

**This webinar was given on Thursday, December 3, 2020 by Roland Kupers, author of *A Climate Policy Revolution: What the Science of Complexity Reveals about Saving Our Planet*, and a fellow at the Institute for Advanced Studies in Amsterdam. It was given as part of M-RCBG's weekly Business & Government Seminar Series.**

Scott Leland:

Hello everyone. Welcome to our seminar. My name is Scott Leland. I'm the Executive Director of the Mossavar-Rahmani Center for Business and Government at Harvard Kennedy School, which is hosting today's event.

Scott Leland:

This is actually the last seminar in our Thursday series. It's hard for us to believe, but the semester is already over, as we are now in December. We've had a terrific lineup of speakers. If you are interested in reviewing some of the past videos that we've had, they are linked to our home page. It's [MRCBG.org](http://MRCBG.org). There's a YouTube link at the bottom of that page. We'll be putting the link in the chat momentarily. We are recording today's seminar, and you'll be able to find that in the YouTube channel as well.

Scott Leland:

Today we have Roland Kupers speaking on climate change. I encourage you to submit questions. I imagine many of you will have questions. We have two ways of doing that. There's the Q&A function, which is most likely at the bottom of your Zoom screen. So you can write in your questions that way. You can also raise your hand using that 'Raise hand' feature in Zoom. We will call on you, or we may call on you, that way as well. So either of those avenues is viable.

Scott Leland:

So it is a pleasure to welcome Roland Kupers back to this forum. He spoke in here before several years ago. Dr. Roland Kupers is an advisor on complexity, resilience, and energy transition, as well as a fellow at the Institute for Advanced Studies in Amsterdam. He's a professor of practice at the Thunderbird School of Global Management at Arizona State University.

Scott Leland:

He is a theoretical physicist by training and he spent 11 years, the first 11 years of his career, with AT&T in the Netherlands and in Italy. He spent another 11 years actually with Royal Dutch Shell in various senior executive functions, including vice president for sustainable development.

Scott Leland:

When he last spoke in this forum, it was for his book on Complexity and the Art of Public Policy. Today, he's speaking on his new book, *A Climate Policy Revolution*, which, actually with the background, it's very hard to see, *What the Science of Complexity Reveals about Saving Our Planet*.

Scott Leland:

So, Roland Kupers, it's wonderful to have you back again. Thanks for being with us. I'll turn the platform over to you now.

Roland Kupers:

Great, Scott. Thank you very much. Interesting, you have the art of making the book disappear. I hadn't seen that before. So thank you.

Roland Kupers:

Welcome everybody. Great that you're joining. What I want to do is take you briefly over the next half hour through the main arguments of this book. Then spend the second part of the hour hopefully answering some questions and going into some more examples.

Roland Kupers:

So, fundamentally, what is this book about? It's about climate obviously. But what makes it, I think, slightly different than many of the climate books that are around is that it is focusing on the how to do climate policy and not the what, because the what actually, unless you've not been paying attention, is actually not so complicated. We need to stop burning fossil fuels and eating red meat. There's a small list of things we have to stop doing.

Roland Kupers:

But the challenge is not figuring out what we need to do, but how to get those things done. And that's really what this book is reflecting on. I'm going through a whole bunch of examples.

Roland Kupers:

What it does is it's based on the science of complex systems, of how we know complex systems change, and lots of examples. I have many illustrations. I'll go through a few today.

Roland Kupers:

It's called revolution. It's about revolution policy because it's about nonlinear change. It's how do we get a revolution, a nonlinear change on purpose. So that's the fundamental idea behind the book.

Roland Kupers:

Now I won't say too much about climate change because I'm assuming that if you've dialed in, you know all the basics. So I won't tell you how urgent it is, et cetera, because that's been said elsewhere and better than I can.

Roland Kupers:

But just to think about the situation is essentially we've sat on our hands. We've procrastinated about climate change. We've known about the urgency of this issue for decades, if not a century, if you go back in literature.

Roland Kupers:

There's a wonderful speech which I can highly recommend, slightly unlikely but very moving, by Margaret Thatcher in front of the UN General Assembly in 1989, passionately warning that we need to do something about climate change. Of course, we didn't, or we did a few things but they're not relevant at the scale we need to do it.

Roland Kupers:

So as a result ... And I think this is the core point for this book. Gradual change is no longer an adequate solution. There is no gradual pathway that will get us to 1.5 degrees. And so, we need to think about how nonlinear change happens. Unfortunately, that's possible, but it's not that easy.

Roland Kupers:

Now you see lots of demonstrations where people have signs that say, "We don't want climate change, but we want system change," which is a nice slogan. But the question is what does that really mean? What does system change look like and what are the tools and what are the practical approaches to make that happen? So that's what the argument I tried to explore in this book.

Roland Kupers:

So the first thing to reflect on for a second is how do things change in the first place? How does change actually happen? Here are lots of images of nature, of how things grow, and a lot of the laws are inside our studying of the world, both the natural world and the social world.

Roland Kupers:

But I think it's useful to distinguish between three different ways of change when you think about policy. One is top-down change. The other is change through market forces. The third bucket that I would offer is this idea of systemic change.

Roland Kupers:

Top-down changes are fine, but, as I said before, we're actually not doing them. There's actually a reason which I go into the introduction of the book, is that democracies, by and large, are set up to avoid making systemic change, and that's by choice. Authoritarian regimes, on the other hand, could make systemic change, but generally with the possible exception of China. They're not really interested in climate policy. So you have these three buckets. Let me just give you three examples of what that looks like.

Roland Kupers:

So top-down change would be close the coal plants, which is the no-brainer for climate policy. But the reality is that there are 6,000 coal plants on the planet. What's more serious is there are a thousand more that are planned and financed and under construction. So, yeah, top-down change sounds like a good idea, but it's just not happening. I'm not opposed to it. It's just not happening.

Roland Kupers:

The other bucket is market forces. The prime example of that is CO2 pricing and there are others. Also, there we have to say that it's either not happening or it doesn't work. So the prices are set for change at the margin, which, for economists, make sense, but if you're trying to change a system, that doesn't make sense. So market forces are all great and good, but at this point, they have limited use.

Roland Kupers:

And so, that brings us to this third bucket, which is the category of systemic change, and that's what I want to talk about. What do we know about systemic change? This is just the world's briefest introduction to complex systems. Some of you may have come across it, and I apologize for the repetition, but some of you may not.

Roland Kupers:

So complexity science, and that's a real thing, is now about 30 years old. So three decades old. Science, not new but also not terribly old. But there's a great precursor. For example, Hayek wrote in 1964 quite eloquently on the theory of complex phenomena in economics. There's a wonderful classic essay from 1972 by Anderson called More is Different. So there are early signals of complexity science, but it is now a full and mature part of science.

Roland Kupers:

The interesting thing is it's across every single discipline. There isn't a single faculty in the world at top universities that does not have a complexity program. The institute that I'm associated with in Amsterdam, for example, is called The Institute for Advanced Study, but actually it's the complexity institute in hiding.

Roland Kupers:

What the study of complex systems is about is how do things, how do systems change from within, from their own internal dynamics? Now the cliché of complex systems is bird flocks. But things are a cliché for a reason. So the question is how do bird flocks organize themselves?

Roland Kupers:

Now we know two things about bird flocks. First of all, we know that there is no choreographer. There's no big boss telling the birds where to go or how to fly. The second thing is we know that the agents in this system are literally bird brains, so they're not too smart. And yet, collectively, they manage to do these amazing things.

Roland Kupers:

And so, complexity science is about understanding, and this is now quite well-understood. It's what the simple rules, it's what the simple mechanisms are that lead to this behavior.

Roland Kupers:

This picture actually is not a bird flock. It's a flock of drones that are programmed with the same rules that the birds use, and they're flocking above burning man in the US. So rules work and you can apply them to drones as well as to birds.

Roland Kupers:

Just one image about the word complex, which is a pretty bad branding for science, because it means something to people. You may have a complex relationship with your brother-in-law or you may find COVID policy complex. That is a different meaning of the word.

Roland Kupers:

Complex comes from the Latin plexus, which is to braid, as these wonderful Nigerian women have done. And so, complex means systems with braids. So it's the science of braided or interconnected systems. Just think about complexity as a different word than the standard meaning that you may associate with it. Just think about these wonderful women.

Roland Kupers:

And so, before I go into a number of examples, to just recap, these three different frames for looking at policy. You have the control frame, the economics of control frame, top-down change through which you can look at issues such as climate change as we do today, but it equally applies to security. Pandemic's a rather important [inaudible 00:12:45] as well. Transportation, financial regulations, et cetera.

Roland Kupers:

You can look at a problem through a kind of a market, referred to in my previous book as market fundamentalist frames, people who believe that the market is always the answer. There's a third frame, which I will illustrate with some examples of looking at these problems through a complexity frame.

Roland Kupers:

The question always is what's the right frame for a particular problem at this particular time? I'm not arguing ... And I've noticed that I have to say this twice because people naturally assume that I'm advocating something better than what other people are doing, and I'm not ... is that this complexity frame is just an expansion of the tool set. It isn't always the best solution.

Roland Kupers:

But for this problem of climate change, I would go further than I think it is actually the thing to look at today, because we've demonstrated that we have been incapable of taking top-down change measures or using market mechanisms effectively, because we're simply not making the progress that we should. So that's really the question.

Roland Kupers:

It is because these climate problems are so devilishly interconnected. Greening the power system is an obvious requirement. But why can't we do that is because the electricity system is deeply interconnected with everything in society. The returns from fossil fuels underpin our pension system and so on and so on and so on. And so, you can't change these things in isolation. You really have to look at their interconnected nature.

Roland Kupers:

So enough abstraction. Let me go through three or four examples that illustrate this. The book actually is full of a whole series of examples, but there's too many, or else it'll get tedious at this point. But let me give you three illustrations.

Roland Kupers:

So the first is solar policies. So if we look at German solar policies, it's become famous because of its innovation about 15 years ago to introduce an interconnection, a feed-in tariff. So you were guaranteed a relatively high price to deliver back power from your solar panels to the grid. That price was high enough, not market-based but high enough, to be able to afford the expensive solar panels at the time. That feed-in tariff has gone down over the years as panels have become cheaper.

Roland Kupers:

That's been a wildly successful policy from all sorts of perspective. It's the biggest development project ever. The German taxpayer has funded the cost-reduction of solar panels for the world at the tune of about €100 billion. But let's look at this policy through these three different frames.

Roland Kupers:

So the first frame, the control frame, you might pick up one newspaper that says, "Hey, look, this is the power of the state at its best. It's the Prussian state that had the big idea and intervened and has made change at an enormous scale. It's top-down policy at its best."

Roland Kupers:

You might pick up another newspaper and say, "No, no. You don't understand this at all. This has actually been just getting the incentive right so that the market and innovation and industry stepped up and they made this happen and delivered this enormous change." Two stories that are probably relatively familiar. The question is what does this phenomenon look like through a complexity lens or a systems lens?

Roland Kupers:

There you would say that one of the great successes of German solar policy is it's been a social norm policy. There's no country where support for climate policy is as deep across gender, across age, across political affiliation as in Germany. I've experienced actually here in my house in Amsterdam, which is in a World Heritage site. I've illegally put solar panels on my roof which is completely forbidden.

Roland Kupers:

What happens is that people ask you questions and they say, "Who are you? Why did you do this? Are you now a vegetarian? Why do you still drive a Porsche?" It's engendered a whole series of conversations. With the level of penetration in Germany, you see knock-on effects into all sorts of other sectors. One of the things that will be familiar to everybody today is that the propagation of solar panels in a neighborhood fits the exact same models as academics.

Roland Kupers:

So solar panels are contagious, and they're contagious with the same algorithm as COVID-19, just a different contagion rate and certainly a different outcome. I don't want to be flippant about this, but the system understanding is actually very similar. So they spread across neighborhoods depending on the kind of city they're in.

Roland Kupers:

And so, these three stories of the solar panels are all true, but the question is, and I have a secret ambition to ask Angela Merkel one day when she's retired, if she ever retires, is whether this idea of social norms policy was actually part of the decision at the time. But it's certainly been part of the way it played out.

Roland Kupers:

So let me go on to a second example, which is inequality. Now Obama, when he left office, fairly late, I have to say, said that inequality would be one of the defining issues of our time. I think he's right, but it's

also not very new. Jean-Jacques Rousseau wrote about inequality. And, of course, Piketty has written two actually rather wonderful door stoppers on the subject.

Roland Kupers:

But from a systems perspective, inequality is a huge factor in climate policy, and yet you don't find it at the COPs, you don't find it in the IPCC. One example is the French gilets jaunes protests that happened over the past years, where the government wanted to increase, for legitimate climate reasons, the tax on diesel fuels.

Roland Kupers:

That ran into ... It's a long story, but the way the French [inaudible 00:19:33] contract was structured with people with lower incomes, living on the outskirts, and being able to commute into cities. The increase in inequality basically ground that particular climate policy to a halt.

Roland Kupers:

But the issue is deeper than that. If you look at who actually is emitting, is responsible for the emission of greenhouse gases, it's the top few percent in the world. Not just in the west actually, it's also true in India and China and Malaysia and Pakistan and everywhere else. But it's largely the rich who are causing climate change. Therefore, the distribution of income and of wealth should be an integral part of climate policy.

Roland Kupers:

Again, not out of ideology, even though I may have views on that, and certainly it was sordid, but the point is you won't be able to progress because the path dependency, so the momentum will not be able to get the system into the motion you want without addressing this issue, without understanding the connection between climate policy and inequality.

Roland Kupers:

Let me give you another example before I run out of time here. Red meat. As many of you will know, the second no-brainer, if you had full freedom, in addition to closing coal plants, would be to stop eating red meat. This is true for red meat, less so for poultry.

Roland Kupers:

But red meat is incredibly energy-intensive and the energy that's associated with it has an enormous carbon footprint. If you were to get the same amount of nutrition through plants, it has orders of magnitude less greenhouse gas emissions.

Roland Kupers:

In the bigger scheme of things, it would seem that it's a thing that's relatively easy to give up, and yet, of course, it isn't. This is perfectly resistant to top-down policy. It's unimaginable that any government would somehow forbid people to eat red meat. You would have an uprising on your hands. Equally, using market mechanisms, taxing, et cetera, will be extraordinarily difficult to realize.

Roland Kupers:

Now if you look at it through a systems lens, social norms and habits are contagious. Solar panels are contagious. But most of our habits are contagious in the same way, again, as bad things are contagious. Good things are contagious also, fortunately.

Roland Kupers:

Now, interestingly enough, we don't really even know in the scientific literature is how you catch vegetarianism. Do you become a vegetarian because your kids ... Or flexitarian or whatever, because your kids so you should stop eating meat? Is it because it's your friends or you see something on television?

Roland Kupers:

So if we understood better what the social propagation mechanisms are of not eating red meat, we could find ways to stimulate that. This isn't advertising. It's about changing the network structure of the connection so that more and more people stop eating red meat.

Roland Kupers:

Now the wonderful thing about these kinds of policies is that you like your own tastes. Everybody hates it when somebody else tells you you need to change your taste. But if you change your tastes organically through your context, you're perfectly happy with them. So that's another different and powerful way, I believe, to look at such an issue.

Roland Kupers:

The other big bucket ... And I've tried to go through several buckets of this, social norms, dealing with path dependencies. Another one is there are particular infrastructures that are necessary to facilitate change. Now one of these infrastructures, and it's slightly wonkish, but I won't go too much into the technical detail, is that if you transport electricity over long distance, you lose a lot of it.

Roland Kupers:

Now there is one way of fixing that, is by building direct current as opposed to alternate current networks. If you model this a little bit, you see that effectively you can create almost like a copper plate over a continent, where the infamous interruptibility of renewables can be fixed because you can move power around from the wind and solar in two different places.

Roland Kupers:

There are plenty of examples like this. This is an enabling infrastructure that's required in order for a change to happen. This is quite an interesting case also. China has so far built 30,000 ... Last time I looked, 30,000 kilometers of high-voltage DC backbone. The US virtually nothing. The first proposal is just being discussed. Europe, in its European way, is cobbling it together between different countries and will possibly get there at some point.

Roland Kupers:

But the idea that certain things are preconditioned in order for system change to happen, I think, is an important consideration. In a sense, dealing with inequality is also an infrastructural thing. It's a precursor to be able to have a system make the required changes.



Roland Kupers:

In summary, what I'm trying to argue in this book is that time's up. We no longer have time for gradual change. We have to understand these snowball measures that have the potential to change nonlinearly, and it's through system science that can give us hints where these things happen.

Roland Kupers:

But bottom-up change has a bad name. It just assumes that let a thousand flowers bloom. That's not what I mean. It's understanding how bottom-up change actually can scale.

Roland Kupers:

This isn't necessarily new. I would hope that some of you recognize that if you take something like the GI Bill after the Second World War that catalyzed a lot of the suburban development in the US, it's a similar catalytic policy that's had massive changes through a relatively small intervention. So it's not that nobody's ever thought of this before, but as a focal area for really designing climate policy around, it is currently insufficiently used.

Roland Kupers:

And so, as a last thought I want to leave you with, is if you're framing policy through a complexity lens, you would look slightly differently. You look literally through a different lens or through a different frame, and you're interested in changing the collective phenomenon and not the individual agents. You're trying to get the bird flock to flock differently. You actually don't really care about the individual birds, but you care about what they do collectively.

Roland Kupers:

As Anderson in his '72 paper said, more is different in complex systems. The whole is not the sum of the parts. So you need to really understand how the whole is shaped and happens. What we're interested in climate policy is the systemic emissions, and whether one person emits more or less really doesn't matter that much.

Roland Kupers:

The second thing is you would really be obsessive about interconnected systems. For example, the argument around people who are pushing green hydrogen fail to see that if you put a lot of renewable power into hydrogen, you actually take it away from fossil fuel replacement and you're just moving stuff around. And so, really looking at the impact of a full system when you're arguing for a new policy, I think, is critical.

Roland Kupers:

The third thing that you see in this systems perspective is you're going to get everything wrong or at least slightly wrong, and you have to assume that you're going to have to course-correct, because these complex systems are not easy to model. This is certainly true for societal systems. So there is no perfect answer. You need to be prepared to keep fine-tuning these things.

Roland Kupers:

So I wanted to leave it there and stop talking at this point. I've got plenty more examples, but perhaps we can get to those through some questions or through some criticism from the participants.

Scott Leland:

Thank you very much, Roland. That was a fascinating tour through systemic change and what it is and why it's important. I have a question or two, but I also want to make sure that people know to submit their questions via the Q&A or the raise your hand.

Scott Leland:

First, just a comment, Roland. You were talking about contagion and the changing norms and social values and bringing up the example of red meat. There's an interesting development in Singapore over the past week, which is that it is now the first country to approve lab-grown cultured chicken. Presumably, lab-grown beef, red meat, is not going to be far behind.

Scott Leland:

It strikes me that this, of course, is hugely important for climate change, as you point out. But the development of this, I don't know how it looks through a systemic change lens. It's certainly not a top-down change. You could argue that it's a market forces-driven change, but you could also say that it's a technology change.

Scott Leland:

I guess that's my question, is how does this look from a systemic point of view and is this something that government should be pushing hard from a policy point of view, or if it's actually bubbling up somewhat organically through technological development, through market opportunities? Should governments just sit back and applaud and let that happen?

Roland Kupers:

I think it's unlikely to scale at the speed that's required. There are plenty of examples of these solutions that seem like a good idea, and they are a reasonable idea. But will they make change at the scale that's required? This meat is a lot more expensive by a lot.

Roland Kupers:

It could be cost-reduced over time, et cetera, but hope is not a strategy when there is a perfectly reasonable alternative, which is just consuming a hell of a lot less red meat. Those who are vegetarians around this call will know that you don't regret eating less red meat when you stop doing it. So it's not that your utility function goes down in any way. There's no price to pay for these kind of changes of norms.

Roland Kupers:

I think it's fine. I'm not against it in principle at all. But I'm skeptical that it would be a solution at the scale required within the time frame required. If we had 100 years, then maybe it's a good idea, if we were back in the '60s. But today we're looking at change over a decade, and it's hard to see how that would happen nonlinearly, this kind of a switch, substitution.

Scott Leland:

Thank you. We have State Senator Mike Barrett is raising his hand. So I'm going to activate him in the session. So Senator Barrett, please ask your question. I think you're muted. Let's see.

Mike Barrett:

Well, thank you very much. Can you hear me okay?

Scott Leland:

Yes, we can hear you.

Roland Kupers:

Yes.

Mike Barrett:

Fascinating discussion. I want to thank our presenter and I want to thank the Kennedy School. It seems as if our presenter, Dr. Kupers, is still arguing that humans, for the most part, have to catalyze this change. The point he just made is that organic changes left to their own devices will not happen quickly enough. They have to be harnessed in some way, perhaps guided or channeled in some fashion.

Mike Barrett:

In the end, for a lot of democracies, this boils down to strategic steps that political leaders should take, if only to reinforce the norms that are emerging, or if only to incentivize the emergence of such norms. So who's thinking about exactly what levers humans can work in order to encourage these systemic changes in a particularly useful direction?

Roland Kupers:

Yes, thank you for the question. I think this categorization is really important. It goes back to the discussion of how does change happen. You can encourage them by telling people they need to change or you can incentivize, which suggests some markets incentives, et cetera, or other incentives, or you can tweak the system. This is where you get to examples like the GI Bill, which changed the layout of American cities in a major way over a fairly short period.

Roland Kupers:

Another example is the incredibly rigorous mercury emissions regulation that the US Congress adopted, which de facto led to the demise of a lot of the coal plants in the US, which was not a climate policy but it was a catalytic policy that had a nonlinear change.

Roland Kupers:

What I offer in this book is to really think about that as a third category. One is policymakers somehow "tell" people what change they want. The other is they set up incentives. The third category is they change the architecture of the system based on an understanding of how systems work so that they change from within. I really think of that as a third category of policy instruments. That's not enough part of the standard policy narrative at this point, in my humble opinion.

Mike Barrett:

If I might just make one follow-up comment that, first of all, I agree with you and that I find that what you have to say in this respect very interesting. On the other hand, it does argue really for an additional layer of sophistication in ... Well, I hesitate to call it top-down policymaking, but certainly an additional layer of sophistication in policymaking.

Mike Barrett:

I think, for example, about current COVID policy in the US. There's no question that we need norms to change and that compliance somehow has to become organic if we're to get out of the dilemma that we're in. But on the other hand, the default tends to be to lionize wonderful people like Dr. Fauci in the hopes that he will jumpstart this organic process of compliance that you're pointing to. So there's a confusion or a contradiction at work here, isn't there?

Roland Kupers:

Yeah, but this is why we have a wonderful Kennedy School, et cetera. But a lot of our policy narratives are hopelessly confused. You see it in Europe, which is ... In France, if you go out, you have to have ... I went to high school in France, so this is very familiar to me. You have to have a little note that you sign that justifies why you're going to the supermarket. In the Netherlands where I am, people retain full agency. You can go out and do whatever you want. People are counting on more voluntary participation.

Roland Kupers:

So this whole COVID situation indeed is a massive experiment in these three buckets of policy. But you're right, to have systemic change or this kind of complexity policy requires a more sophisticated political apparatus and political narratives. But I'm afraid in the case of climate, we don't have a lot of choice because the standard approaches don't seem to be working.

Scott Leland:

Okay. We've got quite a few questions lined up in the Q&A. One of our attendees asked, "What would be some examples of policy measures to reduce emissions in China and India using this framework?"

Roland Kupers:

So China and India, particularly China, is doing remarkably well. It's the one example I would put in terms of top-down climate policy that may actually work. So we'll see.

Roland Kupers:

But one of the major issues in China, which also extends to Korea and Japan, is the financing of these 1,000 new coal plants. So the expansion of the coal fleet is financed by a relatively small number of financial institutions. So finding a theory of change, an intervention with that network of people, perhaps 100 people who are financing that, I think would be a powerful intervention.

Roland Kupers:

So that, I think, would make an enormous difference. It's not just China, but it's the whole Belt and Road Initiative, which rolls out across Asia, Pakistan, Malaysia, et cetera, all the way into Italy. So that's one way.

Roland Kupers:

The other is also I think more attention to this issue of inequality, because there's no doubt that most of the greenhouse gas emissions in China and India are either by the elites or to serve western consumption. One of the things you might think about is ... I know this is in the US has never made it onto the radar. But if you look at the structure of a value-added tax, where you tax at the place where value is added along the chain, you could think of a carbon-added tax, so that the carbon that's added

ultimately is charged to the end consumer, because, currently, western consumers take no responsibility for the carbon emissions that we have outsourced to China and India.

Roland Kupers:

So, again, it's about the interconnection. Which bit of our emissions in those countries are actually caused by us, if I look at the framing of your question? No one-liner answer, unfortunately.

Scott Leland:

Thank you. Another question: "I'd be interested in the view on accelerators such as coupled systems. Electronic vehicles as storage for the grid, for example. If electric vehicles become ubiquitous, the variability issue could be managed without utility-scale battery storage. Do you have any comments on that?"

Roland Kupers:

Yes. So I wrote a whole chapter on electric vehicles in the book. It's a bit of a long story, but let me just give you the really short version of it. I think electric vehicles are fascinating not for transportation and not for the storage issue, but as a social norms policy. It's the largest consumer purchase that any person makes.

Roland Kupers:

If we were to move away to autonomous, self-driving electric vehicles, which is a plausible future, that has the potential to change an enormous amount of things in terms of our social norms, in terms of the amount of accidents that happen, in terms of our medical system, in terms of urban space. In US cities, 30% to 40% of the urban space would be released from parking for redeveloping cities, et cetera.

Roland Kupers:

So I think, through a systems lens, it's not so much by sticking too much to this battery stuff, et cetera, which, I'm not trivializing, is really important. But if you think about the systemic change potential of electric vehicles, it's in the autonomous, collectively owned vehicles and it's not in the incremental ... Tesla, which is basically a really heavy, nice improvement over the previous car, but it's not a system change. There is potential for system change there, but for systems outside the transportation system. It's this interconnection between systems, I think, that makes it fascinating.

Scott Leland:

Thank you. To another question: "To what extent is structural change in our governance systems required for this? Complexity policy lies in opposition to the quick and easy fix strongman politics that is currently visible across a lot of the world. How can complexity policy be integrated given our current four to five-year election cycles?"

Roland Kupers:

The first thing I would say is there aren't that many strongmen. The other thing is that strongmen actually understand this stuff pretty well. They just don't use it for the kind of stuff we're talking about here. But they're quite astute in terms of figuring out what small interventions lead to big changes.

Roland Kupers:

So the answer, I think, is quite mixed. The point is you have to want to deal with climate in the first place or else we're not going to get there. But I think our current governance systems are perfectly capable of dealing with this. We don't need to change our governance systems. We just need to add this toolkit, this set of policy options more explicitly to the options we have. If you look at the lists, the long books and reports that say what we should do, very little of it is about this kind of complexity policy.

Scott Leland:

Thank you. Professor Bill Clark, who leads a program at the Kennedy School on sustainability science, has a comment and a question. Bill Clark, I'm going to read your comment as you submitted in the Q&A. Then if you wish to elaborate, I am going to elevate you to speak on it as well. But let me read you the comment and the question.

Scott Leland:

This is from Bill Clark. He says, "I've been following a lot of the work on implications for climate policy, viewing iterations between environment and society as complex adaptive systems, much of it from schools in the Netherlands. Dominant themes from that work are the importance of cultivating, one, micro-level niches for innovation. For example, solar panels.

Scott Leland:

Two, macro-level for biasing selection from among those innovations, those that will support the transitions you want to achieve. For example, feed-in tariffs. And, crucially, meso-level political action to destabilize or undermine the power of incumbent interests who don't want such innovations or transitions to occur."

Scott Leland:

Bill Clark says that he's putting [inaudible 00:45:34] one paper summarizing this stuff, which we'll try to send out. Could you comment on the similarities and differences between the view from a complexity lens that he's just summarized and your own? Bill, you are live in case you want to add any additional clarification or comment.

Bill Clark:

No additional comments. You read it perfectly.

Scott Leland:

Thank you so much.

Bill Clark:

You read it better than I wrote it.

Roland Kupers:

You may be referring to [Jan Ratmans 00:46:07], by any chance?

Bill Clark:

Ratmans and [Gilos 00:46:10] and [Girbath 00:46:11], [inaudible 00:46:12], and so on.

Roland Kupers:

Yeah. I think what they do is absolutely useful. There isn't a regrettable tendency also amongst complexity folks to reductionism, to too quickly try to get to schemes and formulas, et cetera. I think that suffers a little bit from that.

Roland Kupers:

My view in the policy interventions that I've made or have been involved in is really to have a more open discussion and get experts to co-think, to guide experts in the kind of interventions rather than identify them. So I think the kinds of frameworks that they propose are useful, but I think they're slightly too narrow, and we need to go back to basics and look more broadly at it, because climate policy is fiendishly complex, literally, and touches every single aspect of society.

Roland Kupers:

And because of the interconnection between these things is as soon as we reduce it down to, oh, there's this trick to get the power system to become green, I think we're too optimistic. I think these things have deeper path dependencies and more resistance to change than we anticipate.

Roland Kupers:

As a last comment, one particular category of policies that's unusual and not often said is sometimes you have to purposefully break a path dependency. So it's a destructive policy to cut a path dependency to liberate a system to be able to change. I think the frameworks that have been formulated in the Netherlands in particular are useful, but we're nowhere near what we need.

Roland Kupers:

I don't want to say that I have all the answers. I just think more people should think in this direction. Those people you quoted certainly help, and probably you as well. I'm sorry if I don't know your work.

Scott Leland:

Thank you. A question from [RB 00:48:28], who asks, "With regard to the integration of solar and wind and adoption of electric vehicles, it seems that the field of dreams approach, build it and they will come, works best. If people see them, they will buy and use them. Is that correct and is that what you're suggesting?"

Roland Kupers:

No is the short answer. I think what you're describing is largely the market approach, the market fundamentalist approach. As long as people innovate, it will happen. So let me give you one specific example.

Roland Kupers:

We're lucky that Tesla came along and made electric vehicles possible. But from there to autonomous vehicles, the kind of vehicles that actually would make a difference to the climate, there are a number of enormous thresholds to be taken out. For example, autonomous vehicles, which will be lightweight, do not mix well with human-driven SUVs. And so, you have to think about separating roads, et cetera. There are all sorts of infrastructure things that are required.

Roland Kupers:

I don't mean this as an accusation at all, but one of the assumptions, I think, that underlies your question is the idea that there's a level playing field and that, therefore, every new technology has the same chance. If you look at things through a complex system lens, the whole idea of level playing field is nonsense. It's something that doesn't exist. Things have path dependencies and you have to look at it much more deeply than through this traditional, I think, relatively oversimplified economics lens.

Scott Leland:

Thank you. [Manferre Cultagerone 00:50:29] asks, "Two questions. One, how do you map the systems to be changed? And who is the system operator that can bring about the change? Isn't not saying what your policy objective is patronizing towards the public, or should we just consider it a necessary evil?"

Roland Kupers:

Yeah. Thank you, Manferre. I think, for this purpose, we have to consider the people in governance are the system operators. The people in government, in public government, really operate our societal systems. It's not perfect, but they're the ones that are empowered with different degrees of legitimacy to make these interventions. So I think it's them.

Roland Kupers:

Your second point, I think, is really interesting and it's one I struggled with in the book, particularly in the last chapter. There's an ethical problem with complexity policy because, as you point out very correctly, you're not really leveling with people. There's something sneaky about doing this. And so, there is a real legitimacy issue with that, and that's the dilemma which I, frankly, don't quite know how to deal with.

Roland Kupers:

But, again, it's happened before. If you go back to the GI Bill that I quoted a number of times, did somebody stand up when the GI Bill was adopted and said, "Beware. This might completely change the fabric of our cities and might completely change the racial structure of the country," et cetera?

Roland Kupers:

And so, it's not unusual, but you point to a really important dilemma. The democratic or the ethics around this complexity policy are a really issue that deserves attention and deserves deeper thinking than I've been able to devote to it. So thanks, yes.

Scott Leland:

Thank you. [Diogo Osorio 00:52:29] asks, he says, "Hello, Roland. Thanks for this presentation at my old school." I assume you may know him. "As we are talking about policy change in a scale rarely seen before, how do you connect the framework given by complexity and the cognitive dissonance so characteristic of climate change? The frog in the boiling water. How can we get complexity to be translated in a way that gives the kick without scaring to death those who need to change?"

Roland Kupers:

Yeah. So thank you, Diego. I think my last point is that what we need to change is the collective, so the emergent nature of a system. So we need the birds to flock differently. We actually don't need to get



every single bird engaged or even convinced. And so, the individual agents don't matter that much. It's about changing their collective behavior.

Roland Kupers:

Think also about the upcoming issue with vaccine resistance with COVID. We're really not interested in convincing everybody they should take a COVID vaccine, but we need enough to create herd immunity, because that's the collective's aspect that we're looking at. We're looking for herd immunity from COVID through vaccination.

Roland Kupers:

I think for this climate policy, there's something similar, is that you want to have measures that change enough that, collectively, it changes. Whether they're a couple of people who eat a pound of red meat every day, I don't really care, as long as the collective impact is reduced.

Scott Leland:

Thank you. We have a question from Dr. [Bowdan Oryeshkovich 00:54:16]. Dr. Oryeshkovich, I've unmuted you, so please go ahead and ask your question.

Bowdan Oryeshkovich:

Yes. Could we give a solar panel pad ... First of all, thank you for ... This is the first time I've ever been asked a question on Zoom, so I'm a little excited. Could we give a solar panel pad to every child to train them to collect value energy from an early age so that they can learn to power their devices? I have such a plan for Ukraine, which is very dependent on Russian oil. Thank you.

Roland Kupers:

Yeah, thank you for your question. Congratulations on graduating to Zoom questioning. Yeah, I know. It's a good question. So what I would suggest from a ... So that can be useful from an educational perspective. From a systems perspective, if you think about this aspect of the "contagion" of solar panels, what you would actually look at is in cities, maybe through satellite pictures, what the solar panel deserts are and you would look for influencers, literally. Who are people in that community that people would look for as an example, and you would give them free solar panels so that other people copy them.

Roland Kupers:

For this particular adoption of solar panels, we wouldn't even be that interested in the children. We're interested in the nodes in the community that might lead to rapid propagation literally within the next year, or else we'll just have to wait for those kids to grow up.

Roland Kupers:

So what you're proposing, I think, is sensible, but from a rapid change of society and greening of power, I think there's a more focused approach that leverages our understanding of networks in complex systems.

Scott Leland:

Thank you. We're coming close to the end of our time, so we have a last question. "President-elect Joe Biden has promised on day one to rejoin the Paris Agreement, to make large investments in a green economy, and to incorporate climate policy not just in the Environmental Protection Agency, [inaudible 00:56:33] the various departments and agencies of this administration. Is this an example of a potential climate revolution? Is this how government creates new social norms? More generally, what advice would you give to the new administration?"

Roland Kupers:

So I think this is an example of playing catch-up, and I'm really happy that the US is going to play catch up. But they'll find that other countries have moved quite a bit in their four years of absence from this topic.

Roland Kupers:

My advice, just in the last few minutes, the absolute gem in the Paris Agreement is the ratcheting mechanism. With the ratcheting mechanism, is that people sat around the table and said, "We are making an agreement which we realize is insufficient. We commit to each other that we will have greater commitments every five years."

Roland Kupers:

I think my recommendation to the Kerry administration would be to champion the ratcheting mechanism at COP26 next year and say not only are we coming back, we're actually going to make sure that everybody ratchets up their commitments from the Paris Agreement, because it's the ratcheting that will get us there. The Paris Agreement itself is way insufficient. It's fantastic that it's there, but the Kerry administration becoming the ratcheter-in-chief, I think, would be wonderful to see.

Scott Leland:

Okay. With that, I think we're going to close. I want to thank you very much for a terrific presentation. We really enjoyed this. We hope to get you back again for your next book [crosstalk 00:58:22], whenever that will be. I would encourage everybody to go ahead and take a look at Roland Kupers' new book.

Scott Leland:

To our audience, thank you so much for joining us. you can check out the final YouTube video on the link that's been provided in the chat. So thanks, everyone. We hope to see you next semester when we reconvene with this seminar series again. Thank you.

Roland Kupers:

Thank you to all. Thank you, Scott.