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PANEL DISCUSSION:

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HASS: Good morning, everyone. My name is Ryan Hass. I am the Director of the China Center and a Senior Fellow here at the Brookings Institution. And this morning, I'm delighted to have an opportunity to moderate a panel of experts on America's clean energy transition and how it intersects with the U.S.-China relationship. This event is part of a broader project titled The Future of U.S.-China Policy Recommendations for the incoming administration. This project began last summer, well before the outcome of our election was known. It was designed to generate the best ideas possible for the incoming administration on the toughest issues that they will face. We're going to use the coming hours to examine what the United States could do in the coming years to advance progress on clean energy and carbon reduction technologies while strengthening its hand in competition with China. I will reserve time at the end of our hour for you to engage our speakers with your questions. So please be thinking about what it is that you would like to pose to them. But just to get us started, I will briefly introduce our panelists, and I will be inconsiderately brief in doing so to preserve time for our conversation. But I welcome you to go to our website to look at their long list of accolades and accomplishments and background if you have time and interest. First to my left is Samantha Gross. Samantha is Director of the Brookings Security and Climate Initiative, as well as a Fellow in the Foreign Policy program here at Brookings. Her work is focused on the intersection of energy, environment, and policy, including climate policy and international cooperation, the transition to net zero emissions energy systems, energy, geopolitics and global energy markets. Our next panelist, who flew in from California, is Jeffrey Ball. Jeff is Editor in Chief at Stanford's Doerr School of Sustainability, where he is leading the development of a new global publication of ideas about sustainability. He is also a Nonresident Senior Fellow with us here at Brookings and the Energy Security and Climate Initiative. His writing focuses on energy and the environment. Thank you for being with us, Jeff.

BALL: Nice to be here.

HASS: And our third panelist is David Edelman. David is a Distinguished Fellow at the Internet Policy Research Initiative at MIT in Boston, holding appointments in the Computer Science and Artificial Intelligence Lab and Center for International Studies. He is also, importantly for me, a Nonresident Senior Fellow in the China Center, where he focuses on research on the governance of AI, digital supply chains, and the United States China relationship and the geopolitics of technology and telecommunications. So, with those backgrounds out of the way, we're going to dive right into our conversation. And I'm going to start by asking a question of all three of our panelists. We'll start with Samantha and work our way across. And it's really just a opportunity to set the scene a bit. Humanity faces a threat from climate change, but the world is divided into

nation states. The United States and China are the two largest emitter of carbon emitters, as well as the two largest sources of innovation and clean energy technologies. Not everyone has the luxury of following these issues on a day-to-day basis. So, help us understand how would you describe the nature of interaction between the United States and China on climate and clean energy? And why does it matter how these two countries relate to each other?

GROSS: Absolutely. Well, the U.S. and China are the world's two largest emitters, with China number one and the U.S. number two. And it matters a lot how these two countries interact because they're quite different. I mean, the U.S. is the world's largest economy, whereas China is still moving up its development curve. And so even though we're the two largest emitters, we're in very different places from an economic development perspective. That's really important to keep in mind. The other thing that's important to keep in mind, and it's going to come up constantly during our hour together, is that China dominates many clean energy products and clean energy related raw materials. And China has spent 20 years of really intense support and policy support of clean energy products. And so, the U.S. has a bit of a love-hate relationship here. And this shows in many ways; it shows, for instance, in the Inflation Reduction Act, which is the U.S.' largest climate action ever. There's this tug of war between wanting to do clean energy products here in the United States and to control some of our own supply chain versus wanting to do this quickly and at the lowest cost possible, which today would, in many cases, mean using more Chinese goods. And so, we're in this sort of pickle right now: we want to do the energy transition now because the climate is a cumulative system, so you want to do this as soon as possible. The sooner you do it, the better it works. But we also don't want to rely on China for many of our products, and we want to make sure that we keep jobs here in the United States. And so that push and pull, I think, is one of the most important factors in the U.S. and China's relationship on climate.

HASS: Thank you.

BALL: I have nothing to say after what Samantha just said. But I'll say something anyway. I'm going to answer with one word, which is cost. Ryan, you asked why the relationship between the U.S. and China matters on these issues. And it is because the relationship between the U.S. and China, probably more than any other relationship on the globe, shapes the cost of these technologies, which shapes everything about their use. So let me just try to be a little more specific if we break it down. When I say cost, what matters? What matters is the cost of innovating, the cost of manufacturing, and the cost of deploying. Those are the

things that shape the cost of sort of what is going to be accepted Here, I think for the purposes of this discussion, this is the good stuff, the green stuff. But of course, cost also matters in the dirtier stuff, the high carbon stuff, because the competitiveness of the green stuff is dependent not just on the cost of producing that, but on the relative costs of the higher carbon stuff. All of those things, all of those cost intricacies are largely the result of policy—and they are largely the result of policy by the United States and China, both domestically in each of these countries, (which as Samantha flecked that) are the biggest—well they're huge producers and consumers. But also, really importantly—and I think we'll probably get into this—those countries' policies internationally. And I just want to say just one last thing to sort of finish the frame, which is that to the extent that the relationship between the United States and China tends toward the cooperative, the barriers are lower. And as a broad proposition, the costs are lower. To the extent that the relationship we're probably heading into is increasingly cutting, the barriers are higher, and the relative costs are higher. And this gets back to the balance of whether one's goal is cost or domestic protectionism that Samantha talked about.

EDELMAN: So, when you asked about the nature of the dynamic, I guess I would characterize the nature of the dynamic as mutual anxiety on some level just from a technological standpoint. What I think is particularly remarkable about the U.S.-China relationship on clean energy is that across so many areas, there has been an anxiety in the United States. What would it mean if China were indeed better than the United States? can mean cheaper, it can mean faster, it can mean producing more of a particular strategic technology or set of technologies. Climate related technologies and clean energy are indeed, as Samantha mentioned, the conclusion of a 20-year full investment effort that have indeed made a number of important—and we would argue now—strategically important technologies cheaper, more available, and proliferating more from China than from the United States. Now, it's important to note that, of course, this is not unique, but unusual that there have been, over the years, dozens and dozens of similar efforts, perhaps not all at the same level of investment, that have resulted in major investments in China that have not resulted in the Chinese having a decisive strategic advantage in a particular technological area. But this is one in which the combination of really pushing up against the technological edge as well as the ability to, as we heard about cost, bring down the cost of proliferating in a way that the U.S.—solar is the classic example—but has not been able to compete in the same way. And so, in that respect, it colors the dynamic in a really critical way because the opportunities for true—how do I put it—independence for, you know, smashing the interdependence for decoupling, whatever your phrase of the last 4 to 8 years was, preferred becomes much less possible at scale when you set those kinds of goals. Now, of course, the other side of the anxiety is absolutely there.

You know, what gave way to a lot of this investment and need? Well, as Samantha rightly pointed out elsewhere, it is because China was needing to do more with less. It was a scarcity dynamic that led to this kind of innovation, as we're often seeing in the technological space. And so, as a result, the anxiety in the Chinese side is, gee, the U.S. seems to appear to have the luxury of also producing a lot of carbon intensive energy, has the luxury of not necessarily having to make IRA scale investments up to this point. We may have reached an inflection point with the IRA on that, and obviously with what we're seeing in climate. But at the same time, I think this is an important dynamic to realize that the luxuries of independence will not necessarily be there to the extent that both sides have a desire both to enhance their own climate contributions (or not), but also critically to win this market, because it will not be a case where both sides will be able to win the market in the same way.

HASS: Interesting. Now, I want to say at the outset that you guys are all welcome to jump in if you have anything that you want to violently disagree about. Embellish, amend: the more interactive, the better it'll be for all of us. But Samantha, David was just talking about the need and the scarcity that drove innovation in China. Could you talk a little bit about the strategic energy landscape in the United States and China? How does that look? How does it compare and what effect does it have upon the clean energy transitions?

GROSS: Absolutely. And thanks, David, for setting the table for me for this question. Yeah, the U.S. and China start—are at this point, in their energy systems are very different. And where you end up and how you get there depends on where you start. And we're starting in very different places. The U.S. is the world's largest producer of oil and natural gas. We are blessed with abundant, reasonably priced fossil fuels. China does not have that luxury. China is actually the world's fifth largest producer of oil. But you don't hear about that because China is also the world's largest importer of oil. So, the U.S. approaches the energy transition from a place of fossil fuel abundance, whereas China is concerned about providing sufficient energy to meet its economic growth needs. It has pretty abundant coal, but even coal they're importing a little bit now. And so, we come at this with very different attitudes. This is an important reason why China has put so much policy emphasis on developing renewables, because this is a homegrown energy source that they can increase their energy security with. And you know, actually, even sometimes in the political discourse here in the United States—will hear, well, should we really trade a reliance on good old American fossil fuels for our reliance on Chinese clean energy products and clean energy, raw materials? And so, China has a lot of drive to implement and implement renewable energy. Whereas the U.S., at least from an energy system perspective, less so. And I think that's shown in our policy over the past few years.

HASS: Thank you. Jeff, The Trump Administration and President-elect Trump himself have a solid track record of climate skepticism. But President Trump also prides himself on—

BALL: Ryan needs to become a diplomat because—

HASS: President Trump also prides himself on being a master dealmaker who can thrive in an environment of realpolitik. So, is it possible for President Trump to turn the tables and decide that there are gains to be had through raw dealmaking around climate and the clean energy transition? If he were to do so, how would that look?

BALL: Yeah, I think Trump could play the art of the deal as concerns climate change. And just bear with me for a second. I don't mean to be cute. Absolutely, Trump is a climate skeptic. And if you're here in this room or listening to this online, you probably don't need the litany. But let me just provide it for you. Trump has said that he's going to pull out of the Paris Climate Deal. He called, actually, I want to read this to you. He said that he's going to revoke billions of dollars in IRA subsidies that haven't yet been spent. And he called, in a tweet that went viral in 2012, he said that the concept of global warming was created by and for the Chinese in order to make U.S. manufacturing less competitive, noncompetitive. So that is the Trump that many people are familiar with. But I think it's really important to note what has happened since the first Trump term. A few things: scientifically, things are getting worse. The world is, by most estimates, blowing past thresholds, including an increase in global temperatures of 1.5 degrees above pre-industrial levels. Natural disasters are metastasizing in the state that I live in. I don't have to tell any of you. Los Angeles is on fire. And while it's impossible to ascribe any single event to climate change, it's clear that the prevalence of these events is increasing. So that's scientifically. Economically, clean energy technology—as Samantha has talked a lot about—are getting much more competitive. They are getting more competitive economically, and that is producing a geopolitical competition, which is to say these two countries, as Samantha talked about, China has had a constancy of effort in terms of its pursuit of these technologies. The United States has had less constancy of effort. But as these technologies get cheaper, there's a greater push, which is part of the explanation for the Inflation Reduction Act. And so, there's this dichotomy that's breaking out on the world stage. On the one hand, you have diplomatic efforts such as the recent United Nations conference in Azerbaijan and Baku, which produced very little progress. On the other hand, there's a lot of dealmaking happening internationally. And I think it's actually the case that it is the failure of these much-ballyhooed

grand global diplomatic efforts to produce pride progress that is causing an increase in smaller bore dealmaking, which ultimately may end up being more important. And so just allow me one more point here, which is that which is that U.S. policy, as again, Samantha talked about and David flecked at, has gotten increasingly offensive, has gone increasingly on the offense domestically through, for instance, the IRA. I think it's fair to say that the U.S. policy has been quite defensive and increasingly defensive globally. And that's actually been interestingly consistent from Trump one through the Biden Administration, which is to say building walls on the theory that building walls will keep the competitors out. And I guess what seems to me to be the case and maybe we'll get into this more as we go on, is that if you look at what's happening around the world, particularly in the part of the world that most matters to this question of climate, which is the Global South, not the Global North, what's really interestingly happening is that there's an assertiveness by really important economies in the Global South, which are actually beginning to make lots of deals on their own despite what is—or is not—happening in places like Azerbaijan. And so, it seems to me that if Trump were to decide that purely apart, let's say, for issues of the climate, you don't have to believe the glaciers are melting. All you have to do is believe you can make money here. And there is there is a transactional opportunity to do much more for the United States here.

HASS: Well, making money requires innovation, and innovation drives technology and clean energy technology. And this is one of the sort of key vectors of competition between the United States and China today. So, David, can you sort of bring us into this, how this competition is unfolding? Where do you see the ways in which clean energy is going to shape the technological dynamic between United States and China going forward?

EDELMAN: I think one of the key pieces to understand here is that we're increasingly getting to a place where the critical breakthroughs that are going to be necessary on the clean energy front require substantial strategic technological investments and vice versa. And specifically, that much of the incredible, important strategic technologies that the U.S., for instance, identified in the last several years that have come up in the last couple of years, are going to be wildly energy intensive—and will outstrip our capacity even with non-clean technology to otherwise power them. I think the lens through which to see this—and will be largely the subject of the paper that will accompany this talk and this project. My little contribution to it is one that looks at AI, and specifically, training AI in the context of energy needs. If you know one thing about AI and the energy debate right now, you know that AI is extremely energy intensive, right? Every time you go to ChatGPT, if you use it instead of a Google search for a piece of information, depending on the measure, that

can take four, ten times as much energy for that particular query. But what's interesting is actually the extent to which the fundament of what is actually required for you to make that search is the training of a large model of ChatGPT-o1 or whatever your latest that you use is. Training those models, these AI models, is incredibly computationally intensive, which means it takes a lot of energy and a lot of chips. How much energy? Well, the ones that we're using right now that are considered to be sort of state-of-the-art large language models, in many cases—and the estimates vary wildly—but the best ones that we can get our hands on suggest that we're talking about dozens of megawatts of energy to train one model. Now, there are, depending how you count, let's call it four U.S. large language model providers that are training, call it, three or so of those a year. But the key interesting thing here is that actually the trajectory that they're on. Because, yes, these models become more efficient over time. They're getting better at it. These companies are beginning to operate within the context of a little bit of scarcity, though you wouldn't know it from how well they're being funded. At the same time, there is a dynamic now where it's called the scaling laws. And pardon me for a second, we're going to delve into techie speak for a second. The scaling laws are not laws. They're, at best, conjectures, but essentially says this: the more energy and compute that you throw at training a large language model, and the more data you throw at it, the better it is. And in a linear exponential, if not linear sense, it is pretty clear that these models (so far) get better the more you throw at them. Well, the problem that we're running into now is that these models are again becoming wildly computationally intensive. Training them takes more and more. And you're seeing the companies that are responsible for paying for this, looking up and saying, as they have in many contexts, that the limiting reagent for AI advancements in the next 5 to 10 years will be if can we get enough energy to train them. And, you know, don't take my word for it. Look at Microsoft that decided they're going to make Three Mile Island cool again and literally create a new fission plant that's going to be just serving their centers. I mean, think about the trajectory that is on in terms of taking on nuclear, having it be private for a data center. This is emblematic of what's to come. So, I think when we think about this dynamic, remember, the US and China have both identified AI as a critical strategic national priority. Both have said in as many words that whichever country leads in AI may have a “decisive strategic advantage”. I think that means war winning advantage. More broadly, should we be in such a scenario? And yet at the same time, we're saying the limiting reagent to doing that is: can we get enough energy? And so that bilateral dynamic I think is extremely critical and we think about what will it take to get to that next level of AI innovation—more energy? What will it take to get to that next level of energy innovation? Probably a fair amount of AI, and we can talk more about that as time goes on. But some of the most important contributions that are happening in this space, particularly in areas we don't think of (materials science and elsewhere), are happening because the

contributions of some of these both vanilla AI systems and maybe increasingly some of these large language model systems like the ChatGPT's of the world that we're all using for our everyday consumer needs as well.

GROSS: I'm going to add a really brief point to that; David is really focused on the nitty gritty of why power demand is going up. But I can talk a little bit about what this means for overall power demand in the U.S. So, demand for electricity here in the U.S. has been flat as a pancake for about 15 years. In fact, it's declined a little bit. We're now seeing estimates vary and it depends on all the factors that David's bringing up. But demand increases at least minimum 2% a year, from flat as a pancake for 15 years. And so that is what this is doing to aggregate electricity demand here in the United States. And so, you know, it's really interesting to go from why it's going up to what difference this makes. Just AI and data center demand is driving this. Everywhere else, efficiency is generally driving power demand down. And so, this is absolutely fascinating.

HASS: Jeff, I'm going to move to overcapacity in a second, but I want to give you a chance to weigh in, if there's anything that you want to put on the table on the tech issue.

BALL: Yeah. I mean, what occurred to me as David was talking is that the danger in a discussion like this is that we're so binary and we're talking, for instance, only I'm not a Washingtonian. I actually grew up around here, but I'm adopted Californian, so I feel like a foreigner in this room. And the danger, it seems to me, of parachuting in here is that we talk about the fractious U.S.-China relationship because we're sitting in a policy bubble. But having just flown in from California, let me adopt the Left Coast view, which is that capital is global. Even though politics is increasingly bifurcated, capital is global. And so, here's just sort of an interesting thought experiment. The companies that are based out where I live have increasing data centers all over the world, including increasing operations in China. And these companies have made global promises to decarbonize. Excuse me, I can tell it's my daughter by the ring. And these companies have made increasing promises to decarbonize and as an increasing percentage of their footprint comes from their operations in China, they actually have an incentive in China internally, at least domestically, as a matter of cleaning up its own energy production—succeeding in cleaning up its own energy production. So, lest you think that increasing greenness in China is purely antithetical to U.S. interests, you'd be interested to know that Apple and Google and companies like them are investing huge sums in the deployment of clean energy in China. Why? Not altruistically: because they have made promises globally to reduce their carbon footprint. And if they can't get clean energy for their operations in China, they're toast in terms of their promises. So, I think it's just really important to remember, bottom line, that to the extent we are now entering

an even nastier period between U.S.-China relations. The private sector has made long term promises to its shareholders about decarbonization, multinational companies that will have huge egg on their face, regardless of who occupies the White House if they are not able to meet those promises over the long term.

HASS: Interesting. I want to come back to you in a second about the role of the private sector. But before I do, Samantha: Beijing has subsidized clean energy production inside China to a massive scale, particularly in solar, and it's led to market distortions. It's undercut U.S. and global competitors. What do you think the Trump Administration should do about this, if anything?

GROSS: Yeah, and solar is the easiest market to talk about in this instance because it's the most stark and obvious. So solar manufacturing capacity in China is twice global demand for solar panels. And so clearly there's been some over subsidization going on. But Jeff and I talked about this beforehand, like economic efficiency was not Beijing's only goal. And so, you know, they were doing a multivariable equation and, you know, they've ended up with overcapacity. But the Trump Administration, I think, is really focused on tariffs as honestly, the Biden administration was, in keeping solar Chinese solar panels out and focusing on increasing U.S. solar panel production. And that works to a point. But what tariffs can't do is make the U.S. more globally competitive. And so, yes, you can keep those tariffs up for a while, and I think they make sense, but they can't be the only tool in your toolbox. I think the support in the IRA is really important. I think continuing to support research and development in the United States is very important. You're not going to see the U.S. become a globally competitive producer of today's solar panel technology. Not going to happen. China has already won that race. But when you think about new technologies, the next generation of solar panels, or the one after that. If you think about new battery technology for electric vehicles, that doesn't use as much cobalt. There's a lot of work on this right now, both to get some unsavory sources of cobalt out of the value chain while also having some advantages in battery technology. That's another area where the US could lead. But tariffs will not make this happen alone. You need support for development of these new technologies for the U.S. to be a leader. So, if I were giving advice to the Trump Administration—I'm actually working on a memo doing just that—I would, and I am, talking about you have to continue supporting this and you have to think, as Jeff has said, about competing globally, not just about keeping the Chinese out.

HASS: So, Samantha was talking about the role of the private sector and really driving innovation to help strengthen America's competitive edge in this space. What role do you think that the private sector will play

going forward, Jeff? What can the Trump Administration do to create conditions that foster this type of innovation and competition?

BALL: Yeah, I think it flows from what we were talking about before. And again, I feel like Samantha has laid the predicate here. Look, the private sector is in a precarious place, broadly speaking. On the one hand, multinationals around the world, not just in the United States, based in the United States, based in Europe, based in China, have over the past five years made massive promises to reduce their emissions by the middle of the century. The whole net zero push. And on the other hand—well, not on the other hand—they have made those promises. And what's happened more recently is that they've started to realize the difficulty, or maybe started to admit the difficulty, of actually doing what they said they were doing. So, it's as if every week brings a new announcement about a company that had made a net zero promise, now retrenching on that net zero promise, I can't imagine that the people who occupy the C-suites of these companies are very happy about having to do that. But the reality is this is an incredibly difficult proposition. And yet, although the news is that they're pulling back, it's clear that strategically they've made a long-term calculation that they need to decarbonize. Their shareholders are demanding it. If you talk to their public policy people, despite the vicissitudes of who occupies the White House, they're generally betting on decarbonization as a long-term trend. And I think actually that's really important to keep in mind because, again, in this city, I think it's possible to get sort of knocked off track by the noise, even the quadrennial noise. And the last point I would make is just to take global Samantha's domestic argument, which is that to the extent that a tariff-based strategy has been defensive within the United States, it has also been defensive internationally. And I think is insufficient internationally. And so, Ryan, what might a Trump policy look like—that that were more offensive? So, it would involve shifts in trade policy. It would involve shifts in a whole series of policies that would create a more agile, more competitive United States business proposition around the world, particularly in the Global South. I mean, there are lots of deals that countries like Indonesia and Saudi Arabia and India are doing with powers around the world. And it's typically with China, not the United States; increasingly with China, not the United States. And I don't think that's for ideological reasons. That's because at the end of the day, the deal is sweeter with China. The China deal is sweeter. And there are things that the United States can do. But we have to decide that we want to play that game.

HASS: Well, David, I'm going to ask you how that happens in practice. If we want to sweeten the deal for the rest of the world, what will the next Trump Administration need to do? Because it seems clear that both the Biden Administration, as well as the first Trump Administration, took efforts to try to mitigate risks associated

with overreliance upon China in these key technologies. But looking ahead, what will we need to do? What will the United States need to do to really try to spur progress on the adoption of clean energy technology that emanates from United States?

EDELMAN: Sure. I mean, I'd be remiss not to point out, since it was in the news literally this morning, that the Biden Administration in one of their soon to be final acts just released a, I would argue, at least to take the headline down from *The Wall Street Journal*, wildly controversial new set of policies of export controls on what they call air diffusion. This is essentially setting global quotas for the export of AI chips to all but the closest U.S. friends and allies. This is going to be one strategy, I suppose, which is providing a clear sense that there are those that are on sides, there are those that are off-sides (Russia, China), and then there's everyone else in the middle—creating essentially a competitive dynamic in which the fruits of U.S. innovative labors have to be competed for or simply have to be limited in an explicit, if not implicit message that they need to do their best to demonstrate that they are worthy of the sufficient secure controls to have the fruits of U.S. technology or effectively buy our stuff from abroad. If we're talking about an AI computer, they'll just have to use the tools from elsewhere and not train them themselves. Like I said, this is obviously commercially rather controversial. I suspect it will be diplomatically extraordinarily controversial. But, you know, it represents one, I think, important dynamic of laying down clear lines because of the concern that proliferation of this potentially transformative clean energy, very relevant technology: there's no way to control its diffusion to China, but by preventing its diffusion to non-Chinese (but potentially friendly countries) is the sort of spoken *raison d'être*. I think it's worth taking a step back and recognizing that for these innovations take place, this is something of a departure from the standard mode. What might be a different mode that could be approached is one that I think perhaps more effectively considers—I mean, more effectively than is presently the case and has been for several years—risk and reward in the climate space. So an example right now, for instance, the U.S. Department of Energy's loan program office, a very important part of the U.S. clean energy ecosystem that can make these large-scale loans have limitations about what they can make these loans for on the basis of the technology readiness level: the TRL of a particular technology. In other words, they don't want the U.S. government (through the LPO) underwriting a large risky thing and expect that smaller dollars, both private sector dollars as well as smaller government dollars, should lead towards proving it out. That sounds like it makes sense in terms of the broad context of good stewardship of taxpayer dollars. Until you get a little bit under the hood and you realize, well, wait a minute. Not all clean energy technology is created equal. If you have a particular technology or set of technology that could be transformative, dramatically critical, have a huge impact on our ability to either meet

our climate goals or meet our energy demand. Whatever your frame is, then perhaps those should receive more dollars, more priority, more interest. I think one thing you've seen that's a point of continuity, actually, between the Trump and the Biden Administration is one minor area there that has yet to expand in disclosure—I'm invested in the space. It is nuclear fusion, which is an area where it could be quite transformative. The Biden Administration set a ten-year goal to have fusion on the grid. The Trump Administration was deeply invested in this in their DOE, and they started a real ramp up. The dollars are pretty small, certainly relative to anything IRA. But now take the Chinese counter bet in that, in which right now some U.S. companies are deeply concerned that their Chinese counterparts are effectively ripping off a combination of what they've learned through the international program and fusion, plus some very targeted but large, much larger than the U.S. domestic investments in fusion, to actually get fusion electricity on the grid possibly sooner. This is, I think, is actually a rather constructive dynamic in this race that is happening. But I think what's important to note about it is not just, yes, the U.S. and China are both racing towards the new technology, but that these are bets that, you know, increasingly, I think for either side to succeed (or both to benefit from) are going to have to be indexed to risk against the reward. And I would argue there are several other technologies that fall in that same context as well.

HASS: Interesting. Well, I'm going to shift to diplomacy and the Paris Climate Agreement momentarily. But before I do, do either of you want to weigh in on this?

GROSS: I'll just say that I absolutely love that point. We are seeing a lot of investment in fusion here in the United States. And it would truly be game changing, and the risk reward on that is enormous. And if the U.S. is falling behind on the level at which we invest on that, that is truly to our detriment.

BALL: The one thing that struck me about what David said was his mention of what we're optimizing for, what we care about. And I actually think that's it's a basic point, but really important to keep in mind. I mean, sort of sitting above this whole discussion—and we haven't really named it—is the question of what we are trying to do. Because how we as a country, or China as a country, or we as a world, answer that question, has everything to do with actually tactically what we do. So, are we I mean, to be really reductive about it, are we mostly trying to reduce the cost of energy without regard to energy's environmental implications? Are we mostly trying to reduce the environmental implications of energy without regard to its cost? And the answer, of course, is neither of those things, right? It's somewhere in between. But where you end up on that

scale has everything to do with, I think probably where you end up on all the questions we've been talking about here.

HASS: Well, are you prepared to answer that question? What are we trying to do?

BALL: It's so much more fun to pose questions than to have to answer questions. I mean, yeah, I'll take a stab. I mean, so I guess: three things. One is, and again, I don't mean to be cute here, but we have to care. We have to decide what we're endeavoring to do here. And I'm a journalist by background and therefore have spent a lot of time poking holes in rhetoric that seems empty. So, I'm not the first person to suggest that rhetoric is the most important thing. But if we have a president who is repeatedly saying climate change is a hoax, the world starts to believe that. That says something about the constancy of U.S. interest in these areas. And that has implications for how other countries approach the United States versus, say, China as a potential transactional partner. So that's point one. Number two, just to sort of reprise something that we've said a number of times, the way I put it is that we need to shift from a strategy of fear to a strategy of confidence. I mean, David has talked here about the solar example and talked about protectionism. I think one way to construe this is that protectionism barriers are an inherently fear based strategy. They are inherently endeavoring to stop a competitor from doing more of what a competitor already is doing. That's a very different proposition from identifying a strategy and trying to beat the competitor in a certain area. And so, I actually think that we need to decide as a country what our strategic strengths are, and how confident we are in our ability to do that—and how that stacks up against other priorities that we have. And the problem is that the answers to those questions often change every four years. But we need to reexamine that question. And the last thing, just to j harp on something I've already said, is that if the answers to those questions are in the affirmative, if we care and if we decide we want to pursue a more confident strategy, then that strategy is not merely about what happens within the United States. In fact, I think it's not mostly about what happens in the United States. It's mostly about what happens elsewhere. It's mostly about what happens in the Global South, because that is the place where these questions will be won or lost. That's what I'd say.

GROSS: Add a quick point to that. I love Jeff's emphasis on the word "fear". And this kind of goes back to what David said. I feel like the DOE loan program office, and often a lot of federal policy, is somewhat fear based. There's this fear of investing in technologies, of throwing too much at technology that doesn't end up working. Think back to the Solyndra controversy back in the Obama Administration.

BALL: Just to define terms for people. You want to tell people at Solyndra was.

GROSS: Sure. It was a new solar technology that the DOE loan program office invested in that failed, and the loan program office in the Obama Administration, in general, took a lot of heat for this failure. On the other hand, that's what the loan program office is for. It's going to invest in technologies that are not quite bankable yet. If that technology had been fully bankable, they would have gone to a bank. The point of this program is not to maximize returns. It's to invest in technologies where the U.S. can potentially get big wins. It's inherently risky. So, we need to learn to take a bit more risk and be a bit less fearful of how we spend taxpayer dollars because this is how we win. I believe there was a, in *The New York Times* just a few days ago, there was an op-ed on this. Do you want to teach the government to take more risks? And this is an area where we could really stand to take more risks because the payoff is so big.

EDELMAN: Just add one more point. I think we also, to the fear-based point, which I think is a really smart way to frame this. We have to be very honest with ourselves about what technologies, which innovations, which manufacturing processes; we are actually going to be in a position to maintain our capacity (or even leadership in) versus not. All technology does not diffuse equally. And so, for instance, the Biden Administration made a big bet on this idea that indeed, you know, certain technical elements of lithography, certain chip-making tools will not diffuse the technology: too advanced, too sophisticated, too capital intensive. And, you know, we can debate that. But at least that was a position that was based on deep insight or, you know, deep research on a particular technology, recognizing that we're not going to have a one size fits all approach here. And then, okay, well, maybe we fear. But, you know, as opposed to saying, well, generally we have to keep all of this from going out into the market because of the reverse engineering. Not all tech is created equal, certainly not in the climate space, I think that's one of the sort of secondary lessons of solar as well. Right? That's a capacity; that was technology, and capacity as well. And that dynamic between the two, and, for our own government, maybe this is one of those recommendations going forward, having the capacity within the U.S. government to actually have the knowledge and research to identify when we will be able to protect the technology. You know, you think that the offices that are responsible are filled with thousands of analysts that know all about how these things are made exist. They don't, okay? The Commerce Department is not staffed with tens of thousands of people who have all come from the industry of semiconductor manufacturing. They don't have it. So, they rely on what they hear from

industry, which has a certain lens through it, or what they're able to research from those positions where they often don't have time.

BALL: Or they hear from Brookings.

EDELMAN: That's what I was getting to; they hear from researchers, which is great. But, you know, I think it's really important that we develop that capacity. And, you know, including and especially in Capitol Hill, where the Office of Technology Assessment was abolished for a period of 20, 30 years (now increasingly coming back). So, I think that's something we just have to think about as we got it. We cannot approach this from a point of fear where we're going to take particular technologies and ringfence them because we have a fear of how they might be used or how they might proliferate. We better be damn sure that's the right one to do, right?

BALL: Ryan can I just make one quick point? I. And again, this may be the journalist in me, but I feel like it's really important to at least posit that. Assumptions about how Democrats and Republicans come out on these issues are often wrong. And I actually think the commonality between the first Trump Administration and the Biden Administration on a lot of these questions, particularly geopolitical questions, and the view toward China is structurally striking. Maybe, the difference is more a matter of degree than a matter of philosophy. And it gets back to this question of fear, which is it seems to me that both that both administrations have essentially adopted a view that is antithetical to what David just articulated. That is, we're not going to sort of discern perhaps as much as we should between which technologies we think we can excel in and which technologies we think we can't. I'm just parroting what David has said. And so, one really interesting shift in U.S. approach might be to get more surgical about what we're actually trying to pursue; and through the process of discerning where we think we can be surgical, surgically successful, we demonstrate that confidence. It's a much less blunt approach, a much more targeted approach. And it seems to me that that has the potential to appeal to people, whether they're in red or blue states, whether they're—they're Democrats or Republicans.

HASS: Interesting. Well, in the interest of time, I'm going to ask each of you two lightning round questions, and then we'll turn it over to our audience to take us home. But the first lightning round question relates to the Paris Climate Accord. President Trump removed the United States from the Paris Climate Accord. President Biden returns the United States. Jeff, you observed that it may not be the be-all and end-all.

Whether the United States is in or out, there are other avenues that the United States could use to try to advance and accelerate coordination with other countries on these issues. How are you all thinking about how significant it will be if President Trump delivers on his promise to remove the United States from the Paris Climate Accord going forward? David, why don't we start with you and work our way down?

EDELMAN: Well, you know, ask the technologists about the diplomatic policy question. Look, I think it will ultimately –well, the market is priceless. And I don't mean Wall Street. I mean the diplomatic market is priceless. Right? This is the thing about the Trump Administration; if you want to know what the Trump Administration is going to do, generally look to what the Trump Administration has said it's going to do. I mean, it's generally pretty straightforward. It's like in the campaign and then it gets to the office, so there's a certain amount of linearity to it. And so, on the one hand, I don't think us friends and allies are going to be, you know, deeply shocked to the extent that that happens. You know, I think this has come up before. A lot of the question will revolve around to what extent the trade space is then created by the Trump Administration to have other areas of diplomatic wins. I mean, you know, if I describe this most recent chip diffusion thing as diplomatically provocative, it'll probably be in the low quartile of diplomatic provocation in the context of broader things that President-elect Trump has said he's going to do in the early administration. But the question is, okay, to what end at, say, the end of that first year? Right? Will there be other trade space that's been created? Will there be other points of leverage that have been demonstrated, all the other enticements that exist that were not available under this administration potentially. And so, you know, I would argue that on some level, ironically, the symbolism of it is obviously not great from the standpoint, as you just said, the constancy of U.S. leadership in the world positioning. It's obviously not great for the signaling that it has for the broader climate projects, and particularly, countries sort of on the fence that might figure out whether they're really going to take a GDP hit or otherwise, to be a part of these sorts of deals and do their part. That's presumably negative from a long-term climate dynamic standpoint. But then what? Where do we go from here and what does the U.S. have? I think the questions have yet to be made, as they frankly are in terms of trade too. Right? I mean, you look at what happened with TPPP versus CPTPP, and the others. You know, can you have plurilateral, lateral, and regional trade dynamics that ultimately, you know, come as a sort of substitute for these sort of grand deals? And can they indeed, in some cases even be stronger, more malleable, because they are not just the lowest common denominator? Maybe the big problem here, though, is the emissions levels of China. Right? And does this ultimately embolden China to, in turn, do less in the context of climate, and particularly the context of Paris. And I would defer to my colleagues who actually study this to have a more informed debate.

HASS: Over to you, Jeff.

BALL: I don't think you care what Jeff Ball thinks. I think it's much more interesting what the Exxon CEO says. And Exxon has asked the U.S. not to pull out of Paris. And that says something interesting commercially about where multinationals are.

HASS: Samantha.

GROSS: Yeah, I'll be brief. Everything that they said I agree with. I'll also add that like diplomatically, this looks terrible, but practically a lot of what happens in the negotiation room at this conference or the party meetings that happen every year, its lowest common denominator because the process works on consensus. Where the action really happens is outside the negotiation room with the things that Jeff is describing on deals made between individual countries and companies, etc.—and so symbolically, it's awful. Practically, it's less bad because the action really takes place outside the room anyway.

HASS: Okay. Well, final question for you all, and I ask each of you, so we'll start with Samantha and work our way down. What is 1 or 2 recommendations that you would like to put in front of President Trump and his team as they prepare to enter office one week from today?

GROSS: Yeah, I mean, the primary thing that I have to say— and Jeff, I know we're in violent agreement on this—is you don't have to care about climate to care about making the U.S. a leader in clean energy technologies. There are plenty of MAGA and Trump-friendly reasons to do this. And so, in my work going forward and the things that I'm talking about, I am thinking a lot of: What is the non-climate reasons to care about this? If you care about American competitiveness in the world, if you care about job creation and keeping manufacturing going here in the United States, you care about this stuff. And so don't kick the IRA out. Don't throw away the baby with the bathwater. Don't focus only on tariffs. Focus on making the US globally competitive, not just in fossil, but in clean as well.

BALL: I'll be really quick. I would just say, and this is consistent with a lot of what we've talked about here, treat geoeconomic and geopolitical issues that intersect with climate change and sustainability just as you would treat geopolitical and geoeconomic issues that do not. And if that is the motive, I think that leads you

to a place of a more surgical analysis of what you support and don't support; it gets you into the kind of deal making, the art of the deal, that is Trump's stock-in-trade rhetorically, and actually might produce some progress in terms of climate change if it were pursued thoughtfully by Washington.

EDELMAN: Briefly, we haven't gotten to it much, but the U.S. government has a tremendous amount of largely untapped leverage in the national security exposure that Chinese proliferation of their software and hardware into the global clean energy space creates. There is an opportunity, probably, to both strengthen that technology in a world where we have generally non-secure grids. I think there is both diplomatic trade space for U.S. and China to increase the overall aggregate level of security. But the Trump Administration should know there is a real advantage there, and I think the U.S. has demonstrated with Huawei and the clean network initiative and others that problematizing the infiltration of that technology into global grids because of demonstrated security failings is real: grids can go down when they get hacked. For more, see everything from the research done on this to the anxieties about Volt Typhoon, the most recent large-scale hack of U.S. critical infrastructure. There's a lot that can—and will—necessarily need to happen here in order to make climate progress, clean energy progress, happen in a way that is sufficiently secure. And in the bilateral dynamic (US, China), there is both leverage and an opportunity for bilateral agreement. I guess the related businesses, just piggybacking on what Jeff said, is if the Trump Administration is going to pull out of Paris, then I would hope there's a really good part of the grand U.S.-China bargain on trade and trade imbalances and everything else that also has to do specifically with setting maybe even more ambitious climate goals or clean energy goals or pick your frame. Because either way, a grand bargain that doesn't include that loses an area of U.S. leadership, an area that does include that actually raises all boats in a way that, as we've heard, industry and China itself has made commitments to, and therefore it can be brought along on board.

HASS: Well, these experts have indulged my questions for most of the hour, and now it's time for them to indulge yours. We'll take two questions at a time. Please be brief with your questions. I'll start out with this gentleman right here in the red sweater. And I'd love that woman to join us as well on the questions.

AUDIENCE QUESTION: Listening to this discussion, I get the feel that the rest of the world, apart from the U.S. and China, really matters when it comes to commitments to clean energy, really matters when it comes to diplomatic initiatives. But then when it comes to technology and production, that there are only two players, namely the U.S. and China. I wonder, is that correct? Is there no role for Western Europe, for Japan,

and even for countries in the Global South like Brazil, in developing technologies and innovation that will help deal with climate issues?

HASS: Great. So, hold that thought. Are there any women that have a question that they would like to put on the table? Okay, we'll go to this gentleman here.

AUDIENCE QUESTION: Hi. I believe many would agree that last year's election result generated a rather pessimistic view and tone at the COP-29 in Baku. And many had voiced support that China would take the lead to lead the climate policy globally. Do you think China is willing and uh will it still want to—to maintain this position as an underdeveloped country?

EDELMAN: Sure. We can start on that. On the first question, it's—it's a very thoughtful question. I very much appreciate it, I think. And any impression that may have been taken, (that this is exclusively a bilateral dynamic is) of course, not intended, but simply the frame of the conversation that we have in front of us today. We're here at the China Center talking about U.S.-China dynamics. I think it is absolutely true. I mean, if you just look at the last five years, I mean, I think the EU has actually issued more clean energy patents than the U.S. has across the technological range. Obviously, Brazil can play a huge role in the demand space, India as well, including in software innovation innovations. Software is increasingly critical to a fair amount of how the grid operates. This is a globally and globalized phenomenon. And so, look, it is certainly true that a lot of the technologies that we've talked about here are either at a level of technological sophistication in terms of the supply chain, that there are very few countries that are contributing to the design and build, or at a level of capital intensiveness that their companies are leading and driving. But that is not in any way to say that the innovations taking place that are driving this market are, in some way, happening only one place or the other. I do think we have to recognize that the markets are disproportionate (U.S. and China). And then of course, the investments that are happening in those markets post-IRA in the U.S. are particularly significant. Of course, the EU has had its attempts at creating climate innovation through, you know, not dissimilar spending drives. I think the answer is yet to be written though, in terms of where the sort of preponderant contributions of this round of investments to what we think of—what I think you were describing. As you know, climate innovations have come, you know, as Samantha was enthusiastic about, I'm interested in fusion; it is certainly one of those areas where countries can crack fusion and say that they were responsible for it through their estate investments. Big asterisk. Yeah, that would be a big win. There are some European fusion companies, some Japanese fusion companies. They're mostly in the U.S.

and China, but there are, I think 5 or 6 other examples you could point to that are not necessarily quite that technologically intensive. That could have a very meaningful impact because of the scale at which they be able to place. And it's a great question. Thank you.

HASS: Jeff. Samantha.

BALL: I would just say that first of all, it's a good question. I think when we're talking about the U.S.-China dichotomy here, we're talking about sort of the U.S. block, China bloc dichotomy. And to David's point, I mean, Japan, Korea, Western Europe are the source of lots of innovations. The other thing I would say is that the Global North is not the only source of innovations, and the U.S. actually has done itself quite a disservice over the last 10 to 15 years, exhibiting the hubris of an assumption that it and the Global North, although maybe this hasn't been this explicitly said, somehow has an intellectual lock on innovation. And I think the U.S. has been extraordinarily late to internalize the realization of the extent of innovation that is happening in China. I'm not talking merely about a reduction in the cost of manufacturing stuff on Chinese factory floors. I'm talking about innovation of the sort that would be regarded in Silicon Valley, where I live, as an innovation. And I remember talking to people in Silicon Valley 5 years ago, 6 years ago, who almost sort of laughed at the notion that innovation worthy of the name might come out of China. They're not laughing anymore. And I just would suggest that to the question, humility is a really good quality to retain. And one lesson that we learn from this history is that if we assume that there isn't a next China, and a next China, and the next China, in Brazil or Indonesia or India or any number of other countries, we assume that at our peril.

GROSS: I can touch a little bit on your question, and that is whether, you know, whether China will take the global lead in emissions reductions. China sort of views itself as the leader of the developing country bloc. That is the position that it often puts itself in. But we have to remember that China cares about the effects of climate change, actual climate change as much as anyone else. I mean, they will suffer the effects of climate change. They have areas that are very that are always in drought. A lot of their economy is on the coast. They will have many of the same problems with the actual effects of climate change than we will. So, they have the same impetus to care that we do. And the other thing I would add is that China gets a lot of flak because it uses so much coal in its economy, and we all like to wag our fingers and tell China they need to get off coal. Well, the reason why they use coal is because that's the only domestic fossil fuel they have. They built their economy on coal because that's what there was. And so, it will take longer for China to get off coal than it will in many other countries because that is the resource that they have. And so, it's not so

much that their energy system was built, you know, setting, you know, setting concerns about climate aside. They have the same problems we do. It's just the difference in what energy resource they have domestically and how they can keep their energy systems secure. So, it'll be interesting; if the U.S. steps aside, how China will change their position as the leader of the developing world or the leader of the world. But right now, that's the frame of mind that I think they're taking in.

BALL: We should maybe address the second question. Yeah. Well, forgive me with will China remain a leader in these issues? That was the question?

AUDIENCE QUESTION: People are voicing to support China as replacing the U.S. as a leader in climate policy. Are they willing because they have positioned themselves as a developing country for economic gains so I'm just wondering if in your opinion, are they willing to do so?

GROSS: That's a tough question.

BALL: Are they willing to assume this position of leadership? Yeah. I mean, my sense as one human being is that China has demonstrated convincingly that it has the ability to define the strategy and to prosecute that strategy. And I guess the only asterisk I would say in this refers to a really interesting point that Samantha made is that it's worth thinking about what China's motivation over the last 20 years has been here. And I think there's a sort of tendency in this town to assume that the motivation has been geopolitical domination. And I think it's worth also suggesting that the motivation is jobs. Domestically, the motivation is on creation and ascension on the path of industries that didn't have a dominant player and that were there for the picking. And there is something about the Chinese style of government that lends itself to defining a target and following along on that target. And when the target is defined as identifying an industry and doing very well in that industry, China is structurally—because of its system of government and because of its manufacturing base—very well equipped to—to emerge successful in that strategy. So, I don't have any reason not to think that will not continue. Yeah.

GROSS: I would add to that; that was China's own energy security. They're not doing all of this stuff in relation to us. They're thinking of their own strategies.

HASS: Well, I'm disappointed to report that we've come up to the end of our time together today, but I thank you all, as well as our global audience online, for joining us. One of the things that I've taken away from this conversation is that climate or no climate, setting the issue aside, clean energy is going to be fundamental.

It's going to intersect directly with things that the incoming administration cares deeply about, whether it's jobs, economic competitiveness, global leadership. And for that reason, this is going to be a space that we will have to continue to watch and continue to draw on the expertise of these individuals from confidence and humility; striking the balance between those in the in our approach to these issues is going to be a challenge. But it's going to be important. Words that that really stood out over the course of our hour together were practicality, pragmatism, and taking a surgical approach to these efforts. So, this is a space to watch. These are the ideas and the opinion leaders to follow. Thank you for being with us.