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Welcome to IFLScience – The Big Questions. The podcast where we invite the experts to explore the biggest mysteries of science with your host, Dr Alfredo Carpineti.

I: Welcome to IFLScience – The Big Questions. A series where we ask experts some of the most pressing mysteries of science, technology and humanity. I'm your host, Dr Alfredo Carpineti, IFLScience's Senior Science Writer. And it is my pleasure to speak today with Dr Alexandre Koberle, a Research Fellow at the Grantham Institute for Climate Change at Imperial College. The question this time is can we stop or reverse climate change? Dr Koberle, it is a pleasure talking to you. Could you tell us a little bit about yourself?

R: Sure. My name Alex Koberle. I'm a Research Fellow at the Grantham Institute at Imperial College, London. I'm also in the Centre for Climate Finance & Investment at the business school at Imperial College, London. I'm a lead author in the IPCC Sixth Assessment Report. I've been part of many different types of assessment, the UNEP Gap Report, for example, and the global environmental outlook from UNEP that came out a couple of years ago. I have been studying transitions for the best part of a decade now. I have a background in biology, environmental studies and energy planning. Really looking to a lot of the land use and agricultural side, bioenergy side of climate actions, so nature-based solutions, so to speak, where the confluence between that and the food systems and finance converge. It's a pleasure to be with you here today.

I: Thank you. That is very interesting. Let's start with some background. What is the climate crisis and how did we get here?

R: That's a long story. I think you can trace it back to the beginning of the industrial revolution. That's when we started using fossil fuels more heavily that it drove the increase of CO_2 in the atmosphere. Which then changes the energy balance of the earth, which causes climate change. A lot of this increase in fossil fuel use was, like I said, traced back to the industrial revolution, industrial activity. That's really tied to the rise of capitalism and to the accumulation of capital, the possibility to make these large investments. The roots of capitalism go back to colonialism and accumulation of capital in Europe. It's a few centuries' process that has got us to where we are today.

I: Thank you. One of the goals to avoid catastrophe for the planet is to stay below this 1.5˚C increase of global temperatures target. At the moment based on policies worldwide and what people and companies and governments are doing, how likely is it for humanity to stay below that target?

R: Well, the level of ambition needs to keep going up. There is a process whereby it is going up. Momentum is building towards that. We had the Paris Agreement in 2015. Five years later, we

have the Biden administration coming in. There's a lot of activity around net zero, targets being announced. What needs to happen is these targets need the types of policies that actually do reduce emissions. The targets themselves, you can announce a target, but unless you implement real policies that will change the trajectory of the economic system or the emission system, you won't get there. These policies need to be implemented. The IPCC's special report on 1.5˚c showed categorically that this decade is critical. The next ten years are critical. What we need is climate action and mission going out in the next five to ten years in order for 1.5 to remain within reach.

I: If there was a serious political commitment, if there were policies that follow the ambitious targets, would it be possible to stop climate change, or the best we can hope is that we can slow down and that can mitigate climate change?

R: It depends on the timescale that you measure this in. Yes, we can control and mitigate a lot of the most dangerous effects of climate change. It would be possible, particularly if there was, like you say, serious political commitment. But it needs to be serious political commitment with policies that actually change the financial flows in the direction of low carbon alternatives. If that were to happen, we do have technology options already available today. With larger financial flows going into low carbon, it would actually bring others also to commercial scale, so you would be able to reduce emissions quickly enough to keep…at least within 1.5˚C it's still within grasp.

To completely eliminate climate change is a different question because there is already some climate change in the systems. There is already some warming in the system. There's an inertia in the climate system whereby even if we completely zeroed emissions today, there would still be a bit of warming that will take place in the next couple of decades. Greenhouse gases will have to be removed from the atmosphere in order, for example, just to start coming down. But there's a lot and there's a bit of a…there's this inertia in the climate system that needs to be taken into account. It could, in the long run, be brought back down to the same temperature, the average temperature that we had in the pre-industrial era, but it would take many decades. It would not be something that we could do immediately.

I: Thank you for that answer. This brings me to the crucial question. Let's think in multiple decades, maybe even longer, what would be necessary to stop or reverse climate change as it is, assuming that there is the commitment?

R: Everything that I've been talking about, basically. It's massive deployment of low carbon alternatives. It's a realignment of financial flows to enable this. All of this really goes back to policy change. Policy needs to be put in place to enable this. To expect that the private sector will alone do this and that consumers, through their behavior change, would alone do this is a naïve and dangerous game to play, in my opinion. We do need policymakers worldwide to step up to the plate and implement the types of policies that are needed to send clear signals to the private sector, to consumers, to everybody, to society in general of the direction of travel. Where it is that we need to go. The investments will start following the policy once the policy is in place.

I: There is a lot of discussion about technological solutions. Some go from simple massive tree planting. Other is carbon capture systems from something moderately simple to vast industrial scale to even more dangerous ideas like geoengineering. What is actually there? What has been thought as a reasonable and maybe approachable way to mitigate the planet crisis in the short- and medium-term?

R: Short and medium-term is going to be mostly based on renewables. We're shifting to renewables, to maybe biofuels in the short term as also a viable alternative. Some nature-based solutions like you mentioned tree planting, yeah, it has to be done right. It's not just any tree planted anywhere that's going to work. It has to be done in a well-planned and scientifically based manner. These options do exist. CCS as you mentioned, carbon capture and storage, is also something that's available, but the scale of that is not there yet. It's something that is probably five to ten years. Maybe a bit more into the future depending on how much investment happens immediately. There are options there as well. It's basically just shifting to low carbon as quickly as possible with what's available. Solar and wind are now cheaper than many fossil fuels in many parts of the world. They should be deployed to enable the beginning of this transition now because it's cost-effective to do so.

I: Fantastic. In the slightly longer-term, knowing that there is this inertia of the climate that maybe we can go back a little bit before humanity messed up big time our world, what do you think are the technologies or the approaches that do require maybe long-term planning or multiple decades but also more investment in the long-term?

R: I think, like I said, everything. Everything's on the table. All options are on the table. From renewables to biofuels to hydrogen to demand shift to diet change to behavior change, all of these things need to be part of the solution of how we produce the goods and services that we consume, but also how we consume them. What kind of choices we exercise as consumers will be a part of getting to where we need to be in order to avoid very dangerous levels of climate change. This is not going to be an easy thing to do. This is one of the most challenging things that humanity has ever done, if not the most challenging thing that humanity has ever done, because it has to happen on a global scale and coordinate on a global scale, which is something that has never been done before. Not just organically, but it has to be directed and this is where the difficulty lies is how to build this common direction of travel globally across sectors, across geographies, across societies and so on. That is going to be the main challenge, but there is no silver bullet. I think that this is the one thing to remember is that there's no silver bullet. I think everything is part of the solution and to act that way and expect that to be the case.

I: Thank you very much for…I like the message that there is no silver bullet and you need a holistic approach to actually change our course. I think I have only one final question. If there was one thing that you would want everyone to know about the climate crisis or how to fight the climate crisis or a message that you would want to send out, what is it?

R: I think be engaged. Engagement in all its possibilities. Be engaged in how you consume, anything that you consume, your consumption patterns and your behavior. Try to use carbon transportation, cycle, walk, active transport. Try to choose what you buy and the food you

consume. Travel consciously as much as possible. Just do the things that are possible for yourself. Also, be engaged politically. Be part of the process and demand of your representatives that they put this high on the agenda. This is particularly the case for younger generations that they're going to be living through a lot of the…not just the impact, but the transition. That is going to be quite challenging because for a little while there will be impacts and transitioning happening at the same time. It will be a very turbulent time. The sooner we start, the easier it becomes maybe two decades from now. I think that this urgency of the action meetings that happen now stems from making things much easier a decade or two down the line here. That's what I'll say, engagement, I think. Be engaged. If you take this seriously, do your part. Be the change that you want to see in the world.

I: That is a fantastic message to end on. Thank you very much.

R: Thank you. It was a pleasure.

Thanks for listening to IFLScience – The Big Questions. Don't forget to subscribe so you don't miss any future episodes. And join us next time when we'll be investigating the depths of consciousness. Until then, take care.

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