Interview with Prof. Susan Solomon
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AS: To what extent do you think the international ozone protection regime can be used as an exemplar for the international climate protection regime?

SS: Ah, there is a fairly extensive section on this in my book and the bottom line is that it's easy to say they have a lot in common scientifically. You know, both sets of gases, most of the major ones anyhow, have very, very long lifetimes so the accumulation problem from year after year of emissions is very serious in both cases. It's easy to say that both are global problems, so there has been a– and of course the ozone regime came first, which meant that many of the same people – I don't know if you know this – but many of the same diplomats that worked on the ozone regime thought "oh it worked so great for ozone– why don't we just translate those ideas into climate change?" and you can of course find some discussions on that, for example, in Richard Benedict's papers and books, which I'm sure you've come across. You know he was the head US negotiator I knew him very well, he has Alzheimer's now unfortunately so you won't be able to interview him, but so those things are all easy to say but in practise what we've learned the hard way is that they are necessary but insufficient conditions to say that the two can be managed in similar ways, and some of the key reasons – I mean there's lots of reasons they can't be – one of the easy ones to talk about, of course, is the fact that even, you know, at least at the beginning of the Montreal Protocol you only had maybe… I don't know the exact figure, but on the order of a dozen, probably, chemical companies, worldwide, making the substance, so it was, it was straightforward to think about controlling production and you were controlling some of the very same companies that had made pesticides and pesticides had the same, you know, those companies had learned about control hahaha They had an ability to work within a regulatory regime – that's rather different from the fossil fuel companies, but it isn't just that, it's all the more important issue really is the fact that although chlorofluorocarbons are used in lots of different applications within our economy, no one would ever say that chlorofluorocarbons were the sort of, you know, mainstay or the basis for our economy, and the real the real fundamental problem is that you need energy to make a Euro and therefore when when you look at carbon emissions versus GDP you see a very strong relationship, where the wealthiest nations emit the most carbon, because they, they first of all need the energy to be to become wealthy, and second of all, once they become wealthy, they become, you know, very avid consumers, so all that snowballs to… to… to mean that there's ah, there's ah, an economic link there that is just far, far deeper than it ever was for the chlorofluorocarbons. And what that means is that the two major producers, the major producing countries, are not going to agree to a serious binding protocol and I think we learned that the hard way over many years of negotiation, I mean the Kyoto Protocol was sort of a brave attempt to model a climate protocol to at least get started on a climate protocol in a way that was similar to the, the ozone protocol, the Montreal Protocol, and you know it, it did achieve some important successes. I think you have to give Europe a lot of credit in being willing to go first, particularly countries like Germany and Denmark and others, who invested in technologies for alternative energy sources and really had a huge role in kickstarting

the decreasing cost of those technologies, um, but there was no way that the US and China were going to sign on, I mean in any substantive way. Of course, as you know, Canada signed on and then got out because and it's fundamentally because once horizontal fracking and shale oil became so profitable, you know, who's making that kind of money is going to agree to something that substantially curtails it. And you know, so the voluntary nature of Paris I think is absolutely a critical aspect of why it's the right way to go. When you have a binding agreement, all countries kind of try to low-ball it, because they don't, they can't afford to fail, you know, 'cause if they really want to stay in, then they have to meet whatever target they set. Whereas if you make it voluntary, there's a you know it's a huge incentive to be bold and to say "OK…", you know and it's also a huge incentive for each country, it's more than an incentive, it requires each country to really seriously sit down and figure out how much could we do, right? Before they come in with their pledges. So it encourages, sort of, a rise to the top, instead of everybody falling to the bottom, which is what happened with Kyoto. So I think that Paris is the right way to go, a voluntary agreement, especially now that costs for alternative energy sources have come down so much. So you know, I think you can easily see where we have managed through some technologies that have enabled the development of cleaner fuels, like horizontal fracking and drilling for gas it has you know had a huge impact on displacing coal, like in this country, but in some other countries too. Gas is still a fossil fuel, so in my opinion it has to be viewed as a bridge fuel, but I'm not personally opposed to the idea of that because the foremost imperative has to be phasing out coal. Now there's one other thing you may not have thought about, which is that, the fossil fuel companies, their business is to exploit a mineral which they either own or lease and they have an enormous infrastructure investment in that resource. For example, you know, there are dozens of offshore, big offshore oil platforms, and every one of them costs a quarter of a million (sic, billion) dollars, so you know they have to recover that investment. Peabody Coal owns mountains tops of coal, so they own a massive amount of coal, they're looking at trillions of dollars of investment, many, many trillions. They are not going to be the ones who are going to profit from whatever else is done. The opposite was true in Montreal because, first of all, you know they had significant investments, but in the order of billions and not trillions and the same companies, if they could be smart enough, stood to gain, maybe not gain, but at least not, you know, lose money hand over fist, by going over to something else. They knew they would be the ones to make the hydrofluorocarbons and the hydrochlorofluorocarbons and now they're going to make the hydrofluoroethers for refrigeration and air-conditioning so it has many, many aspects of win-win-win in the case to the Montreal Protocol, whereas the climate change issue is just too easy for people, for countries, to be just far too wary about getting into it. I mean I could go on for the whole rest of the hour on this question actually, but maybe that's enough to get you started. Does that work for that? I actually have more to say about it, but I'm gonna leave it. Do you have any other follow-up question based on what I just said?

AS: Well, I was also going to say at the top that I'm not Walter Cronkite, so I don't think you need to be worried about a "gotcha" moment or anything… Being aware of those differences, although there are similarities, there's also quite substantial differences in the circumstances or the facts surrounding each regime, but acknowledging them,

notwithstanding them, do you think similar success, similar emissions reductions, that were achieved under Montreal, could be achieved under the existing climate regime?

SS: I do.

AS: And how do you think that might unfold?

SS: Yeah I do, I do. I'm very optimistic about what's going to happen going forward on climate because the cost of renewables has come down so much, number one. So even in this country, it is, if you're going to build a power plant today, it is cheaper to build a solar or wind plant than it is to build even a gas plant or a coal plant for sure, coal has gotten quite expensive in this country and nuclear is more expensive still. I'm not against nuclear personally and I do recognise the potential for the intermittency issue, but you know there's various ways that that can be solved, so I'm not I'm not as concerned about that. When it comes to transportation, you can see the rate at which the electric vehicle is displacing the internal combustion vehicle, so at least for private cars, you know, it's been a tremendous rate of substitution there. General Motors has just announced that they are not gonna make any more fossil fuel vehicles, so it's you know everybody recognises I think that private cars that run on fossil fuels are on their way out. Obviously the last thing to go will probably be the airplane you know I mean how we're going to– what we're going to do with biofuels or other things, but right now I mean air travel in some ways is more, you can actually do things well it's emissions because of the governance regime that already exists for air travel. Even if you can't phase it out, you can tax it, which is what you know Europe is getting ready to do. I think that you will see, you've already seen big changes if you look at the pledges that have already come in for, you know, what the US and Europe are both doing is talking about net zero by 2050. China is talking about net zero by 2060, so they want an extra 10 years, that of course is based on the "common but differentiated responsibilities" principle, right? They need more time. I think that Mr Biden's summit was very important, both to make sure that the US got a clear pledge on the table at a very early point, demonstrating his commitment, and of course the Europeans have come in too and both of them are talking about you know 50% reductions by 2030. The 2030 pledges in many ways are more important than the 2050 pledges. 2050 is largely aspirational. 2030 sends a signal to industries, right? It says even in the next 10 years, you're going to have to do things differently. Of course, you know, the European Union has made announcements about policies, internal policies, that they are now working out and I'm pretty confident that they will. We're figuring out whether we can do it via Mr Biden's Infrastructure Plan. We don't know the final outcome on that and it could be that will be delayed. China has not pledged yet, but when they do I would watch for them to pledge 50% by 2040. Again, they're going to want a 10 year, probably, delay relative to others, but that's OK. If everybody does what they are promising to do, and of course you know there are a lot of things that have to go right for that to happen, but when the economic forces are lining up to help them go right, as they are now, when there's money to be made by going in the right direction, which obviously there is, because fossil has gotten expensive, then you know I think you're going to see a very rapid rate of emission reduction. The other thing of course that's happened is there is a far, if you want to get back to my [three

Ps], so that's the Practical side. It's become much more practical. It's also become far more Personal and Perceptible and the sad fact is that we waited long enough for the signal to emerge from the noise of variability, right? So you know that was already true somewhat earlier, but the longer you wait, the bigger the signal gets, the more damage is done, the more people are affected, the more obvious it is that this is the kind of earth system climate that we haven't seen before, and it's different you know the challenges that the phenomena that we're talking about are familiar, in a sense, I mean, we have had wildfires before, but we haven't had wildfires like the ones we've had now. You have had floods before, but you know churches that were hundreds of years old have been destroyed. China has a long record of heavy rainfall and you know we're getting things happening that are just way outside the norm in too many places to be easily ignored anymore, or just kind of poo-pooed, so you see I think the phenomena becoming more personal and perceptible. You see people, especially young people, engaging with it, so the social pressures have begun to look to me, particularly strong in the sort of under 30 crowd, which is basically saying, well, this is the world we're going to have to live in, and you know we really don't want it to get to 4°C warmer than it is right now. I think we will be able to hold it to 2°C, now everybody needs to acknowledge that 2°C degrees is **not** 0°C, so 2°C is also not 1.5°C. I think there's an outside chance of 1.5°C, only if a lot of things go right with carbon capture technologies, which right now are uncertain, it's possible, but even 1.5°C is gonna be a big change, you know it's already a pretty big change at 1°C. So what that means is that the international negotiating issue is going to be compensation for the developing countries, so that the countries that are, it's not so much China, which you know has substantially developed, they will continue to develop, but they are substantially developed now, but certainly further development in India and especially Africa and parts of Asia you know you're going to have to work out a regime that fairly compensates those people for loss and damage and makes good on the promises that were made in Paris about financial transfers. One of the real problems and I don't know how to solve this, I think at this point it's not solvable, and it's kind of sad actually, you know the good thing about Montreal was that the financial arrangement was that the developed countries would pay the developing countries the difference in cost between doing whatever they were going to do with CFCs and doing it with the alternatives. Not the *total* cost, but the *extra* cost, if there was any. Because the substitutes came on so fast, they haven't had to spend a huge amount of money. I'm pretty sure that over the lifetime of the [Montreal] Protocol, they only spent about $2 billion. And the way that they got that, in the United– they probably did the same thing in Europe– the way the countries that paid into it raised the money was by windfall profits tax on the chemical companies, so you know that was all fine. I mean you know, they would have liked have not paid any tax, but they were already having a windfall so you know how much do you have to worry about? The windfall mainly came with the increased price of CFCs, as they were phased out, so you know anytime you start to reduce supply, then you'll make more money with selling, you know the reducing… supply and demand, it's sort of basic fact. What's happening with the climate regime is that we're not paying the difference we're paying all of it and that, that's going to be very expensive. How that's going to work, now I think the most likely and perhaps most dangerous thing that's going to happen is that: rather than have it be money that is in a sense a foreign aid contribution, where they just get money,

what's more likely to happen is a foreign investment thing, where private companies who are funded by you know, some US or European source, build a power plant in Namibia and sell the electricity to the Namibians and what is going to be really important is to make sure that that doesn't end up being exploitive and just another way to make more money than is fair and whatever, you know, defining what is fair is gonna be a huge challenge.

AS: So you touched on a couple of other things that were of interest, like the Green Climate Fund, modelled on the Mutual Liability Fund, but I don't can't recall the history of the MLF, but with the Climate Fund, under the voluntary scheme, they've pledged $100 billion and paid a fraction of that, so how do you think that might change? Do you think they might introduce some sort of industry levy or tax?

SS: I think they're gonna introduce a way to increase the amount of private investment, 'cause it was never clear there was always a discussion: is it public investment or private investment? How much is what? That was not stated, um, but you know if it's gonna be some big solar energy company getting partly subsidised by Germany to go in and do these kind of things, and charge for services, um, that's more than likely what I think will happen. So in a sense it will accelerate, it will certainly help to accelerate development, which is obviously a good thing. I like to tell people that you have to be a cretin to be against development 'cause you know it's talking about people's health and wellbeing and you know simple things like toilets and electricity and all of that that we all enjoy in the developed world and take for granted, is what they desperately need, not to mention a few vaccines right now, which is part and parcel of the same problem, so we will have to really work hard to make sure it's not going to end up being exploitation and that's what I think hasn't been resolved. I don't know what Europe, I don't know the details of how people are thinking about it, but I don't think it's going to be public, just going to be foreign aid. The numbers are just far too staggering for that to be the case.

AS: Another aspect that we touched on earlier and I don't think you referenced it by name, but you mentioned Europe and some of the policies they've got in mind. Were you thinking of this “carbon border adjustment mechanism” that they're floating? Modelled on the trading restrictions under the Montreal Protocol.

SS: Yeah, yeah and that makes sense because that's the only real mechanism that they have to avoid leakage, right? So you know it's perfect.

AS: I think then maybe we'll move on to the IPCC stuff that I wanted to ask you about. I was looking at the membership of the IPCC and it says it's got 195 States, which is actually 2 more than the UN, so I don't know how they manage that, but from your experience, I imagine that it's quite unwieldy trying to herd cats like that, but at the same time there must be benefits, so how does that sort of broad membership both assist but also impair the conduct of its scientific work?

SS: Yeah, we had 130, when I was chair. I will never forget one occasion, it was actually in a contact group, where one particular government wanted something that had to do

with defining what is “dangerous”. You know, it's always been clear that what is “dangerous” is not a scientific question, right? It involves you know “dangerous to who?” and “how much risk is too much?” So it involves values, as well as science, and this person or this country was, and I won’t and I can't say which and I wouldn't anyway, was trying to force it into Working Group 1, which and it doesn't even belong in Working Group 3, to tell you the truth. I mean in my opinion that is not what IPCC should be doing. It was amazing to watch how both the extreme people, who do not really want a protocol, and the people who do, so the left and the right if you want to think of it that way, although that's not really the right language, jointly shut this country down. The reason is that they greatly value science and they greatly value the fact that it's the one touchstone that they can all take as a starting point for going forward with their political discussions about how to deal with what is “dangerous”. But if they don't have that, then it just becomes you know total pandemonium, and they know that. One thing that John Houghton actually told me when I became Co-Chair, and I had many nice discussions with John, Sir John. He said to me: “well, you know, the value of IPCC is it brings the discipline of science to policy”. And I believe that's true and I've also talked to enough policymakers, who told me how much they value its discipline. They value the fact that it gives them something that is substantive, that allows them to conduct the required work that they have to do and they know they have to do it in a way that makes sense so they actually, if you give them a chance, will help you get things right. But you have to be a strong, I mean I will say and I hope this doesn't sound too self-congratulatory, you must have a strong Chair. You must have a strong Chair, who will not let the science be twisted in any way and this holds not only for your WG, it holds for all three, who will not, let me put it this way, will not let the facts be twisted. You simply have to stick by your guns and resist any attempt to change the substance of the work and I had no trouble doing that. I really dedicated myself to the task, I probably spent 80 hours a week on it, doing almost nothing else for a number of years and I read every draft of every chapter. I read every comment. I read every response to every comment. That doesn't mean that I you know memorised them or something else, but you know I took very seriously the need for me to have a very good and deep command of the whole report, so that I could know what we could stand by and what we couldn't. In some cases, I had to help the authors come up with ways to present things or describe things that were more robust, that would stand up to scrutiny, and that's basically what they're testing. The two week or in our case it was I guess a week, the approval process is a way to basically build a shared understanding between the science community, or I keep talking out science, but you know let's say Working Group 1, between the science community and the policy community, and 99% of what they do is only tweaks in language that actually make the statements better and clearer to the non-expert, which you know it's a painful process, but it's the way to engage them deeply enough that you actually all end up doing a very good job on that I think. At least I'm proud of the 2007 report, I think we achieved that, but they didn't make any substantive changes. There was a 1% kind of trying to actually make them and me plus other and you can't just rely it's not just the Chairmen, it's very important that the governments weigh in and help, and they do, to shut down that 1% of silliness, and you just have to give them the opportunities to do so and to structure the meeting, structure any contact groups, in such a way that that gets achieved, rather than just you know nonsense. We also did

it on the synthesis report. I think all three Working Groups worked really well on the AR4 Synthesis Report, making sure that that was also a very robust process. I can't speak for Working Group 2 or 3, but the ones that I've been involved in, I really value the countries' inputs and I think it made for a stronger report.

AS: Thank you. There's a couple of things that, we could bifurcate here in two directions, but I just want to pick up on what you were talking about with the language and coming up with refined, clearer language. I think this was in the original cut of questions too. The key takeaway was the use of "unequivocal" as your adjective and then the "likelihood" of those other statements in the AR4 report. So could you just give a bit of background as to how you arrived at "unequivocal"? Was it in there from the start or was that a refinement?

SS: It was in there from the start in the science team, in the author team. Now not from the very start, actually, we you know it takes, one of the things that's important about IPCC is the amount of time it takes to write a really good report because even getting all the scientists on the same page is an interesting process and sort of processing everything that you've learned is a challenging process. We had, and I don't even have copies of the originals, I didn't keep them, I didn't want to keep them… We had in our zeroth draft, which was never circulated outside the author team. When I say zeroth draft, I don't mean the "official" zeroth draft, I mean the you know the really, truly, first internal draft among the team. We had statements about how several, it's more like what's in the next sentence of the report, you know "independent measurements of many different variables, including sea level rise, glacier retreat, warming temperatures, blah blah blah are all independently providing strong evidence that the world is warming" or something like that. And it was way too scientific you know and it wasn't me, and I don't deserve the credit for this. It was, I believe, Brian Hoskins and Nathan Bindoff, who were authors, co-authors, on the technical summary and summary for policymakers, who came in and said "look, this is just too scientific, it's too technical. Why don't we say warming is 'incontrovertible'?" And I didn't like that because it's not language that you would ever use in a scientific paper. It's also kind of defensive, I mean "who's trying to controvert it?" Similarly, people said "oh ok, you don't like incontrovertible?" I don't remember how many of us there were, you can look at the report on the number of authors I think it's in the order of 20 people or something on the final document, the SPM, maybe might be even 30… Somebody said: "well, what about 'irrefutable'?" Same problem. We left the meeting not sure what we were going to do, but sure we had to do something, so I promised them that I would really work hard and come up with some better language. One of the things that I've always valued is a thesaurus and one of the things I used to actually give a thesaurus to every person I knew that graduated from high school. Of course nowadays you use them all online anyway, but I had hard copies of about five different thesauri, 'cause they're all different, and I kept looking, and looking, and looking, for synonyms for "irrefutable" that I found not so defensive. I came up with "unequivocal" in one of 'em and I said "hey, that's a pretty good scientific word, which you might say in a scientific paper", that evidence was "equivocal". You might say evidence was "unequivocal". That's not a defensive word. It's just a statement of your assessment of the evidence, so we put it in! And we send it off to the governments and I don't

remember what the comments were, you can get them, I mean they are publicly available. We didn't get that much push-back actually, we probably got some, and then what happened in the final plenary approval was, my colleague Qin Dahe, who was in the Chair at that time, so my Co-Chair was in the Chair and I was sitting next to him. When it came up, there was a little bit of discussion about "this is sort of an unusual word" and "how does it translate into different languages?" I think I said or maybe it was even the TSU Head, I don't remember, which would have been Martin Manning, but somebody said, maybe it was a delegate, I honestly don't remember, but somebody said: "well, you know, I don't think we should be debating the translation, because you know that's the job of the UN translators and they'll figure it out" and there was no further flags raised. So they were all thinking, so I… "Gavel it down, gavel it down!" Because you can do that, if there's no further flags raised, you can do it and, if people are obviously hesitating, so he did it and that was it. Kaboom! Bring the hammer down on "warming is unequivocal" and that was it. I'm very proud of that whole process. I think it worked just the way it should have.

AS: Fantastic and more broadly what role do you think language has in in making climate protection more effective? The way we talk about it and whether we say "climate change" or "global warming" or "global heating", things like that, terminology we use.

SS: Yeah… I don't have strong opinions on that, to tell you the truth. I say "climate change", but that's a result of my many years in the IPCC. I *don't* like you know "climate weirding" or that kind of thing. I think we've gotten to the point now where people know what it means. In the beginning it was easy to debate the significance of it and of course it's not just warming, sure, but I think now it's clear enough to people. I mean again it's become so personal and perceptible that I really don't think you need to debate exactly – you know, you could call it "Fred" and it would be fine. We know what we're talking about. Well it's outside our window, you know

AS: The multiple lines of evidence are everywhere. Just circling back to the alternative path from earlier, you were talking about trying to wrangle the representatives as part of the drafting process, so how did you balance the scientific principles, you know the the scientific rigour and the peer-reviewed nature of what you were looking at with other, UN-type factors that might have been imposed on you that aren't necessarily par for the course for the scientific method and those things are like the geographic representation being balanced and just the sheer political pressure that you're under on this particular issue.

SS: Are you talking about picking the authors or are you talking about the language of the final report or what?

AS: I guess the more procedural aspects. Picking the authors and how to I don't know accommodate everyone in the drafting process, when you might have I don't know you from NOAA or other prestigious institutions, versus who knows the University of Bangladesh or wherever else.

SS: You know we had a great author team, we really did… I found the developing country people really a joy to work with. They had done enough good… I mean we were careful who we picked. We refused to pick people just on politics, but we picked people who had you know some kind of substantive publication or two or three to their credit, and they understood how science is done and they were happy to be there, they were happy to be learning from other people, and other people learnt from them. I feel that within the author team I cannot remember ever having an issue. I really can't, everybody just wanted to get science right. Within the negotiating framework, what you have is again this balance between the two sides ends up putting you right back where you need to be, if the Chairman you know deals with it in a strong way. The Chairman has to learn a lot about how to be strong with those people, because they will take advantage of any weakness. I will tell you one story, again not saying who it was, but when I was new to the job and we were going through the task of approving the outline, so the very first step is you put up an outline of what you want the chapters to look like and it's pretty general I mean you know, but you know there's titles for each chapter and topics. A particular government just was he, they did not say anything in the meeting, but they had sent in written comments about how they were very concerned about chapter X, whichever one that was. Then in the coffee line, their representative came up to me and he said, it was a man, I will tell you that much: "If you don't change that and do it this, this, this and this way, you know I won't let this go through, I'm gonna tear you apart" basically. So I said: "Ok, thanks for the information" and I was actually quite shaken, but I knew I just decided that I was definitely not gonna give in to any bullying. So I went in there after coffee, prepared for a fight, and the issue came up, and no flag was raised. And I realised, right then and there, that there was no way that he and they were going to say anything in public, they were just trying to intimidate me into doing it myself right and you just cannot bend to any pressures. You just always have to have your eye on "what do the facts imply?" and "what does the science suggest we can do and should do?" and then you just stick to your guns and know that the good countries will help you, sometimes on both sides. I will say that in my plenary, that Qin and I Co-Chaired, we had significant help actually from Saudi Arabia, which was amazing. The person that was the Head of their delegation was just extremely good and very, very helpful. It was amazing, I never expected that. I mean I didn't know what to expect out of them, but they were great.

AS: That's great, thanks for that example 'cause I was going to go fishing for one of them in referring to Ben Santer and his treatment in the 2nd Assessment Report, where that was pretty nasty, so I just wondered whether there were similar situations for you, but yeah if that leapt to mind, then…

SS: Not in the formal process, I mean, I think obviously the worst thing that happened on the AR4 was "Climategate", which you know whoever, whichever country, if it was a country, and it could have been, sponsored that hacking and then you know that it ended up having a life of its own and it was very, very, very painful for a certain number of scientists, which was very sad, but we've learned a lot about how bad hacking can be now and people just have to learn that they can't consider email to be private communication.

AS: Another thing you just touched on in that neat anecdote was standing in the coffee line, I mean sure it went in opposite direction, but this institution where I'm interning with the UN is the Scientific Committee on the Effects of Atomic Radiation. While I've been there, they held their annual session and delegate after delegate complained about the enforced situation of doing it online, more than anything because they couldn't have the informal interactions in the coffee line, where they said all sorts of "Eureka!" moments happened, or you know breakthroughs were achieved.

SS: Some of those are actually helpful, some of those are actually good, but some of them are, as in this example, very bad, but a certain number of them are really helpful. I don't know if you've read Richard Benedick's book, he gives a great example of where Russia was suddenly balking at the idea of signing the original Montreal Protocol and the Russian delegate did not speak English very well and he just kept saying "no, no, no", you know "we can't accept this, we can't accept this" and then in the coffee line, Richard was talking to someone else in German and the Russian realised that he spoke German. He came up to him and said: "oh you speak German? Well look let me just tell you here's my problem" and they went out to lunch and spoke German during lunch and came back in with a solution, so sometimes what happens in the coffee line is very good, so it cuts both ways. It's a great story and what it was, was that the Russians were already building a new chemical plant and he had been sent to this meeting with strict instructions that they had to finish building that plant. So there's a special, you know and Richard once he understood this, figured out, 'cause the problem is German is… and the guy, I guess, I don't know why he didn't just speak Russian during the session, or maybe it's because this was going on at a contact group without translation. That's probably why… So Richard went in and fixed it with, because you know, he couldn't speak German in the plenary because German's not an official UN language, but Russian is, but it must have been in a contact group. So Richard went in to the contact group and fixed it with something that is incredibly specific: "no more chemical plants to be built, except those already part of existing national legislation" or something, you know just find it in Richard's book, it's really a beautiful story, if you want to tell those kind of stories, but that can also happen.

AS: Ok fantastic, no I'll go looking into that. Now the problem is now we've rambled over all sorts of topics, which is great 'cause I wanted to get there with the questions, but now I just need to double-check, if I need to swoop back over anything. Again, considering the IPCC process in general, do you think and I think you touched on this in your sort of opening remarks, but do you think it would be more effective if rather than go for the global, everyone 195 member states, or 130 in your case, if they had focussed more on the big emitters and work more closely with national or regional scientific organisations – do you think that would have been any more effective?

SS: No because today's you know today's small emitters will be tomorrow's big emitters and everybody has to be part of this, so I don't see how you make that work. I mean you could do some stuff that would stimulate technology development, which would be good, but you know then there's nothing wrong with doing that too, but it's not a substitute for a global agreement because you know in the end everybody has to ask to be part of it or it's just going to be a disaster.

AS: OK another question, which I hadn't written down, but it's sort of just been looming in my head: at what point do you think that IPCC's role might evolve and take on more of a WMO ozone assessment role, as it now is of sort of just monitoring how we're going on our progress and when do you think it might stop putting out Working Group 1 report saying "this is the basis for doing something about this issue"?

SS: Oh, I don't think you'll ever stop putting out Working Group 1 reports, just as we haven't stopped putting out the Science Report of the Montreal Protocol. The Montreal Protocol also has three parts. It has a science on impacts, and in their case Technology and Economics TEAP, and then the impact group, and then the science group and, frankly, the science of ozone is more exciting right now than ever and I think the same thing is going to happen with climate. Yes because as the world gets hotter, there will continue to be phenomena that we don't understand and as the regimes go into force there will be a need to… and I shouldn't say into force, because they're voluntary, but as the regimes try to evaluate "are people really meeting their commitments?" and things like that, which they have all agreed that they will do, there will be many, many challenges on measurements of emission and interpretation of those measurements will involve physical science. There will be feedbacks in the biogeochemistry that we probably haven't even dreamed of yet. I don't, I do not see it going away. In fact, if anything, my hope and it's one that Ted Parson has written some really nice work on is that IPCC will become more likely to report in the sense that instead of having a Working Group 3 that also tries to do policy, you know that doesn't really make any sense. I mean I don't see, I think that's where all the contention arises that's where the technology kind of gets left by the wayside because the report becomes too controversial because of its policy pieces. If they would just do technology and economics, if they would be more like TEAP, it could be a much more effective process for them.

AS: Only two more questions, I'm conscious that…

SS: Have you read Ted Parson's paper on that?

AS: No, but I've taken note of his name but is that…

SS: Edward Parson is his proper name.

AS: And how recent is it?

SS: If you can't find it, just ask me and I'll send it to you. It's pretty old, but it's I think he still believes it and I do too.

AS: Thanks, just on the technology and sort of industry point, I was intrigued to know more about how in your experience as Co-Chair, did the industries have a role be it oil companies were they behind the scenes trying to influence the report at all, or was it through the instrument of national governments?

SS: Yes and no, I mean they were able to have lobbyists running around and I'm sure you've heard some of the stories of that it. There was an era in which there was an industry lobbyist, who kind of ran around in all the plenary approval processes feeding information to friendly governments and stuff and also they were submitting comments on chapters and they actually did that during my tenure too, so you know they submit comments that you have to respond to, but you know if the comment really doesn't make any sense, then the answer can be pretty short. But some of them also submitted some useful comments, so you know and really what can be incredibly useful, what I think is really kind of tragic actually and I've said this to people like Chief Scientists of oil companies and been ignored, but one of the things that made the Montreal Protocol so good actually was the fact that the chemical companies, you know DuPont Company, had its own model. They had a group that did computer modelling of stratospheric chemistry, very similar to what I did back in the 80s. You know there are models and those guys were smart. They were respected scientists. They came to all the scientific meetings. They gave presentations about what their model said and I think that was absolutely key in making that transition so smooth. I wish that some of the fossil fuel companies would do the same. Now it's gotten to the point where it would be hard to do, in the early days it would have been easy to do, because there were you know in the early days of climate modelling very small groups built climate models. Now the machinery and the number of people and the level of effort that you have to have might be too much to expect any company to do, although I think they could do it. They could still, they could do an EMIC, for example. You know there's a lot of – you know what an EMIC is? Earth Model of Intermediate Complexity, so those are the more simplified models that are run out for thousands of years and stuff like that. They could do those. University groups still do those.

AS: So fossil fuel companies never did that, but if they did they haven't made it public, is that what you're saying?

SS: Well they did not contribute to the scientific literature as active expert members, who basically then became part of the community and respected members of the community. Aaron Owens, who was the head of the DuPont modelling group, was one of the smartest guys I've ever met. Don Fisher was a very bright guy. They had a little group of about a half a dozen people. Joe Steen(?) Joe is still living, I'm not sure about the other two to tell you the truth, he's retired. They're probably still alive, but I don't know what they're doing.

AS: I want to finish on a lighter note so my last question was: you said you're proud of the AR4 and I think quite rightly, it was very comprehensive and just a huge undertaking, which sort of laid the groundwork for a post-Kyoto Protocol, but then that famously failed to materialise at the Copenhagen COP, so that's one of several setbacks you have had along the way in your career: what is it that gives you hope that we will get there in the end, despite the setbacks along the way?

SS: Oh you know Copenhagen… I don't think we were ready to move to a voluntary protocol yet, so Copenhagen I don't consider it a setback at all, actually. Copenhagen would have been an extension perhaps of Kyoto, if they hadn't made so many stupid

diplomatic mistakes, which is basically what happened. And between that and you know terrible weather in Copenhagen at the time and other stuff, it just wasn't meant to be. It would have been an extension of an existing regime that could have helped somewhat, but I think we weren't ready to do Paris and maybe that's simply because the signal hadn't gotten personal and perceptible enough yet, that is part of it. It's unfortunate because the nature of this problem is that the sooner we act, the easier it will be. We have to start you know doing stuff that we can do and I really think that one of the problems with the whole debate, if you want to call it that, is that people are too focused on "oh, but you know net zero is impossible". It's a silly debate. We don't know what's going to be possible by 2050, but we do probably have a pretty good idea what can be possible by 2030. It's already 2020, so you can look 10 years down the line and when you get to that point 10 years down the line, you'll be able to look the next 10. So if we had started earlier, maybe we could have done more earlier we maybe could be further along than we are now, but as I say that the technology and costs have gotten to the point where things are practical and a lot is going to happen, a lot is already happening, so I don't I don't know that it could have been any faster and I certainly don't view it as a setback in my career. Not at all.

AS: Great, thanks. All right well maybe I'll stop the recording now and let you get on with your day.