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CLIMATE POLICY ACROSS THE GLOBE:

LESSONS LEARNED AND KEY CHALLENGES

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P R O C E E D I N G S

MS. SIERRA: Good afternoon and welcome to Brookings. My name is Kathy Sierra and I'm a senior fellow here in the Global Economy and Development Program working primarily on climate change, and it's my great pleasure to welcome you to I think what's going to be a very interesting event.

We want to thank and welcome the Climate Policy Initiative, who today is releasing its new report, *The Policy Climate*, which takes us through the past three decades of looking at major policy changes in major economies, the United States, India, China, the EU, and Brazil, and taking us forward looking as well at some of the major sectors. We'll be hearing today from the lead presenter, editor of the volume, as well as colleagues from CPI and WRI.

Let me start by introducing our speaker and presenters and then we will begin the program itself. First, our main speaker is David Nelson. He's senior director of the Climate Policy Initiative, working out of CPI's San Francisco office where he manages the global research program. As I said, is lead author of this report, *The Policy Climate*.

Before joining CPI, David worked as an investor and strategic advisor to energy and utility companies and the regulators in Europe, Asia, North America, South America, Australia, for more than 20 years. So, he knows of what he speaks. He was senior vice president and global sector leader for energy utilities and commodities at Alliance Bernstein, where he managed one of their portfolios as well as a hedge fund. He also led their global energy research team and was analyst covering global utilities. Before working for that, he had a

long career with various consulting firms doing strategic consulting; Boston Consulting Group, AD Little, and the like. He holds a degree in mechanical engineering from UC Berkley and an MBA from Wharton at the University of Pennsylvania.

He'll be joined and is joined on stage by Tom Heller, who is very well-known to all of us in this field. Since CPI's inception in 2009 Tom has served as the executive director and really strategic thinker for the CPI. We all know that he --- before he founded CPI he was a professor at Stanford University for over 30 years, serving as a Shelton professor for international legal studies, senior fellow at Stanford's Freeman Spogli Institute for International Studies, senior fellow at the Woods Institute for the Environment, and we know him as an expert in law, economic development, and the performance of legal institutions.

He's been increasingly engaged since 1991 in the area of climate change and energy, with particular interest in the policies of China, India, Mexico, and Brazil, and other leading emerging markets. He's been engaged in the IPCC as a lead author and contributor to major reports there. He also was part of project catalyst as a core team member, and since March 2010 has acted as vice chair of the governing board of the Global Green Growth Institute, which is headquartered in Seoul. He brings degrees from Princeton University and a law degree from the Yale Law School.

Joining him onstage is Jennifer Morgan, also very well-known to us here in D.C. as the director of the Climate and Energy Program at WRI where she oversees that institution's work on climate change issues and guides its

strategy in helping countries, governments, and individuals take action towards a zero carbon future. She's WRI's lead representative in international climate meetings, including the negotiations of the UFCCC. Before joining WRI she worked at E3G as the global climate change director, where she led that institution's climate change work focusing mainly, again, on global initiatives. She also served in the program of global climate change at WWF and focused, in particular, on the Asia Pacific, heading at the time WWF's allegation of the Kyoto Protocol climate change negotiations. So, brings a very longstanding history and understanding of climate negotiations, and I'm sure will bring that to her comments here.

She's review editor for the IPCC chapter on international cooperation, agreements and instruments, as well as serving on a number of public and private advisory boards, including Siemens' sustainability advisory board, scientific advisory board of the Potsdam Institute, and the Danish institute, CONSITO. Did I get that right? Good, thank you. She holds a BA from Indiana University in political sciences and Germanic studies and a masters from our own SAIS here.

It's with regret that I let you know that Heather Seichel, who is the deputy assistant to the President for energy and climate change had to extend her regrets. I'm sure that it's a disappointment. We were very interested in hearing her take on the conclusions of the study with respect, particularly, to the United States. But I'm sure we'll have the chance to have her here at Brookings another time when I hope you'll all join us then.

So with that, let me ask David to come to the podium to present the report's overview and its findings, and then we'll join the conversation. Thank you. David.

MR. NELSON: Thank you, Kathy, and thank you, Brookings.

For more than 20 years, the world has --- the global community has been searching for a global agreement that many think is needed to combat climate change. And yet after many fits and starts, we still do not have that agreement that we seek. In our angst about the slow pace of negotiations, many of us forget that even with a global agreement, much of the action in policy that needs go forth must take place at the national level or even the local level. We also sometimes forget that even without a global agreement, much of this policy can still take place. And we must not forget that where there is policy, there is an opportunity to learn and to possibly improve.

With that in mind, we are pleased to present *The Policy Climate*, a review of policy relevant to climate change that we have designed with several objectives in mind. First, we want to inform policymakers, negotiators, the global community about the broader global picture of climate change in one comprehensive form. We want to inform them from the perspective of policy, economics, and institutions.

The second is, we want to provide a basis to learn about what works and what doesn't so we can actually improve our policy going forward. Third, we want to set the priorities for how the world can improve policy and what analysis and experimentation in policy, really, that we need to do. And this helps,

you know, both the world and more parochially, helps CPI set our agenda in terms of how we can actually help understanding the effectiveness of policy going forward.

In this report we have identified the most important sectors in each of the regions we work. That is, Brazil, China, Europe, India, and U.S. In each of those countries, what we've done is we identified those sectors that comprise approximately 80 percent of the mitigation potential and then seen what policy is going in there, to see if there is policy in each of these countries related to those big mitigation opportunities.

In each of those sectors we look at, first, how emissions has changed. What has been the process over the last 30 years for a mission moving forward? What have been the drivers of that change? What has caused this change in emissions? And finally, what has been the relevant policy and how it has evolved? The idea being, if we see how the changes occurred, can we see if the policy has been responsible or what impact it has actually had?

This, we believe, is the first step to comparing policy against the drivers. And we believe that this work, especially when combined with CPI's insights in other countries around the world, can provide us many, many interesting insights. Some of those insights --- I'll go through a few of those right now. The first is, as we said, despite the stalled global negotiations, policy relevant to climate change has accelerated and increased everywhere. There are things going on, there is a lot to learn from. This policy --- it's not only at the national level, but it's at the provincial level and the local levels, and it's usually

driven by concerns beyond just climate change. It's usually driven by energy security or economic development.

And this policy gives us ample opportunities for learn. For instance in Brazil, we have learned that policies can have a substantial impact on reducing deforestation. In Brazil, about 75 percent of Brazil's Co2 emissions come from land-use change, but policies that Brazil has enacted has saved 62,000 kilometers, our research has shown, in the late 2000s. And that it is a mix of incentives to the municipalities to enforcement of their mandates, command and control policies, that have contributed most to this. We've also learned that what works for large-scale deforestation might not work so well for small-scale. So, we have to continually be evolving our policy as we go forward to make sure it is continually adapting to the facts on the ground.

In China we have seen massive efforts in energy efficiency and renewable energy. Programs like the closure of older power plants have saved more than 100 million tons of Co2 per year. But even so, Chinese growth has overwhelmed the savings, and China contributed 68 percent of the incremental increase --- the global incremental increase --- in Co2 emissions --- energy-related Co2 emissions, I should say, over the last decade. And that demonstrates that despite the increase in policy, that we still have a long way to go.

In Europe we've seen the introduction of the world's largest carbon market. We have also seen how this umbrella policy needs to be supported by a number of other policies in order for it to work. You can't just

have one single iconic policy. You actually need to have a number of policies working together, and that's where Europe provides a lot of insight.

In India, we have observed that the local conditions on the ground and the need for development above all matters, and in fact in India --- again, other research that CPI has done --- has showed that policies that worked well in other places have been undermined due to the state of the financial and economic markets there. Without having adequate markets, policies that are imported from the U.S. or Europe may not work as well.

In the U.S. we have seen how policy can move forward even without a political consensus or an over-arching singular climate policy, and how federal and state policy can work together. But we've also seen how this messy but useful way of pursuing policy can lead to inefficiencies. For example, again with other CPI work we have shown how adjustments to the tax incentives that are currently being used --- how adjustments could save the U.S. $5 billion.

As interesting as what we've found in each of the countries, we've found that there are a number of challenges that each --- that these countries share. First of all, in every case these countries are fitting climate within other policy priorities. That's very important to know, that climate has to become part of the whole policy mechanism, not a policy in itself.

Second, every single region we work in has governments at different levels. We think about the U.S. versus the federal government in the states, but actually China is exactly the same way. India, the difference between the states and languages in economic development is vast. Even in Brazil there

are very much differences between different regions and the states, and policy needs to actually have a combination of federal policy, plus local policy so that we can actually understand --- use the local knowledge to make those policies work best.

Another common question is, when do you use mandates and when do you use incentives? And really, when do you switch between the two? And it is not obvious --- I think sometimes you really need to understand and look into the details again on the ground to understand which will be effective. And again, as we said, in the Brazilian case --- maybe that we need to switch from a more mandate-heavy to a more incentive-heavy. It's work that's ongoing for us.

How do you distinguish, again, on a related one, between policies that work on large actors and those that work on small? With a large actor --- a power plant, or a steel mill --- they're easier to monitor. There's more data that is available and you can actually --- it's easier to actually approach the problem right there. But when you're dealing with 100 million households, how do you actually get the policy to work? And again, this ties very much in with working with mandates versus incentives. When do you need them for one versus the other?

And finally, the final question is around public sector versus private sector, when should the public sector be involved, what incentives do you need to get the private sector, and in particular, how do you get policy right such that you can get private investment?

Finally, we note that in this analysis, despite the tremendous

growth of policy and its impact, the overall impact still seems small. You may look on some of these charts and you'll see this big growth in renewables. But when you compare it to the overall generation, it still comprises a very small percentage. And so, we've looked at this and we've seen lots and lots of policy going forward but it still doesn't feel like it's enough. It will go better, and over time it will increase, but we may need bigger changes. Something we may need to think about.

You know, and that leads us to innovation. We need both innovative policy, to think about new policies, as well as policy to promote innovation --- technological innovation. Then, with that innovation as our final tool kit, what we need to do is do more of what has worked, learn how to improve those policies, and then use our innovation to create more effective low-carbon policies and industries.

With that, that's my remarks. Thank you. (Applause)

MS. SIERRA: We'll just get mic-ed very quickly. Great. Is it on? Thank you. Great, so we'll now move to the conversation, but before we do I do want to let everyone know that some of the other key actors in the preparation of this report are here with us, and later in the Q and A you will be able to perhaps hear from them. We have Barbara Buckner, who is the head of CPI Europe who focuses mainly on climate finance. A very good colleague of ours here at Brookings, Juliano Sun Siao. Have I got it correct? Mas o meno? Director of the Climate Policy Initiative that focuses on land use and forestry issues, and he is headquartered in Brazil. And Thomas Vladjik, did I pronounce that right?

MR. VLADJIK: Vladjik.

MS. SIERRA: Vladjik. I had it right the first time. Analyst at the Climate Policy Institute and is a co-author of the report. So we will have some other expertise here.

But before we engage in a conversation, I wanted to turn to Jennifer to really get your perspective on the report. How you think this contributes to our knowledge, and what are some of the issues that you see coming from it. Jennifer?

MS. MORGAN: Great, thank you. First of all, thanks for contributing a great addition to the discussions around and to a great report. I think it will provide all of us with a good base and I understand you're going to keep moving as you move forward and continue to it to keep track and learn, which is a really important function of all of this.

I think one of the key messages that I see here is in these countries --- and actually, in almost every major economy of the world --- that the discussion really is about the how. How to do the policy, not whether to do the policy. And you see that sprinkled across in the report and in other work that you're doing, whether it be prices, whether it be regulations, whether it be standards, state-level, city-level, national-level. It's really quite an in-depth discussion that's happening in capitols around the world, and I agree that those are linked in with other policy debates.

And where I think they're most successful, they've been connected where the policies and the politics have come together in order that they stick

around for a while. Because I think that's one of the greatest challenges, is you know, you go through the process of getting these things in place and then there's a change in government, and how do you ensure that that stays in place?

I think it is fair to say from an international perspective that a lot of these things were breeding, and then Copenhagen came and then in some ways catalyzed something that wouldn't have happened otherwise. So I think you don't get too much into attribution in the study, because I know that's incredibly difficult. We tried to do that at WRI. But I think understanding the link between the national and the international better for each of these countries is quite important.

For some, like in Australia, very linked-in --- you didn't look at Australia here --- but for others, less important. Maybe a U.S., less important for Europe, incredibly important of that link between the national and the international.

The common challenges that I kind of saw across the countries? You know, first of all, that --- how you do link in the policies with the building of long-term political support and coalitions for change. You have quite a bit, I think, importantly on institutions, which are very important and I think oftentimes get overlooked. How you get your institutions set up and in a way that, you know, either has something like a UK external climate commission to keep things on track and have that independent view in there. How you ensure that on such an immensely complex issue. You have the different agencies or ministries working together. I don't know --- it would be interesting to do an institutional

assessment. I don't know many countries that have gotten that one completely right yet.

The importance of understanding the benefits of action and linking that in to the priorities, obviously, and I think as climate risk increases around the world, really understanding those risks to infrastructure, to value chains, and feeding that into those discussions as far as the pace of change. Because I think that's one thing you said, but it's an obvious point. Even though we do have all these actions we're far away from where we need to be to stabilize the climate at safe levels and avoid pretty cataclysmic impacts. So, how to link in I'd be curious, kind of the risk-side of the climate impacts into those national priorities, I think is a key challenge that countries have.

And those long-term signals to the markets. So in some of the work that we've done, looking at wind and solar policy along the value chain in five countries, one of the key findings was, well, China and Germany are moving further fastest, they've got the largest job growth, they are capturing markets, and that's because they have a long-term policy of more than three years and plays on the national level. So, kind of lessons learned across there.

As far as what I took out of kind of your research on what the to-dos are, clearly part of that is just making the case and bringing forward the benefits of climate action in light of the domestic priorities that every country has. Not only developing countries but countries here. As you understand the limits to growth, but also documenting and creating that evidence base. Accelerating the pace of learning. So, I mean, I think a lot of this is we don't have a lot of time and

getting these policies right based on those national or local circumstances is challenging, and of course it has to be locally-driven but you can learn quite a lot. So, in Germany's energy transformation right now they're having to go through things and make decisions that are far more rapid that probably what other countries were. They're going to do some things right and some things wrong. So, how do we learn that and then bring it into other countries I think is quite important. Getting those institutions right, trying to get the longer-term there and the incentives.

And then I think, really, developing a regime that creates those incentives to go further and key functions. So, whether that be transparency so countries can know what each other are doing, particularly countries in competition --- whether it be those incentives for that transition to a low-carbon economy, either within the climate negotiations or outside the climate negotiations, and then really trying to drive that level of ambition in a fair and equitable way.

And then last but not least is just the adequacy question. I mean, we just looked at the U.S. in-depth and the U.S. isn't on track right now to meet its 17 percent target. So, what can we be doing to speed up the path of that transition in this country, and then inspire others to follow as well?

So, those are some initial thoughts.

MS. SIERRA: Thank you, Jennifer. And, Tom, you bring not just sort of this perspective of what's happened in the climate debate, but a broader focus on development, both in your work over the last 30 years as well as many

of the engagements you've had with the countries that are analyzed here. Perhaps you can share sort of the broader take-aways from this work?

MR. HELLER: Thanks, Kathy. I'll try, and it's just as well because I think the messages that David delivered are the appropriate messages that the Climate Policy Initiative would hope that you take away. And since he and his team and Tom were the real producers of that, I'll fall back on my general strategizing or whatever you called it. I'd like to make four points that I think are both evidenced in the report, but also useful in the context of thinking about what it means.

So, point number one. I've been around, as Kathy said, a long time, and this is not 1992. 1992, Brazil was broke. India was broke, China was just starting on its growth path, the United States had just won the Cold War, we were about to get the peace dividend. Europe was just completing its single act, and heading forward with great hopes ahead of it. That was the period in which we created the framework for the climate negotiations.

And my point is, as you all know, the world has moved on. In many ways, it's upside-down. Capital is not where it was then. Capacity to act is not what it was then. Geopolitics are not what they were then. Growth is located in different places in the world. And this has produced negotiations that in many ways are trapped in the paradigm that made a lot of sense in 1992, but as David and Jennifer have all indicated, nations have moved on from that. And I think a big part of the future of the negotiations is catching up with where things are.

And very importantly, for those of us who were around at the

beginning, we've been surprised where the policy has taken place. It was quite different than where we expected it to take place. The South plays a much larger role than the North. The mechanisms through which policy is carried out is often much more consistent with some of the mechanisms that would be more associated with political systems in Brazil and in China than we might have expected.

But the main point is, the first one, that this is much more universal than we expected it to be at the beginning. And that is valuable, and perhaps looking out over the next years, some of the things that we used to think were disadvantages, like national banking systems or planning systems that coordinate across sectors, might have greater value than we would have thought about in 1992 when development was conceived somewhat differently.

Second point. Climate policy is policy first and climate second. Okay? At the beginning we thought we were going to have a legal treaty that covered the whole world and would have an instrument, and that instrument was some form of carbon price. It's been through a lot of machinations, as you all know, but that's not what's happened. What's happened has been exactly what's been referred to. There was not a displacement from above of national mechanisms. Rather, policy is carried out --- and this is a main message of the report --- through the inherited architectures of the countries who are doing this.

Changes are in many ways inside the mainstream, and in a sense that's really good because people used to talk about the importance of mainstreaming climate. Don't bring in special purpose vehicles, get this inside

the line ministries and the finance ministries. A lot of that has happened. But one of the things that it means, I think, is that in order for us to do things internationally, as Jennifer suggested, we have to understand multiple policy traditions. We cannot look at the world through the lens of any one country. If you want to see what China is doing, you better look inside the financial system and how they finance investment, which does not look the way it does in the United States. And similarly, if we are going to move forward internationally in ways that I think Jennifer has alluded to and that we have to, I think it will be around the edges of these national policies more than it will be in any return to the idea of displacing them through some sort of unified structure. So, mainstreaming, universality, both in a sense successes relative to where --- even surprises where I thought we thought we were in 1992.

Point number three. You know, it's development first and climate --- you name where it comes in. So, I am always impressed by lessons which were reiterated again to me a couple of weeks ago that are pronounced by President Yudhoyono in Indonesia. He always says, growth, poverty reduction, jobs, climate. And even climate falls in there with biodiversity and water and a whole series of other ecosystems that we're concerned about. And I think we have to understand this. Not that climate doesn't count, but that climate cannot be a constraint on growth. Growth is the pre-condition for getting successful climate policy, not the antithesis. And if we think about it that way, then really our climate problems come largely from the way that we produce food, because it's agriculture which is now taking down the forest or disturbing the soils, and we

need that for food security for people all around the world. And it's about the way we produce fuel, energy. Climate is the byproduct of how we do this.

And these things, these markets for food and for energy are changing for a lot of other reasons besides climate, okay? And in many ways, the increasing scarcity and the increasing demand for these resources that come from development are hallmarks of triumph over the past years. It's not great for climate, but it means that demand is much higher in the world for things that matter to people. Food for their kids, energy so that they can have light and mobility.

So, we are on the backside or the flip side of one of the successes in the world that we really hadn't expected to occur with nearly the same speed in 1992. And I think what this implies, as many of you know, is that we have to think about climate and climate policy through the lens of investment and increased productivity out of those resources. We must get more out of the resources that we have in order to meet this demand, and if we do it intelligently there are real possibilities to cut down these wasteful byproducts that we get from using these resources as profligately as we had in the past.

So, the last point. There are things that we have to do that can be done within the margins of existing systems of energy and of agriculture. And there are things that we have to do to get to the kinds of levels to which Jennifer was referring that go well beyond that. We have to, in order to meet the kinds of climate goals that the IPCC and national leaders have talked about, we have to imagine first doing everything we can within the margins of these systems, but

we have to think about systems change at the same time.

And I think that's something that kind of divides the world up into the problems we're facing and the progress we're making, because there are multiple problems that we need to confront within the margins of the systems as we have them. David referred to some of them. How do you get from getting energy efficiency gains in large-scale industries into small-scale industries? This already is a problem. How do you deal with the fact that you can get debt financing for renewable power in Norway that you cannot get in Turkey, let alone in Kenya? There are issues that need to be dealt with without thinking that we are going to reform everything. How do you deal with the difference between systems of national banking, such as Brazil and China have, and systems that are much more market-oriented in their financing, such as we have in the U.S. or that you have in Europe?

All of these questions are areas where I think we are, in spite of their variety, really making progress. We see a lot being done around the world in energy efficiency, in renewables, in agriculture, and the policy climate refers to all of that. It's when we cross the threshold and start thinking about real systemic change that has a much larger insertion of renewables and clean power into the grid systems that we have where we don't have the storage systems that allow that to occur, where our energy systems are basically stupid. They don't really have any intelligence built into them and they're not that different than what was developed 100 years ago.

At these questions we're not, either in terms of investment dollars

that are being made around the world or in terms of policy. I just don't see that much that is happening that is anticipating what I think are very important changes in the global economy that are coming into which we have to invest. And I think it's at that level that the accomplishments that we've had are less significant than I hope they soon will be. And that involves a series of other problems. These are much more capital-intensive. I think they often involve sectoral policy and macro-policy as much as they do climate policy because there are transformations of markets and locations that are underway, and climate will be one factor within those changes.

So if you come back --- universality, mainstreaming, doing pretty well. As we turn to much more substantial change of systems, not so much evidence that we see in the world that we are beginning to crack the nut that we have to anticipate in which different climate conditions, different investment conditions, different development models will dominate the world into which we are thinking of injecting our policy.

So, thanks very much, Kathy.

MS. SIERRA: Thank you. So, what I've heard is that we've got some positive news coming out of this report that there's been momentum, accelerated momentum, it's bottom-up, it's coming from the national and sub-national arenas, perhaps there's some international cooperation, but the nut has not been cracked yet in terms of the international agreements that might be needed to accelerate that to get level ambition up and to really accelerate the learning and best practices going forward. At least that's one --- the way I had.

But, Jennifer, so if I heard you right you said we still need to work on the international regime. This is not going to be enough, realistically. There's an agreement that by 2015 there will be a new agreement enforced. People are working on that right now. What are the prospects for that? What's changed in the political economy to make us think that we're not going to have another Copenhagen moment in two very short to-come years?

MS. MORGAN: Well, I think there's a couple of things that have changed. I think one thing that's changed in comparison to pre-Copenhagen is that this type of thing is happening on the ground. So I think there's further confidence about the fact that if you shift to a low-carbon economy or use more renewables or efficiency, that you're not going to go bankrupt, that actually, you know, you can continue to create more jobs, you can reduce your dependency on foreign oil, all those types of things. So I feel like there's a bit more --- a bit less of a leap of faith then there was at that point in time. Whether that gets translated into politics, I think is still an open question. So, I think that's one piece.

I think the level of urgency is higher, and that can either contribute to a Copenhagen-like scenario where you just have a level of panic of the most vulnerable countries around the world who see their very existence at stake and contribute to a Copenhagen situation, or it could potentially bring in a greater sense of risk of those economies that need to do more. And therefore, they see it actually in their self-interest. Because if you do get that climate, you know, even --- climate mitigation is not a constraint for growth, but climate impacts are,

right? And so, if you get that kind of a sense, then I think that can move forward.

As far as the prospects go, I don't think we know yet, to be totally honest with you. I think that there is a real intent. The French government at the highest level is already engaged out there with putting in place institutions and people to be seeing what's possible. You have a heads of state summit scheduled by Ban Ki-moon in 2014, and you have kind of the clearing of the plate from --- in the negotiations themselves because you don't have all these different tracks anymore, you have one kind of main round now that will deal with this.

But it really depends a lot, to be really basic, on what happens here, I think, and whether or not there's an intent shown to de-carbonize in major sectors in the United States, and that confidence is built. And then all of these other things that we were talking about.

On the one hand, I feel like prospects aren't bad because countries have been through this before and in some ways you can kind of see the way forward and I think it's seen as a moment along the way, you know? Rather than a big summit. But there's a lot of work to do to kind of clear the brush, figure out what this agreement needs to do, how it fits in with other things going on outside of the UNFCCC. The regime is much more complex than it was pre-Copenhagen and there isn't that much time to deal with that.

So, that's my balanced ---

MS. SIERRA: That's your take.

MS. MORGAN: I mean, we have to get it done but we have a lot of work to do.

MS. SIERRA: Tom, two things. One, any comments on Jennifer's assessment in terms of how it looks from your point of view. But beyond that, I want to pick up on the last point that you made, which is what we've seen so far. Many of the advances that are reported in this report really talk about the kinds of policies that are looking at --- I would say more than at the margins, but are looking at today's energy systems as they are the food systems.

But you're really talking about innovation. You're talking about the innovation of systems and new technologies. We did a bit of a review on innovation here at Brookings and found hundreds of pieces of international cooperation looking at trying to improve innovation systems in the developing world. Very little scale above that. Do you see any prospects for international cooperation in the field of innovation?

MR. HELLER: Yes. I mean, I think it goes on all the time. When I used to be a serious lawyer, that's what I did. I did, you know, contracts between parties who were innovating all the time. And I think there is often a sense that this is more strange than it really is. I mean, there is a great deal of technology that moves around the world and there is an enormous amount of investment that supports that movement.

I think that what is --- can be said at a larger level, Kathy --- and here I'm going to follow typical CPI process and try and respond to what people in countries are asking us about innovation, okay? Rather than pronouncing on things more generally. What we see --- let's just take --- I won't talk about the United States because obviously I've spent my life in Silicon Valley and I don't

want this to sound like some sort of a California-centric complaint. So, let me talk about some of the other countries.

In China we get a great deal of inquiry from within the government itself about the fact that they are probably spending --- depends on how you count things, as always --- but they're certainly spending as much as any country in R&D out of the public fist. They are spending a huge amount of money. By their own assessment, they're getting very few results, okay? What's wrong? Why is it that the pay-off on this investment is much less than they had hoped?

And I think it probably has something to do with institutions and systems and the way the Chinese economy is functioning and whether you can really capture the profits, the rents, from innovation within a system where you have a series of state monopolies in critical sectors like transportation, energy, telecommunications, or whether those rents will be squeezed out. So, there are lots of questions.

I ask questions about, is it better to innovate by trying to have our own national labs or by going out and buying companies in Europe where the innovation is done? We'll buy them, and we'll bring it home. How should --- should we do shale oil by learning how to do it ourselves or by contracting with American firms who have that capacity? So, there are lots of questions that are being raised about innovation that have a very situated place in the political system.

Very quickly, Jennifer referred to Germany. I give tremendous credit to Germany for what they have done. They brought down the cost of PV

solar at very substantial expense. It looks like Mrs. Merkel will survive this election in September, but one of the principal challenges is a backlash that has come because Germany has paid very high prices to bring PV solar costs down around the world. All the rest of us benefit, in the modular prices that have occurred, but Germany is stuck with the bill for the next 20 years because they have contracts that continue to buy at these very high prices for these huge volumes they've installed. That can't be the right way to handle innovation. It's got to be much more of a public good, and I think there are things that could be done better in the negotiations to deal with those kinds of things.

And then finally, just let me say a word about Brazil in this context. To my surprise, because I'm one of these people like probably some others in the room who never set foot on a farm except maybe a vineyard somewhere in Northern California, I've been stunned by the fact that agriculture is just at the beginning of the real application of the scientific principles that have been organized in genetics and various forms of bacteriological work. The opportunities for investing in agricultural productivity are enormous, and we need a lot more food in the world. But the question is how you run the system. Do you run the agricultural system at very low productivity? In which case, you're going to eat up the world's forests in order to produce what's necessary. Or do you run the system through innovation in agriculture so that productivity grows on lands that in many ways have already been stripped of their environmental value and tie that into landscape analysis so that the innovation allows you to preserve the ecosystems, at least as options into the future that otherwise will lead up if you

don't get the productivity in better shape than it is.

So, I think innovation is enormously important, doesn't get enough attention, and will continue to challenge us for decades to come. But unless we invest into the future that is coming, to repeat myself, we will neither solve climate nor will we be able to develop out of it.

MS. SIERRA: Great. So before we turn to the audience, David. Any comment on what you've heard?

MR. NELSON: Yeah. So first, talking about the global negotiations. I think one of the first things we have to realize is we have to put ourselves in the shoes of every country and understand why they may find an agreement difficult or what might be the constraints.

If you're thinking about China, for instance, we have an aging population, one that has been struggling to get wealthy before they get old and that's a really important criteria. A lot of this industrial growth has been driven by this fear that they're going to still be a poor, middle-income country and have a billion retirees on their doorstep. And so, they're always thinking about this push and they don't want to find any constraints. They also want to think very much, can we solve this problem ourselves? We don't want any external constraints, so that we can make the tradeoff between that.

You have the same thing in India, which is at an earlier state of development where 57 percent of the population lives on less than $2 a day. Again, when you're telling people we need to actually be setting aside and generating some amount of renewable energy, we're going to have to pay for that

renewable energy and they're saying, well, I know that India is going to be affected by floods or droughts that may happen in 20 or 30 years, but I need that meal for tomorrow. And so, we very much need to be thinking about how those constraints --- and that doesn't mean it can't happen.

And some of the interesting things about it is that there are inflection points in all of these that can lead to solutions. One of the most --- to me, one of the most interesting and promising inflection points is that now China, if you look at their growth in generation and coal use over the last nine months, very early days --- and there's a lot of room for interpretation. But, you will see generally in developing countries they go from a perspective where the actual growth in power demand is higher than economic growth. And then, there is an inflection point and at some point it actually goes below economic growth.

In China, you then could say, well why has power generation fallen? Well maybe the growth isn't what it thought, or maybe it reached the inflection point. It appears possibly that China has now reached, due to an increase in the service sector and to changes in their economy that they're now promoting a different mix, a more China whole-growth pattern, that they may have reached this inflection point. And so if you have coal demand growing at 4 percent --- sorry, power demand growing at 4 percent and renewables doing the growth that we're seeing, it could be that coal demand is growing less and you see coal prices in China actually falling. And this provides a platform where the Chinese may be more open to negotiation because the economic circumstances on the ground in China are more hopeful and won't create quite the sacrifice that

we're envisioning.

The other thing to remember is, you know, when you try to add up where China was 10 years ago, the amount of sacrifice that they made is much higher than we imagined sitting here in the West. If they're in a situation where they do not have the same amount of sacrifice to make it may be easier. But then going to that and heading on to Tom's point, you know, there is --- if India is the next one up this ramp of industrial-led growth where missions begin to rise and these sacrifices to make, that's where we really need to be thinking about innovation so that we can reduce the sacrifice.

A lot of what CPI is about is, you know, we're not necessarily saying you should do more policy or less policy. We want to make sure that the policy that gets done is more effective. And the reason for that is these sacrifices may involve political will, and the more effective the policy is the less that the renewable or energy efficiency policies cost, the less political will you need, and the more advancement you can have in places like India.

And so, those are the overall things. We need to be looking at inflection points and we need to be improving the effectiveness of policy such that we need less political will forward.

MS. SIERRA: Great. So with that, both overview of the report --- very handsome report, I must say. I enjoyed reading it --- and perspectives from Jennifer and Tom as well.

I want to open it up to the audience. I'd ask you to please identify yourself. I'll probably take two or three questions and then bring them back to

our panelists.

I have a question here in front.

MS. WERTHEIM: I'm Mitzi Wertheim with the Naval Post-Graduate School. I'm an anthropologist by training who never went to graduate school. But I'm the one that got the Defense Department engaged in energy because I started a salon at my house and out of that a Hollywood scriptwriter was at a party with Don Rumsfeld just before Christmas in '05, captured him for half an hour, and explained why the Defense Department had to get into this game being the single-largest buyer of fuel in the world. And from that, we got the line in Bush's State of the Union, “The nation has a problem, we're addicted to oil.”

The problem we're facing at the Navy right now in terms of all of this is figuring out how to get behavior changed. It's a really tough issue. I mean, we understand it intellectually. How do we get people to feel emotionally that they need to do something about it?

The other suggestion I want to make is that the National Intelligence Council came out with a new report called *2030* and they have a thick book --- this thick --- and they put out a 2-pager called *Le Menu*. And so, all the key points in their report can be read by senior policy folks, get the ideas, and don't have the time to read something as beautiful as this is, but they're not going to pick up the detail.

The third is, I think --- hang on. The third is, you need to do process maps or systems maps because there's so many components to this.

People need to see it visually because it's so difficult to understand what are the things that affect others.

MS. SIERRA: Thank you very much. Here?

MS. FRIEDMAN: Thanks. My name is Lisa Friedman, I'm a reporter for *Climate Wire*, thanks for doing this and a great report.

Secretary Kerry just signed a couple of climate change agreements. The one that's getting a lot of attention is with China. This is for any of you, if you could talk a little bit about, you know, how significant is this or isn't this, what's new that you see, and maybe from either Tom or Dave, having done such a deep dive on policies in China and the U.S. What are one or two areas that, if the U.S. and China did something new stemming from this operation agreement, you know, it would really change the dynamic heading towards 2015 or do something real on the ground, something that's not currently being done. Thanks.

MS. SIERRA: Thank you. Another question?

MR. EBINGER: Charles Ebinger, Brookings. If the shale gas revolution that we've seen in the United States and the rest of North America takes off in 8 or 10 other countries, including China, what impact do you think that has on slowing down the transition away from fossil fuels towards renewables?

MS. SIERRA: Terrific, thank you. That's a great set to start with. We have a question on behavior. So, how do these policies that you've analyzed really think --- work as they push to behavior? As well as some comments on the

report itself. I'll let you speak to that, David. Perhaps, Jennifer, you can take the first stab at the China-U.S. Agreement. And, Tom, first stab at the shale gas revolution. But any of you can speak to any of the questions as you see fit.

So, David, let me ask you to start and then we'll walk down this way.

MR. NELSON: Start with the ---

MS. SIERRA: On the issue about behavioral change and how do we help analyze the policy frameworks so it actually makes the behaviors real?

MR. NELSON: Yeah, and this is not in the report. But we have been doing a lot of work in the energy efficiency area with respect to behavioral change and there is a lot of analysis that is suggesting that the policies we put in place do not achieve as much as they should because of a number of things --- anchoring biases, there are biases in terms of landlord-tenant ownership, and such, that the literature is rife with, that. And it is something that, you know, requires a lot of blocking and tackling in terms of that. You know, it's small. There has been no, as far as I know, universal, you know, insight in terms of how you actually fix behavioral issues. There are whole array of these questions. There are a number of policies at work here, and the impact fades away.

And so, it doesn't really lend itself to analysis on this scale because we're not really seeing the major impact yet. It's an area that needs more study, but it's one that is not --- if you're to say, can I measure the impact of behavioral policies going forward? We just can't yet get it, and so that's the issue.

With respect to the question about the key points and having, you know, identified the really key messages for each of the policymakers. That is our day job, so to speak. What this here is about is getting an overview of policy across the piece --- so people can begin to integrate it. Our work is diving down into each one of these. We don't want to go through and say, on the basis of --- this seems to be exhaustive analysis. But this is an overview. On each one of these policies, we want to go in and actually say, did it work? Didn't it work? Why? What are the lessons we can learn? How can we improve our policies? And then, we give the message. And so, that's really the way that CPI is actually setting forward.

Imagine this as setting our priorities, and then all our other papers --- which you can read on our website or wherever --- will say, this is the specific issue for that particular policymaker. You should be thinking about this.

MS. SIERRA: Jennifer, for China-U.S.

MS. MORGAN: Yeah. I think stepping back and looking at it is the first visit. Secretary of State and the second Obama Administration to China and the fact that a working group which, you know, is an important kind of way of working within the dialogue, is set up on climate change, not energy or energy security. I think it's very significant, especially in the midst of everything else that the Secretary had to deal with while he was on his trip.

I think it got, in a way, overlooked because of the other issues that are so much more in the media, but it really --- so I think it provides an important new moment for U.S.-China collaboration. There's been a lot already, but I think

we and others are engaged in --- but I think the opportunity is to do something that Tom was talking about, which is go beyond kind of the day-to-day piece and really think about the innovation and think about the larger transformational change.

And I'd just link it quickly to the shale gas question, because I think in some ways, you know --- we just published a report two weeks ago on shale and looked at the methane emissions, the fugitive methane emissions and how shale is done will have a huge impact, obviously, on its climate impact as well as its impact on whether or not renewables continues to take up or not.

If you were to actually have the U.S. and China collaborate on shale and renewables, it would be quite interesting. China, I think, from a national policy perspective has learned a lot about renewables policy that the U.S. doesn't have yet, and the U.S. has quite a --- you know, has an initial set of regulations on methane, can do more, but how to do that in a way that's energy-secure, locally-sensitive, and climate safe, I think. That would be one idea I would put into a collaboration.

But, Tom?

MR. HELLER: Yeah. U.S.-China is a difficult issue. I mean, we had collaborations established four to five years ago in carbon capture and sequestration, in electric batteries and motors, in coal bed methane. I cannot honestly say that I have seen any deviation in the trajectory that either country was on because of this collaboration and, hopefully, there will be some improvement here. It's now part of the strategic dialogue, it wasn't in the past,

and sometimes the strategic dialogue has been effective at reaching top policymakers. I think it's good that Secretary Kerry is expressing his own interest in this, and I'm hopeful without being wildly thinking that we've reached one of those inflection points that David refers to.

Shale gas. Hell of a question, and I certainly don't come close to answers, except to say that the field in which we're playing has been changed in so many ways, and not just in the more obvious ways. Brazil has enormous reserves of offshore gas associated with the pre-salt deep oil. Will Brazil bring that gas onshore, as it has to, converted into LNG and sell it out into the markets? Which could have an impact on global prices. No one is going to make an investment that big because no one knows what the unconventional gas is going to do around the world. So first, it has a big impact on these markets that can be put in different directions.

Secondly, China-U.S. and shale gas. If you look at who is actually investing in a lot of the U.S. companies, there's a lot of Chinese money. And if you go beyond into residual oil zones and the stuff that's really out across the horizon, it's mostly Chinese money that's on offer. Whether we take it or not --- so again, this goes to how they learn. Do they learn by purchasing or do they learn through contracting? Or do they learn through --- it goes back to the other question and I don't think the answer is there yet.

On the main question that you asked, I don't think or at least I would make a guess if I were an investor --- which is kind of how I think about these things --- I don't think it's going to have a big difference in the renewable.

Shale will have a big difference in the renewable versus fossil game in the next couple of decades. I don't think it's a game-changer. I think it's a game-changer on the coal-gas spread, and I think we will see shifts on that, which can be very good, assuming that the methane leakage is not what some people fear.

I think on the whole, that will be good as long as we think about the --- in the U.S. we had a lot of spare capacity in the gas industry, both in generation and in pipe because of our own investment patterns. That's not true in China or much of the rest of the world. There's not a lot of spare capacity. So the question becomes, if you really do build out the infrastructure, then there are obviously unconventional gas reserves sufficient to run for six, seven decades into the future. Depends on how you price what are potentially stranded assets, and that's where I think we may do some work. But it's, you know --- as always, it's --- the real questions are down in the dirt and into the financing, and I think investment decisions are the place where you can really affect that future. And so, we tend to look at things through investment lenses, as opposed to, say, optimization lenses or other methods that have often been more common in the climate change modeling area.

MR. NELSON: Can I?

MS. SIERRA: Sure. Very quickly, thank you.

MR. NELSON: Very quickly, a couple of things in terms of the policies in directions forward. One thing I'd like to highlight, going back to this theme of innovation. If we look at some of the major big-scale innovation projects that have failed, frankly, or are not failed but are taking much longer than

we had hoped --- and namely, carbon capture and sequestration and the fusion problem --- many of these have broken down for a variety of problems, either international agreement problems --- getting the international agreements in place for fusion has taken so long and has also sort of forced us into one technology direction, rather than being broader. If we had been able to actually divide and conquer in a way through some agreement that everyone could agree on, we would be in a better circumstance.

With CCS, the European experience has been trying to establish different pilots in every country that have made these CCS programs too small because, again, trying to figure out how do you actually do innovation, large-scale innovation without having one party have more access to some of the intellectual property than the others? And so, that is an area --- I don't know how to resolve it, but it seems an obvious area to begin to push, which is looking at how we can divide and conquer amongst nations. The intellectual property that is needed to bring forward these technologies.

And then secondly, on the shale. And I'll dig into this very quickly, but there's a number of things to consider --- and I'm drawing on my old --- I used to be an oil analyst, so some of this is going back there. First of all, we must remember that U.S. geology is very favorable towards this. Shale gas will be much more expensive in other areas and it will take time to develop. We can't expect that you're going to have the same sorts of economics.

Secondly, if you have all this gas available --- is a really --- I know I shouldn't be saying this as a policy man, but it's a great fuel. You can really use

it in a lot of uses. And it's not clear that if you have the certainty here you shouldn't be actually looking to be replacing some of the petrol, some of the gasoline and diesel, and going --- using more of that natural gas in other uses that provide a different sort of transition that naturally would lead the price going up. And in some ways if you actually use it in that perspective, the transition doesn't have to be as damaged as it would be if you had the current circumstance with low gas prices.

And by the way, the current prices are not at what we call the longer-end cost of shale gas. Those prices will go up, and part of that uncertainty is --- uncertainty about the long-term price of it as well as the long-term availability of shale gas is currently preventing a greater transition of the transport fleet in natural gas.

And so, you know, I do not think that the current circumstance of shale gas necessarily is where the long-term direction needs to be.

MS. SIERRA: Great. And I think we have a set, Tom, for one more round. Way in the back?

MR. LYON: (off mic) and it is my understanding ---

MS. SIERRA: Could you identify yourself, please?

MR. LYON: Jeff Lyon, I'm with Green Planners.

It was my understanding --- I mean, it hasn't really --- I mean, you mentioned the issue of methane, but also, you know, I don't know if folks have had a chance to see the movie *Gasland*? I mean, it's a very --- aka “fracking”, why don't we call it fracking. And I know in New York, I know they've issued a

moratorium, I think, for the next two years precisely because the safety implications of shale gas are --- they're still trying to understand. So just makes me a little uncomfortable that it seems like you're talking about the investment potential and sort of negating the health and safety costs. So, I mean, I think that'll be sufficient for now.

MS. SIERRA: Thank you. There was ---

MR. LYON: Well, can you address that issue?

MS. SIERRA: We will. We're going to take a series of comments. Right here, this gentleman here.

MR. MORROW: Hi, I'm Dan Morrow, I teach on climate change policy at George Washington University.

I wanted to follow-up on Tom's second point. I think you referred to it as mainstreaming. These national policies are developing within a unique institutional and political context and we need to assume that that's going to carry forward and not be displaced by some university (inaudible).

Now in that context, perhaps you've read the proposals of David Victor who basically suggests that the best way forward is to have carbon clubs where a few countries get together and negotiate the deals among themselves, where they make mutual commitments (inaudible). And so I wonder whether if you look at these five countries, could you imagine that they would sit together? Or maybe starting with two or three of them, and do deals that are mutual commitments that begin to lay the foundation for an expanding circle of carbon clubs.

MS. SIERRA: Another question? I think this gentleman.

MR. BIRNBAUM: Hi, I'm Ira Birnbaum with the U.S. Agency for International Development, and I'm with countries in the Eastern European region.

So, this question perhaps --- not necessarily, but perhaps could be linked to the previous question. I am going to assume that your study looking at Europe was focusing on the EU member states, but if not I'd be happy to know it. But if so, do you draw any implications from their --- the EU policies for the Eastern European countries, most of which do aspire to join the EU? And how applicable might some of the better European policies be for the countries in Eastern Europe?

MS. SIERRA: Okay. I think one more --- actually, this gentleman right there. No, no, this. There, thank you.

MR. JONES: Thank you. Timothy Jones from Clearview Energy Partners. Any thoughts on the externalization of carbon policies? What comes to mind is the ETS, including international aviation emissions in their policy. Are those productive towards getting a goal carbon price or ultimately counter-productive?

MS. SIERRA: Okay, great. Well, I think let's take it and turn back to our panelists. I think very quickly let's get a response on the shale gas question. I am sure that we here at Brookings will have this debate over the next period, and unfortunately Charlie Ebinger, who leads a lot of our work on energy, has left. So next time, we'll make sure we get him as well.

Quick response on that. Interesting comment on carbon clubs, plurilateral. Is that the way of the future? It's been a lot of research and thinking on this, EU versus Europe. What's the coverage and what is the likelihood of having some additional learnings. Have you broadened your scope?

And then finally, let's think about some of these new policies coming out of Europe, the ETS, aviation and the like. How ripe are those, you know, to make a difference on an international scale?

Let me ask Tom and then we'll move down.

MR. HELLER: Shale safety. I'm no expert. There are --- we have a general rule at CPI that we shouldn't get into what a lot of other people are going to do much better, and there are lots of groups working on this. I'm not saying that, you know, I know the answers on that and that ought to be handled in every place it's done. The only thing I would say is that it's generally true that if you look at the U.S. industry you've got a huge number of effectively wildcatters who are very small operators. So even if Chevron, a company --- I'll stop. (Laughter)

Even if companies with great technical capacity can prove they can do this relatively safely, it doesn't tell you about either the rest of the industry and the implementation of those rules. It certainly doesn't tell you about what's going to happen if you're in Western Szechuan. So, I think it's a real issue. If we let it go, I don't want to do that. Just that we are not working those things ourselves because others are doing it better.

Club solutions. Absolutely. You know, David was with me for a

long time at Stanford and those ideas have been around. It turns out that when you try and do club solutions it's not so easy to put these different groups together. But that's something we spend a lot of time on. We spend time on that particularly with regard to a lot of the financial mechanisms that are coming into play.

Can you create a means for handling risk guarantees with some types of renewables and some types of countries, and can you create a club solution of seven or eight countries who would actually supply that capital and manage those risks --- agree on risk management techniques?

So, yeah. I think the future involves a lot of these club solutions, but murder --- and I can tell you this from personal experience --- when you actually go out there and try and negotiate what these are, is it easier than the multilateral agreements? I don't know, but at least you get output that I think is workable. So, that would be my best answer to that.

I think a lot of these club solutions, by the way --- Heather is not here --- I think can be well thought of in the United States where groups of states --- if we can't get national legislation, then we ought to think about these club solutions to a greater degree than we have before. I've just been very active between California and New York in thinking about some of these things, and how they spend funds that are being specifically allocated for climate innovation and it would be better to have both of them together than apart.

So, I think club solutions ought to be seen generally, and I'll let Barbara and others talk about the EU. But we are for example looking very

carefully at the --- CPI is --- at the policy portfolio of the European Investment Bank in energy efficiency --- which is partly, as you well know, inside the EU but much of it is in the near or broad and the ancient term for the countries you're referring to. And so, yes, we are definitely interested in that because the EU is interested in it. And I don't --- the complex relationship between not just Eastern Europe and the ex-cession countries, and EU --- what did you call it? Best policy? Is a tricky one. Part of Eastern Europe is inside the EU, and consequently those relationships are complex.

Thank you.

MS. SIERRA: Jennifer?

MS. MORGAN: Sure. I, too, on the shale gas side of things, I didn't mean to minimize. We are in a similar situation where we work on the fugitive methane emissions. But I wouldn't understate the risks of the other side of the ledger, the local impacts that are quite profound and the changes that it's bringing about on communities. I mean, it's a massive debate.

So, not to understate that. It's just that I haven't --- we haven't focused on it as well, but it's clearly not just a carbon question, it's a really fundamental societal question, I think, and we've done a little bit of work on the water risk side of things, which is really not to be laughed at, particularly in some of the places where shale exists.

Quickly on the club side. I actually just published an article on transformational clubs and how to try and get them to move forward. And I --- because not as a replacement, but as a complement to the UNFCCC, and did a

landscape analysis of 17 of these things that are out there right now. Found three main criteria to be more transformational. One is a more --- a common vision.

So really, where the countries that are members of that club, whether that be phased out of fossil fuel subsidies, whether it be price parity and renewables, whatever it might be, that needs to be their benefit, which I think is going to be a really important piece. Whether you call it incentives, whether you look into the trade area, whatever economic benefits for the members that join --- an exclusive membership, entry ticket to the club --- I think are three criteria. If you want to get something up and running that is more than dialogue or implementation, which our assessment is what's there right now. Lots of conversations in this space going on right now. I think it is hard, having tried to get some of these up and running as well. And I think you have to hook it onto existing institutions, otherwise you're creating a whole other negotiating structure and there's only so much bandwidth that countries can actually deal with on these issues.

And that's where I'll stop. I mean, I think on the EU side of things, on the carbon policies --- I mean, it's a fundamental piece that the ETS --- you know, the entire backloading debate that is occurring right now. I think that obviously needs to be a priority to get that fixed. And I think, you know, a sense of analysis as to why that's occurred. We haven't done work on it.

I do think as well that I find the aviation discussion to have been productive, because I think it's quite important on something like this --- it's

almost like a club that someone moves forward and tries to make something happen. And so, I hope that the EU sticks with its deadline

MS. SIERRA: David, last word? Tom, sure.

MR. HELLER: Sure, just one thing about clubs because it was picked up and I should have said earlier. You asked us the question about the five --- are these five? I doubt it. I mean, we're having enough trouble, the bricks themselves, on things like a club solution for this new bricks bank that we've been doing some work on for them. Not easy to do, but I think the composition of these clubs calls for some innovation in themselves.

So, it may be both sides of a transaction. People who are interested in supporting work and countries that will actually host countries where it would be go on. And what can be really important is, you can begin to introduce different incentives so peer countries can monitor each other not to defect from an agreement in the club. I mean, it's probably more in the monitoring and transaction cost side of things that these things work, which prove to be very big problems at the international level, even if you get an agreement. And so, I think that you have to think through both the design and the implementation of institutions.

David, I'm sorry. I cut you off. Please.

MR. NELSON: Okay.

MS. SIERRA: Final comment and then I'll try to sum up. David, thanks.

MR. NELSON: So, very quickly on fracking. Of course we're

looking at this issue. Range of credible estimates we've seen --- others, not ours. We're not engineers and scientists. It shows that this is either a, you know, positive with respect to global warming or the highest fugitive emissions levels means that this is just the same as coal. And that's the range of credible estimates. We need to understand this more.

The other thing I need to put forward is that increasing gas generation in the U.S. may lower the average carbon output in the power sector, but in Brazil or in Europe it would actually increase the average carbon output --- or generated.

With respect to safety, again, you know, I don't think we're in a position to say anything about this. I would say that some of the risks are the very same that we have with conventional gas as well. So we need to be thinking, you know, very carefully across the whole portfolio of drilling activities. And you know, looking at how you actually improve the regulation of drilling activities, particularly the small wildcatters going forward.

I won't talk about clubs. In terms of externalization of carbon prices, I have to talk about this because this is important for CPI. This is exactly the sort of thing that we like to study, and it's one that without detailed study of who is impacted, how they're impacted, how the mechanism works, I don't really want to say anything. I just want to say that this is something that we can see benefits and we can see problems, both institutionally as well as the effect it would have on the markets. And so, it's something we're really looking forward to looking at. But I wouldn't say that based on what we've done so far that it is

something that we really want to opine on --- or that I would like to opine on.

And then with respect to Europe. It's not just Eastern Europe, you know. Europe is a laboratory for a number of policies going forward. They're applicable anywhere in the world, but they have to be modified to a situation on the ground. It may be in many cases that Eastern Europe is more close to –-- and when we're talking Eastern Europe, that's not part of EU. We're talking Ukraine and places like that. Maybe closer in some ways to Europe, and may not. And so, the point is, we need to be looking around the world, scanning policies, see what works, and see what needs to be adapted for any particular country.

MS. SIERRA: Thank you. Let me try to sum up, and then invite you --- so you don't leave --- to cocktails we're going to be having right after this session.

We had, I think, today a very wide ranging conversation about a new report that we're looking forward to the future series of that took stock of the last three decades of policy changes in key economies of the world that are responsible for the greatest number of emissions. And so, therefore, what happens in those economies matters quite a bit to climate.

Provided this overview, and stock-taking. We're looking forward to the next version that's going to take us forward in terms of more evaluating and giving us a sense of what the biggest bang will be in those economies and sectors.

We learned from the report that it's horses for courses. That you

can't have a single set of policies that's going to work everywhere. You need to look at natural endowments, you have to look at institutions, you have to think about where India is today on its development trajectory, where China has been, and Brazil, and the like. But there's still areas of learning from each other.

We're reminded from our panelists, especially Jennifer, that this is great. Great that things are accelerating, ambition is still too low. Pace of change still too low, and so that's a problem. And so, while we can have some sense of optimism from your report, we can't gloss over the fact that we still have a problem, though perhaps the political economy is shifting. And we will be watching very carefully and closely the international negotiations and the conversations that are happening pluri-lateral, the China-India discussions --- I mean, not China-India. The China-U.S. Discussions going forward as we start thinking about these next two years. Level ambition, coherence, and drive to scale-up.

Finally --- and I think importantly --- we also had a conversation about innovation, because while the policies for today's technologies and today's pathways I think are reasonably well-known, I think we would agree that we are under-investing, still, in innovation. Maybe not so much in these five economies, but I certainly from our own research here at Brookings see an under-investment in R&D for the next tier of emerging economies, and certainly for the least-developed economies, which are going to be bearing the brunt of the changing climate itself. And so, innovation for those systems, I think, should not be overlooked.

Going forward we're going to be, hopefully, seeing another paper going forward. I know that many of us are going to be using the slides in here with proper attribution, I hope. So, hope that they're going to be nicely available because they really are very terrific. And we certainly thought that it was a very interesting contribution and way of looking at the world.

With that, I want to thank our colleagues at CPI, thank David and his colleagues for this great report, thank Tom for joining us to give us insight, and very much especially thanking Jennifer, a very good colleague of ours at WRI and who has made tremendous contributions to this effort, both at the global stage but also thinking about how it interacts with U.S. policy.

With that, I would like you to join me in thanking our panelists and then we will move to cocktails. (Applause)

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I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

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