggests, is that when we start narrowly—and this has historically been done in U.S. policymaking—then political interests become vested in the narrow approach and entrenched against broadening, so the broadening does not happen. That is, I thought, the point of yesterday's discussion—concerning how ecological systems were very complex—so, if we take narrow approaches we will have perverse environmental effects and we will not get to the broad approach. I am not arguing for infinite breadth. The other point about measurement uncertainty is that there is, what I called in an article, the precautionary paradox here. The precautionary principle says uncertainty is no justification for inaction. So, we are uncertain about what degree

of global warming will be caused by a certain amount of emissions and what the regional impacts will be. That is no excuse for doing nothing about global warming. Well, then when we get to the non-CO<sub>2</sub> greenhouse gases, we say: "Oh, uncertainty! So let's not do anything about them, let's wait." Even if we have uncertain measurements, those can be a better basis for action than for inaction.

*Rowland:* I tend to think that it is easier to get the whole bag at once and then try to fill it in and actually make the measurements later on, than it is to add things when you start small, because when you start small, all the lines get drawn early on.

*Lee:* The next question regards industry attitudes toward different types of global climate change policies, specifically the use of energy taxes.

*Claussen:* There has been a real shift in the business community, and it is not only what they are doing inside—it is how public they are being. There has been a real shift. I would say the reality of Kyoto made for some of that shift, the increased consensus on the science made for some of that shift, and some of these CEOs actually reading the IPCC reports made for some of that shift. And, actually, a fair number of them really believe it. Because Kyoto is there, whether it takes five or ten years to implement or not, some of these CEOs would like a say in the policy, and you cannot do that by just saying no. The other thing I would say is that the group that always opposed any kind of action, whether it was Kyoto or anything else, is still there. They are the people who view themselves as the losers in this. It is primarily the coal industry, but it is also parts of the oil industry—but not all of it. It is the railroads who transport the coal, and so on. And they are still there, and they still have the same arguments, and they still are very vocal. So, you have not seen all of industry suddenly decide this is something that ought to be done. But there really is a significant split within industry, which is positive for constructive policy because at least we have some support for some things that are rational.

Now, do they like the idea of a carbon tax? I think they prefer the idea of a cap-and-trade system. They may not like the targets in Kyoto and may think that they are too soon or too much. Some of that might have to be revisited. But I think they

prefer that kind of a system to a tax. Right now I'd say you'd get very little support for a tax.

*Rowland:* Starting in May of 1997, the monthly global temperature broke the record for that month—that means 120 years or thereabouts of measurements. The monthly May 1997 temperature was higher than any of the Mays in that 120 year record. Then, in June, the June 1997 number was higher than any of the monthly records for June. That pattern continued for 18 months. If you are throwing a coin, about the 18th time it comes up heads you get suspicious that it may not have a tail. And so, the question of what people were thinking in 1995, or 1992, goes out of date when 1998 broke the temperature record by a considerable amount for any year before that.

*Lee:* The last question asks whether increases in agricultural productions might also now interact with global climate considerations because of nitrous oxide.

*Wiener:* I think that is quite a good point. In terms of the share of total human contributions to radiative forcing, nitrous oxide is fairly small compared to carbon dioxide and methane, the vast bulk nowadays. But, at the margin, that is, if you made changes in particular policies, nitrous oxide emissions could be quite important, and the example that I suggested, but did not elaborate in my talk, was that we switch from fossil fuel combustion to biomass fuels—one of the leading proposals for doing so is to replace oil with corn-based fuels. Corn is one of the most nitrogen fertilizer intensive crops and that would involve a good deal of nitrous oxide emissions. There might be ways of growing crops without so much nitrogen fertilizer. There might be ways of growing nitrogen-fixing crops. There are all sorts of other options one might pursue. But, if one does not pay attention to nitrous oxide, one could have some very pesky perversities.

