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P R O C E E D I N G S

MS. MATHESON: Good morning and welcome to this joint Brookings Institution and Urban Institute event on energy taxes and climate change. I'm one of your cohosts Thornton Matheson, Senior Fellow at the Urban-Brookings Tax Policy Center, which evaluates all aspects of U.S. tax policy including energy and environmental taxation.

We're conveying before next week's U.N. climate summit in Glasgow to discuss the role U.S. tax policy in addressing climate change. The U.S. which is the world's second large source of carbon emissions has set a goal of reducing those emissions to 50 percent of their 2005 level by 2030.

What is the current U.S. fiscal regulatory strategy to achieve that goal? And how can help tax policy help us get there? And now let me introduce my cohost, Sanjay Patnaik, Director of the Brookings' Center on Regulation and Markets and Bernard L. Schwartz Chair in Economic Policy Development.

MR. PATNAIK: Thank you so much, Thornton. Welcome everyone. Also, on my end as Thornton mentioned, I am the Director of the Center on Regulation and Markets, and climate change is one of our main focus areas. We work on different aspects of climate change including carbon pricing and climate risk management.

It's a real pleasure to welcome our distinguished speaker and our distinguished panelists here today who will walk us through some of the important aspects of U.S. tax policy and climate change which is obviously a very hot topic at the moment.

Without further ado, I would like to introduce our keynote speaker who is Dr. Catherine Wolfram. She's an Energy and Environmental Economist that currently serves as the Deputy Assistant Secretary for Climate and Energy Economics at the U.S. Department of the Treasury. She is on leave from the Haas School of Business at the University of California, Berkely where she is the Cora Jane Flood Professor of Business Administration and she recently served as an Associate Dean for Academic Affairs. Welcome, Catherine. Thank you so much for joining us here today.

MS. WOLFRAM: Thank you, Sanjay. And good morning, everyone. The subject for today's event really could not be more timely. As many of you have no doubt read there's progress being made on a host of these issues. For instance, just this week, Secretary Yellen is leaving for the G20

meetings and will go from there to COP26 summit in Glasgow, Scotland. And there are also ongoing discussions between Congress and the administration about what the final version of the budget reconciliation bill will look like.

So I will get to energy tax policy, but I wanted to start by telling you a little bit more about myself so that you have context for my remarks. As Sanjay said, I'm currently serving as the Deputy Assistant Secretary for Climate and Energy Economics at the U.S. Treasury. I'm on leave from my position as a Professor at UC Berkeley.

Before coming to government, I had been in academic for 25 years, 21 of them at UC Berkeley and I've done empirical research on the energy industry including privatized electricity markets in the U.K. In the 1990s, electricity industry restructuring in the U.S., oil markets, energy efficiency and environmental programs and electricity reliability. Much of my recent work focused on energy in the developing world with projects in Kenya, Uganda, Ghana and India.

So let me start with some high-level thoughts on the Biden climate agenda. To summarize, progress on the climate front, I'll start by noting that President Biden fulfilled his promise to rejoin the Paris Agreement on his first day in office signaling that America is back in the fight to tackle climate change. We want to rally the world to join us and this will culminate in many ways with the COP26 meeting, but we also know that we have a lot to learn from the recent work of our international partners since we lost four important years.

In April, the president announced an ambitious nationally determined contribution as our goal as part of the Paris Climate Agreement. And this NDC as it is called is 50 to 52 percent reduction in U.S. greenhouse gas emissions relative to 2005 levels by 2030.

Now, the National Climate Advisor, Gina McCarthy, and her team have emphasized since April that there are multiple pathways of keeping our NDC, but at a high level the plan is to work on the electricity sector to achieve a lot of the early emission reduction and then to begin to electrify other energy use using that clean electricity, for example, with electric vehicles.

So in the case of the other large emitting sectors beyond electricity in the case of industry, transforming buildings. We're paving the way to achieving greater reductions later. Really planting the seeds for electrification but those seeds may take a while to grow.

So let me give you some specific examples of the administration's climate activity. I find it useful to characterize the activities in the four broad areas. The first is the tax components of the president's plan. The second is the nontax component of the president's plan things like subsidies and standards. And the third is the components that are currently in the $1 trillion Infrastructure Investment and Jobs Act, IJA. And fourth there are other activities.

So I'll talk about each of these areas but spend more time on the tax aspect given my role at Treasury. So staying with this first category. Here is a rundown of the tax aspects of the president's plan, all of which have made it into the $3.5 trillion budget reconciliation bill that was introduced by the House.

At a high level, the tax credits are playing an important part and are serving multiple roles. For instance, they're both encouraging the deployment of existing technologies, things like energy efficiency, renewables. But there are also incentivizing new or emerging technologies like carbon capture and sequestration.

So, some of the specifics include an extension of the existing production tax credit and investment tax credit for renewable electricity generators. It's primarily wind and solar right now, but the tax credits are not specific to wind and solar. And the bill calls for an expansion of these tax credits to include energy storage if not already collocated with renewables.

But a draft legislation creates new investment tax credit for high voltage transmission to carry the new wind and solar incentivized by the tax credit that I just mentioned to the consumers. There are also electric vehicle tax credits up to almost $15,000 depending on where the vehicle is manufactured and the use of labor.

There are tax credits for medium-duty and heavy-duty electric vehicles and for electric vehicle charging infrastructure. There are tax credits for existing nuclear power plants and ensure that they remain operating as all of the new renewables enter the energy markets. There are tax credits for energy efficiency and electrification in the building sector. Tax credits for advanced energy manufacturing, an extension and an enhancement of the tax credits for carbon capture and sequestration and then new credit for direct air capture and another new credit for clean hydrogen and sustainable -- tax credits for sustainable aviation fuel.

So this is a long list, but I wanted to give you a sense for the scope of the measures that are being proposed in the reconciliation bill. And one huge advantage of tax credits is they fit very squarely into the budget reconciliation category so there are no worries about the parliamentarian in this case.

And secondly, they serve to mobilize private capital. So for example, the investment tax credit offers an incentive of 30 percent of upfront cost. The big incentive, but the bulk of the cost will be borne by private investors.

So moving to the second category of the nontax policies. These also play an important role in the president's plan. So as a few examples, the reconciliation package passed through the House included a clean electricity performance program. This is an adaptation of a clean electricity standard for budget reconciliation purposes. It's similar to state level renewable portfolio standards and the overall goal of the program is to add incentives to get to 80 percent clean electricity by 2030.

Discussion about whether that provision, the clean electricity performers program is included in the final legislation are ongoing, but my own view is that there are additional tools to drive us towards a cleaner electricity grid including regulatory controls.

So the package also includes subsidies for home energy retrofits and home electrification. Things like installing heat pumps or electric stoves or other electrical appliances.

So moving to the third category, the Infrastructure Investment and Jobs Act includes several climate provisions as well including considerable investments in resilience for instance designed as tax credits or incentives for state and local government. There is funding for a grant program to invest in a nationwide network of electric vehicle charging stations and there's also substantial investment in research development for things like clean hydrogen and carbon capture and sequestration including research and development funding and funding for pilot projects.

So all these programs and proposals are now under consideration by Congress. The president is working closely with Congress to get an agreement and it is certainly a top priority for the administration.

But while many eyes are on Congress right now, there's also a lot going out on outside of the legislative context. So for example, the Environmental Protection Agency is working on regulations

that would address mercury emissions from coal powered powerplants. And while that's not a climate related regulation directly by making it more expensive to operate a coal plant, it would have significant impact on carbon emissions.

Another big example in the regulatory sphere is the fuel economy standards for passenger vehicles which are currently being revised. I know treasury climate activity the best so I'm going to focus a bit of time on those. And just as a bit of backdrop, Secretary Yellen has created a climate hub and we at Treasury hired a climate counselor in April, John Morton.

Secretary Yellen herself is very engaged on climate issues and has made climate policy a focus of the Treasury Department. For instance, I've briefed her on a number of issues including, for example, like electricity transmission, which I think of as assertoric even within the sphere of energy policy. And during that briefing at one point, I said that something was kind of in weeds and she pressed me for more details. She is certainly engaged here.

And roughly, Treasury climate related work falls into three categories. The first is economics and tax policy, the second is climate finance, and the third is climate related financial risk. I've just described some of the prime examples of the work covered by economic and tax policy.

In terms of climate finance, Treasury oversees the U.S. relationship with the multilateral development banks. The Green Climate Fund coordinates with the G7 and the G20 finance ministers and it also runs some domestic financing programs like the state small business credit initiative, the SFVCI. And funds from that are potentially available for climate related work.

The last category, climate related financial risk has also been a key area of focus for many people at Treasury. And what this really means is in general we're all seeing an increase in investor's interest in green finance and it's now up to the regulators to make sure that investors have the right information on climate risk. Both transition risk which is the risk associated with the transition away from a fossil fuel-based economy but also the physical risk meaning the risk associated with increased heat, severe weather and other physical manifestations of climate change.

The secretary of the Treasury, as chair of what's called the Financial Stability Oversight Council or FSOC, she's working with the independent agencies to make this regulatory process as efficient and effective of possible. And importantly, the FSOC released a report last week that

recommend several things including increased action by the federal regulators on several fronts, scenario analyses of systemic risk caused by climate change, enhanced disclosure of actionable data and continued investment in really the expertise and the agency capacity to support these efforts.

My own observation is that climate related financial risk is the area where I've noticed that the biggest discrepancy between the attention it is getting from researchers, which is not zero but not a ton and the attention it's getting in the administration which is definitely a lot. So I hope that this is an area where we see more serious analyses.

So I want to spend the rest of my talk making some high-level observations on the economic principles behind the administration's approach to the clean energy transition. And in a nutshell, the strategy is really to provide what economists call public good. For non-economists who are listening, a public good is something which private markets will not naturally provide or at least won't provide enough of.

Because it's just difficult or impossible to make money selling a public good. This is because once a good in the public domain many people can enjoy its benefits. So a private company can't monetize its full value by trying to sell to individuals. And since private markets do not provide enough public goods, there's a clear role here for government.

For the economists who are in the audience, we know that there aren't many examples of truly pure public goods. And in some of the examples I'm going to provide below, I'm really talking about creating causative externalities technically, but I'm going to be a little loose and, you know, call these public goods just because I think of these as positive externalities is a bit (inaudible).

So let me provide several categories from the administration's clean energy work that fall into the public goods category. First, a major category of government investment is in infrastructure in general. I believe that we've all moved beyond the debates about what policy applies as infrastructure and whether it be like childcare and the care economy more broadly qualifies as infrastructure. So instead of going down that road, let me just tell what I have in mind in the energy context.

The present plan provides for things like subsidizing expanded long distance electric transmission, which will help bring renewables from places where it's sunny and where it's windy to places where people live and consume electricity. Another example is the investments in the IIJA in a

pipeline transportation system for carbon capture sequestration. So much the same way that the interstate highway system of the 1950s created opportunities for commerce. This will make it easier for companies to invest in carbon capture technology knowing that they will be able to put this sequestered carbon somewhere. Investment like this really creates a backbone for a clean energy future.

A final example along these lines of building up a clean energy infrastructure is planning a nationwide network of electric vehicle chargers. And I'll just say that in all of these cases given the network and spillover benefit of having this new clean energy infrastructure there's a clear role for government investment.

The second broad category that I want to speak about is information. And as I just described the efforts around climate related financial risk involved providing clear, consistent, and actionable information about what risks companies or state and local governments, et cetera, are exposed to and what steps they're taking to protect themselves against those risks.

And now, our hope is that many investors and decision makers will benefit from this information some in unforeseeable ways, which really makes it difficult for it to monetize the information. So in addition that the certification that the information is of consistent quality has huge spillover benefits. So I would note that the information and data is kind of like the infrastructure for an information-based economy. So again, here a clear role for government to play a role in providing that information.

Lastly, the IIJA also calls for large scale investments in early-stage technologies like clean hydrogen, direct air capture and electrification. And the public good or positive externalities here are that we can all learn from these investments whether that means learning that something is prohibitively expensive and not as straightforward as we had hoped or more optimistically learning about how to do things cheaper and more effectively.

So I'm going to conclude, but I realize that there is one omission in my discussion on the economic principles supporting government action in clean energy and that's fully accounting for the negative externalities associated with carbon emission. Accounting for the negative externalities would be a textbook example of pricing a bad, i.e., the negative externality associated with the carbon emissions. So certainly, there's a glaring market failure underlining climate change and underlining most environmental issues. And that's the failure of markets to recognize and price the emissions of

environmental bad such as greenhouse gases.

Indeed, there have been various proposals that speak to the issue of carbon pricing, but it's worth noting that the subsidies between energy technology are a complementary approach taxing the bad and the complementary approach involves subsidizing the good or the alternatives to the bad.

So to conclude right now, a number of policies are still part of the fluid and ongoing discussions in Congress and it's also important to note that there are non-legislative and regulatory measures that the government can enact. Thank you so much and I'm happy to take several questions.

MR. PATNAIK: Thank you so much, Catherine. This is very enlightening and very interesting especially given the current importance of the topic. I had a couple of questions.

So one is we have to COP26 coming up, right? And a climate conference in Glasgow. So can you tell us a little bit about what does the U.S. plan in terms of international support for climate change adaptation and mitigation? What kind of measures is the Biden administration thinking of of bringing to the table?

MS. WOLFRAM: Yeah, certainly. So first let me take you back to April of 2021. The leader's summit on climate that President Biden hosted. At that summit, he announced that the U.S. will double our annual climate finance to $5.7 billion by 2024 to help the developing nations tackle the climate crisis.

And then in September 2021 address to the U.N. general assembly, President Biden pledge to work with Congress to further double the U.S. climate finance. So this will result in U.S. climate finance reaching over $11 billion by 2024.

So this pledge complements our longstanding contributions to the multilateral development bank and these play a key part of the climate finance architecture and really complement our work to raise climate ambitions at the multilateral development bank.

MR. PATNAIK: Okay. Great. Thank you. Another question that often comes up and that's kind of like a little bit of a hot potato, I would say, is fossil fuel subsidies, right?

I think people often forget that we still have a lot of subsidies for fossil fuels in the U.S. and around the world. And so, when you look at the calculations, it shows that if you repeal current tax subsidies for fossil fuel production in the U.S., you could raise at least $3 billion a year, but the House

Ways and Means draft did not include any of those measures to repeal those subsidies.

And so, we are curious. Like in the face of climate change why should we continue subsidizing oil, gas and coal production? If we try to (inaudible). It doesn't really feel right to put money both in the renewable energy sector and still subsidize fossil fuel production, right?

MS. WOLFRAM: Yeah. So here's how -- let me first start with the economic behind those tax expenditures that are aimed at the fossil fuel companies. And these are things like the percent depletion allowance, (inaudible) quickly but the percent of depletion allowance governs the depreciation rules that fossil fuel companies can apply to things like drilling equipment.

The studies I've read including by Gib Metcalf, who is on the panel that's following this, suggests that the tax expenditures don't really subsidize production per se because they don't really change the company's marginal cost to production. So I think it's probably more accurate to characterizing the fossil fuel tax expenditures as subsidizing oil, gas and coal company's profit and not their production per se.

I will also note that repealing those tax expenditures in order really just to put fossil fuel companies on the same footing as other corporations that was part of the president's budget. And for instance, it was also on the green book that Treasury published back in May. So I can't speak to what happened in Congress, but I just want to emphasize that that was originally part of the president's proposal.

MR. PATNAIK: Okay. Sounds good. I think we're at the end for the first part of the event today. And I want to thank you again for taking the time. I know you're really busy especially at this moment in time to take time out of your day to come to us and speak to us. Thank you very much.

MS. WOLFRAM: Thanks, Sanjay. Yeah, super important topic so thank you for hosting.

MR. PATNAIK: And I will hand it over to Thornton who will now do the second part of the event which is the panel with our distinguished experts. Thank you, Thornton. I'll hand it over to you.

MS. MATHESON: Yes. Thank you so much, Catherine, for that keynote speech.

And now, we begin the discussion panel section of our event. We are very fortunate to have three highly distinguished experts on the energy tax to discuss U.S. tax policy as it relates to climate change.

Gilbert Metcalf is the John Deveojio (phonetic), Professor of Citizenship and public service and a Professor of Economics at Tufts University. He is also a University Fellow at Resources for the Future. And if the panelists want to turn their cameras on, come on screen now that would be great.

Carole Nakhle is the founder and CEO of Crystol Energy, a London based advisory, research and training company.

Kurt Van Dender is head of the Tax and Environment Unit at the organization for Economic Cooperation, the Centre for Tax Policy and Administration in Paris.

So to start with I've asked each of our panelists to make a brief introductory statement on what they see as key issues relating to U.S. tax policy and climate change. Gib we'll start with you.

MR. METCALF: Great. Thanks, Thornton. And I just want to say just at the outset how exciting it is to hear Catherine talk about Treasury's engagement in this issue. To have Secretary Janet Yellen, who I have spoken to at previous Brookings' events about our climate policy. I know she's deeply engaged in this issue. I worked with John Morton when I was at Treasury in the Obama administration. He's a very thoughtful, smart guy. And of course, Catherine is a leading energy economist. So it's a terrific team at Treasury. So that I think is really exciting.

So just quickly sort of as an overview, we've heard that the Biden decarbonization goal is a 50 to 52 percent reduction from 2005 levels by 2030 and net zero by 2050. That 2030 goal is a 35 percent reduction from today given the progress that we've made since 2005. And there's a lot of work that has been done including some that I've done that indicates that this is easily achievable with relatively modest carbon pricing.

However, as a recent Rodem Group report makes clear, it's more difficult if you have to rely on a regulatory only approach. So that I think is -- really speaks to the importance of the budget reconciliation negotiations that continue.

The costs of the economy are modest to trivial from carbon pricing based on work that a number of people have done including work that I've done with Jim Stock at Harvard. But there are clearly significant sectorial shifts in employment and economic activity. And that, of course, is the political challenge.

However, having said that I really don't think we're on track to meet our U.S.

decarbonization goals. And it doesn't appear that there's the political will at a national level to enact ambitious mitigation legislation.

Clearly, carbon pricing is the most desirable approach but as is well understood this is politically challenging. But as Catherine has pointed out, tax credits which are a key part of the budget reconciliation package. Tax credits can do quite a bit and I think that's what is really going to be driving a lot of the action and interest in federal policy.

I actually find it somewhat striking or puzzling that Senator Manchin is so adamant around the policy. When you realize that coal accounts for three percent of the jobs in West Virginia. And many of these jobs are going away anyway given the trajectory of coal in the U.S. over the last few decades. And it just seems to me that the senator is giving up a once in a lifetime opportunity to cut a great deal for retraining, retooling and reinvestment in West Virginia and other coal states that we can do with a clean energy transition, so I find that kind of puzzling.

But let me say a few words about clean energy tax credits. They are an important driver as Catherine has pointed out. The production cash credit has been incredibly important for wind and the investment tax credit for solar.

I recently wrote a policy brief for the climate policy lab at the Fletcher School at Tufts to talk about how there are ways we can improve the existing tax credit structure. And the most straightforward tweak, and we can talk about this if there's time, would be to tie the production tax credit amount to the social cost of carbon.

Currently, the production tax credit of roughly 2.5 cents per kilowatt hour for the first 10 years has not changed in real terms since the production tax credit was first enacted in, I think, it was 1980. So I think we should -- given that this is the tax credit is a way to sort of level the playing the field between -- if we can't tax the dirty resource, let's subsidize the clean resource. We can use the social cost of carbon to do that.

But there are other tax credit issues and I think the budget reconciliation plan does a good job of addressing these. Policy durability has been a key issue in the past of having to reauthorize this legislation every couple of years. That gets addressed in the reconciliation package as does some other factors that we could talk about.

Finally, the last comment I want to make is that, as Catherine has pointed out, transmission and storage are a huge deal. It is incredibly important to address these along with overall grid reliability if we really are going to have a strategy of electrifying everything. I think of that today as I look at the windstorm outside my house in Cochran and worry if we're going to lose power at any moment. Fortunately, we haven't. Knock on wood.

So tax credits are incredibly helpful, but we have issues like interstate transmission, competition between states, and the ability of states to hold up investments. So that's a challenge that will require work by FERK (phonetic), I think, among others.

But to summarize, the Biden administration clearly understands that while carbon pricing would be terrific and is important, it's not sufficient. We have a lot of other levers and need for regulation and incentives and I find it quite encouraging to see this sort of all-of-government approach that the administration is taking. Thank you.

MS. MATHESON: Thank you very much, Gib. We'll move next to Carole Nakhle.

MS. NAKHLE: Hello, everyone. And thank you very much for having me with you today. I'm an outlier here. I'm calling from Germany in Europe and it's interesting to hear the perspective from the U.S. especially when you're talking about climate change because climate change is a global problem. It's interesting to see how the world's largest economy is dealing with that.

I thought that perhaps it helps with our discussion into a broader context, primarily the energy transition context to understand why we're having this debate about carbon pricing, carbon taxes, credits, you name it. And it's an interesting observation because we have been through energy transitions before. So we went through a similar year, so we had one that we needed fuel only to be squeezed out and then replaced by another fuel in terms of dominance.

But the current transition that you are facing has no precedent. Why? Simply because it is not driven by economics. And what I mean is that it is not driven by a massive transformation of our industries and production costs as was the case with the industrial revolution that gave coal it's prominent presence in our energy mix. Nor it is driven by a competitive advantage as we saw with oil versus coal.

So the current transition is driven by changes in preferences. Now, add to that that the current energy system globally or in the U.S. is massively dominated by fossil fuels. And the reason why

I'm saying that if you look at the numbers on a global scale that more than 83 percent of the world's energy needs are met by fossil fuels. And I mean with that oil, coal, and natural gas.

In this respect, transitioning the fuel mix into a less carbon intensive state would therefore not be possible without costing those changes in preferences. And this is why you need a carbon price being a carbon tax or a cap-and-trade system as you have mostly here in the EU. And this remains the key ingredient for decarbonization to really kick off.

However, and this is easier than done. I think I heard my concern-panelist and speakers mentioning or alluding to that particularly the political dimension. And if you look around the world, you can see the slow pace at which putting a price on carbon has been around the world. After all, I mean energy constitutes a relatively large share of the expenditures of the low-income households.

And I would like to add to that, three additional important dimensions. As I mentioned earlier, climate change is a global problem. So you need everyone on board. Otherwise, for example, if you simply tighten the rules, domestically, you put pricing on domestic industry, you are putting your domestic industry at a disadvantage versus international, let's say, organizations, industries.

So to avoid a carbon leakage, you need a broader tax but that requires major coordination between countries and we're not really there yet. I mean I know the trend is heading in that direction, but again the base has not been quite impressive.

The second point is the scale of this challenge because to make a meaningful contribution, the carbon price needs to be set high enough. I recall a few years ago when Germany set a certain price for carbon, which would increase to roughly 40 U.S. dollars per ton by 2025. Then the Chancellor Angela Merkel, the former chancellor, said, we need to bring the people along with us because she was criticized for not pushing for higher carbon pricing.

And actually, if you look at what the experts are saying. If you want to achieve not only the two degrees but the 1.5-degrees Celsius target that the climate scientists are telling us then you would need at least $100 per ton carbon price by 2030.

And the third element I want to add is that we have to recognize that the energy transition, this full greening of our energy mix is not going to happen overnight. So you need to have some kind of balancing between maintaining investment in oil and gas and even coal, but of course it has

to be with a less impact on the environment simply because the green technology is not readily available. We're seeing today in Europe, for example, the gas prices increased by 600 percent in one year is partly because of that problem.

Now, after that, the fact that the timing today is not great. I mean we are still recovering from an economic crisis like no other because of the pandemic. But even before the pandemic hit, some of you may recall here in Europe at least and also in America and the Middle East when governments attempted to make, let's say, gasoline fuels or vapor fuels more expensive through taxes, they were faced with protest. And here I'm going to cite the yellow vest or gilets jaunes in France which still remains quite vivid in the government's memory.

This is not to say that it cannot be done, but it's a delicate balancing act. Now, on how it can be done, I have to say that economists, and I'm one of them, agree that carbon price is more effective than regulations. And the preference is for carbon tax and here I'm going to quote the Treasury Secretary Yellen who said in 2018, carbon tax is a textbook example for a solution for climate change.

However, if you look at the countries that apply carbon tax, they are probably less than 25 countries versus, for example, the cap-and-trade system. You find it in more than 45 countries. But it can be done if it's properly designed because after all any kind of tax no matter how good or bad it is really the outcome of it depends on how you design it and how it fits into the broader fiscal system.

And here, I'd like you to look at the Norwegian example because Norway applied -- it was one of the first countries to apply carbon tax. But it was only one of the first countries. One major oil and gas producer that applied a carbon tax back in the 1990s, and they have followed an interesting way where they introduced it at the low level and then every 10 years, they increased it gradually. And now, they have very ambitious targets.

And let me now conclude with an important element that we heard from Catherine about producer's subsidies, and I agree with her. In my opinion, this is still a gray area. Definitely, there are possibly a few subsidies around the work, but most of the work and the findings we heard are primarily focused on consumption subsidies. And they should be tackled, but when it comes to production subsidized, I think more work needs to be done.

However, a lot more can be done if one looks at the overall fiscal system that applies on

oil and gas producers, for example, because if you design it properly in a progressive way then those so-called subsidies don't need to be put in place. Thank you very much.

MS. MATHESON: Thank you very much. Now, we'll move to Kurt.

MR. VAN DENDER: Thanks for the invitation to this event and this very interesting discussion already.

So I mean we've basically already hinted to the three principle ways that tax policy can contribute to climate change. You can try to price the back part of taxes. You can try to provide support for the goods reducing emissions through tax credits as has already been discussed. Tax policy can also help you to shape distributional outcomes of your climate policy. So concerns about regressiveness and these kinds of thing.

Tax policy can help in that respect to -- it was already mentioned, made clear that today the U.S., the focus is not on pricing the bad, it's more on the tax credits to support the good.

I nevertheless was going to take a couple of minutes to talk about how carbon pricing. So pricing the bad is evolving in the G20 countries today. I think this is relevant to the U.S. situation even if the U.S. today is not moving forward with ambitious carbon pricing plans. What happens in the rest of the world in that sense matters in terms of the effectiveness of the U.S.'s own policy choices, for example.

Fortunately, today we have released at the OECD an intermediate update of a report that we do regularly which is called effective carbon rates. In effective carbon rates, we look at three forms of carbon pricing, namely carbon taxes, prices from emission trading systems. But we also look at fuel excise taxes. Fuel excise taxes are not usually intended as a carbon price, but they nevertheless from an economic point of view translate effectively into a carbon price, which is why we take then into account.

So we published today an update. Of course, it can run up through (inaudible) that's why the timing is what it is. And a report which you can download. It's called Carbon Pricing in Times of COVID-19. What has changed in G20 economies? So it's about G20. It's 2018 to 2021. So what has changed in the last three years.

And as I said, we look at CO2 emissions from energy use and we look at carbon dioxide emission permit prices and fuel excise taxes. Headline results, if you want to know more, you should tune into an event in OECD's virtual COP26 pavilion. We do an event on this work on the third of

November so next week, early next week.

Headline results. Lots of change since 2018. Significant increase in coverage of emissions by carbon prices in 2018. We had 37 percent of CO2 emissions from energies that were entirely unpriced. So there was no fuel tax, no carbon tax or no emission permit price for 37 percent -- sorry, I'm saying it the wrong way around.

In 2018, 37 percent (inaudible)

MS. MATHESON: Kurt, I'm going to interrupt you. We don't hear you. You're on mute, I think.

MR. VILSACK: Sorry. I had a technical problem here, which caused me to misspeak as well. Can you hear me now? Okay.

So 2018 to repeat, 37 percent of emissions was priced. 2021, 49 percent of emissions is priced. So 12 percentage point increase in the share of CO2 emissions from energy use that is subject to one of these three types or several of these three types of carbon price. It's a very significant progress in just three years.

What happened? New emission trading systems in Canada, in China, in Germany. New carbon taxes in Canada as well. In South Africa and some national taxes in Mexico. These are the main ones. So significant progress. New systems in a lot of places.

Also, significant price increases that mainly is the story about the EUETS. If you compare the current price of nearly 60 Euros per ton of CO2 that four times as high as it was in 2015. So we go from 15 Euros per ton to 60 Euros per ton in three years. This is not pure volatility, there is structural shift happening here.

So very significant change, very significant change. Very significant progress with the use of carbon prices and with carbon price levels, but the change is concentrated to take a couple of places. It's not happening in the U.S., for example. There are other places where it's not happening either.

How does the U.S. compare today? Let's look at excise, fuel excise which is mainly a story about world transport. In 2021, roughly the same situation as in 2018. In the U.S.A., if you take federal and the average state's gasoline taxes, they translate into carbon prices 47 Euros per pound

approximately. If you do the same exercise in the EU, you look at fuel excise taxes, it's 185 Euros per pound of CO2 so four times as high.

If you look at the electricity sector, this is not mainly fuel excise. This is ETS and carbon taxation. What is the combined effect of ETS and carbon taxation in the U.S.? Well, less than a dollar or a euro per ton of CO2 on average across the U.S. in the electricity sector. In the EU in 2018, we had 15 Euros per CO2. Today, we have 39 euros per ton of CO2 so a significant increase. In Canada in 2018, we had seven euros for pound of CO2. Twenty-five euros per ton of CO2 today in 2021.

So lots of progress. Very uneven progress. The result is an increasingly uneven carbon pricing landscape if you look across the G20 and if you look across G20 and OECD. Ambitions are up. We know about zero commitments. We know that increasingly in several places including the U.S. these ambitions are being translated into policy action, but the way, the approaches are very different. Tax credits, carbon pricing. I mean it's always a combination of the two usually, but the emphasis differs a lot between places.

This triggers a discussion about spillovers. If some places advance so much with carbon prices, what should we do in terms of handling spillovers into trade development agendas? I'd be happy to discuss further. Thanks for your time.

MS. MATHESON: Thank you very much for all those engaging thoughts. I'd now like to offer each panelist a chance to respond briefly to Catherine Wolfram's keynote speech as well as to each other's remarks. So, Gib, we'll start with you.

MR. METCALF: Well, I think the main point I'll make, I already reacted a little bit to Catherine's sort of broad landscape of the four areas that the Biden administration is focused on. I think that's really important just as a reminder that I think carbon pricing is absolutely necessary, but it's not sufficient.

We need R&D spending. We need to address regulatory bottlenecks including transmission siting. Storage is a huge problem. I worry a lot about a strategy of electrifying everything. If a tree brings down the powerline in my neighborhood and we've electrified everything. So that worries me a little bit.

I think Kurt has brought up an important point which is sort of the growing disparity in

carbon pricing around the world. Many economists including, you know, Bill Nordhaus, the late Marty Weitzman have really made the point that harmonizing carbon pricing around the world is absolutely essential and does a lot to address the concerns about competitiveness and leakage. So I think that's a challenge.

And Carole has also brought up, I think really interesting points about some of the political issues that we have to address in moving policy forward. It's a challenging problem. And what makes it so challenging just to remind ourselves is that costs are borne by a small fraction.

The fossil fuel producers who have huge incentives to lobby against this. And it's also borne by a smaller fraction of countries in terms of where the sources, fossil fuel resources are. But the benefits are diffused and many of the benefits are obviously more -- we're seeing more climate damages every day. But the benefits accrue far into the future and that's a huge challenge for this global problem. So I'll stop there.

MS. MATHESON: Thank you very much. Carole, any response to the other panelists or to Catherine?

MS. NAKHLE: I have alluded to some things that Catherine has said but I want to agree with Gilbert about -- I mean we have a massive challenge, a global challenge. And you cannot rely only on one instrument and then wait and hope for it to produce the result that we want. And the short relatively short period of time that scientists are telling us to avoid a catastrophe.

So but here, you know, when we look at the U.S., what the green policies are pushing for. I have the feeling there is too much emphasis on the carrots, but the sticks seem to be forgotten. I think you need to balance between those two, and it's important.

I know that carbon pricing is not the answer. It's an important element. However, you want to pursue it, but it's important to target the culprit here and that is carbon dioxide emissions.

And that's why I have strong preference for carbon pricing in addition, of course, to other instruments including regulations. But relying on one instrument and leaving the others out, I feel that we're not going to get too far to achieving the ambitious targets set by governments.

MS. MATHESON: Thank you very much. And finally, Kurt.

MR. VAN DENDER: Yes. Thank you. And so, I'm in agreement that carbon pricing if

you can do it, of course, is important. But also, strong agreement that it is not the only component of an effective climate mitigation package, shall we say.

So I mean there are several market failures which are in play here. Some of the main ones were mentioned in the introduction. It is not just an absence of pricing externalities. There are knowledge spillovers which are also a form of public good that policy can seek to stimulate. And tax credits are one way of doing that.

This is a realization which is emerging in several countries that are trying to design comprehensive climate policy. Yes, pricing. And with pricing, the idea is not necessarily to introduce a very high carbon pricing immediately today, but to make sure that investors in their long run planning know that a carbon price is coming and that they can introduce this in their long run decisions.

So providing certainty about a carbon pricing path probably is just more important than existing on the very high carbon price immediately today. So that's one element there.

Then the complementary policies, tax incentives, tax credits, the design is difficult. We can discuss it in detail, but we see in a lot of places that difficulties emerge with providing support for upstream innovation. So close to market tends to work relatively well, but if you want to do very upstream innovation, it becomes more difficult to provide support there.

And there's also a problem with targeting in the sense that large firm's incumbents tend to benefit more from taxes than the small and young firms, which is from an innovation point isn't always ideal. So I'll stick with that for now. Thank you.

MS. MATHESON: Right. Thank you so much. So we'll move now to the audience Q&A portion of the presentation.

We had a very interesting question or a bunch of contrasting questions come in with regard to carbon taxation. A senior climate policy advisor to Chevron asks, what's the biggest barrier to achieving what we all agree is the most efficient and effective policy tool available to U.S. lawmakers? And he didn't specify what he was talking about but I take it to be a carbon price.

However, other audience members posed questions like that assume that fossil fuel companies influence is actually what is preventing politically carbon pricing in the U.S. So I wanted to pose this question first to Carole because, you know, your advisory firm works or has worked with some

major oil companies.

What, in fact, is their perspective on carbon pricing? Is it uniform across firms? Is there a lot of variation?

MS. WOLFRAM: I mean they actually have a variation in views but at the end nobody likes additional taxes. Let's be clear about that. But I understand where some skeptics when they hear industry arguing in favor of a carbon tax. They might think this is greenwashing and they are trying to just simply push for something that they is politically very sensitive to apply, which is partly true. Because if you look at the whole value shape.

For example, of oil and gas, you can see that around 88 percent of the emissions, the carbon emissions, actually happen at the consumption level including they talk about power shifting industry, vapor fuels and the rests is only on upstream extraction, and production and exploration for oil and gas and the processing.

But actually, when you dig deeper, you realize that these companies, whether oil majors or smaller players, national oil companies or private companies alike. They know that there's no way out. The game has changed and the shift towards a greener future is not starting because already progress significantly.

And that's why we see some companies are taking it quite seriously. And you see already some of the big players in the industry cut out petroleum, change their name to better energy, the national company of Qatar. Qatar added energy in their name. It's not just the slogan. Actually, there is some commercial strategic reason why they would favor carbon taxes because otherwise they would be faced with something else.

Because first of all, if you think about it. Carbon tax actually kind of favor natural gas over coal. I mean although they are all fossil fuels, but natural gas emits much less CO2 on per kilo hour basis compared to coal. So a carbon tax would favor gas when that lends a longer shelf life to the bad assets of these companies.

Another point, I can think of it can also support what is today expensive technologies such as carbon capture and storage. So on balance, I can see why some people would be skeptic of the company's position vis-a-vis a carbon tax. By at the same time, there is a reason why these companies

know that a carbon tax is the least evil than other measures on the industry.

MS. MATHESON: Great. Thank you. I meant to encourage other panel members after the first person has spoken to feel free to chime in with additional views.

MR. VAN DENDER: Maybe just to add on what was said which I agree with. Mention was made in the introduction by Catherine on climate risk. And I think carbon pricing is a good way of reducing risk.

So we know that carbon neutrality commitments are increasingly widespread and ambitious. There is uncertainty however about the speed of reducing emissions about policy approaches. So about policy instruments. That uncertainty could result in what is referred to as a nonorderly transition. So if you want an orderly transition, you need to provide that policy certainty.

And I mentioned the carbon price about before. This is seen in a couple of countries as one very good way of providing certainty about what the cost of emissions is going to be for industry including producers. And some of the oil makers already in 2015 actually made that point if you run up to the COP then the Paris agreements then that came out that providing the certainty through a carbon price would be a very good way to help them plan the transition.

MS. MATHESON: Kurt, I actually had a follow up question for you.

MR. METCALF: Can I just say one thing for the --

MS. MATHESON: Please go ahead.

MR. METCALF: Kurt is absolutely right on the policy certainty. In the U.S. context, I think a lot of the support for a carbon tax is part of a thought of quid pro quo that we give up regulation under the Clean Air Act of carbon pollution in return for a carbon price.

And of course, there's much opposition among environmentalists to that but I think the quid pro quo could be done differently, which is that we basically have a moratorium on regulations so long as there is a carbon price that leads to at least as much as emission reduction as you would get under regulation.

And I think there could be a bargain struck there, but you clearly do not want to strike a deal where you say, we're going to give up the right to regulation carbon pollution under existing legislation.

MS. MATHESON: Well, actually that brings to mind what we're talking about regulation versus taxation. I wanted to address that issue in a little more detail.

Some policymakers claim that a benefit of a regulatory approach to climate change is that it doesn't cost taxpayers anything, but to tighten energy tax regulation increase energy cost for businesses and households. And more broadly, what are the pros and cons of a regulatory versus a tax-based approach to reducing carbon emissions? Gil, for you.

MR. METCALF: So let's be clear. Any policy to reduce emissions is going to involve cost. Whether it's a cost for tax. Actually, the taxpayer cost is not so much the cost because that's just a transfer. You know, we collect taxes from Thornton, and we give the revenue to Sanjay that's just a transfer within the system.

But it's the real cost produced emissions that we care about. And let's also be clear that the benefits of reducing emissions way outweigh the cost. And so, the -- to me the main benefit of regulatory approach is that it obscures the cost which from -- as an economist, I don't like that, but politically that certainly makes it more politically palatable.

However, that comes with its own cost, which is that we know from a huge body of research that carbon pricing is much less costly to the economy. You know, for any given amount of emission reductions you want, we can do it more cheaply with carbon price than through regulation.

And that's because we're using the market and prices through the market to let market participants make their own decisions as to how to proceed. You know, do we want to cut electricity emissions first? Or building emissions? Or transportation? It's just a clearly a better way to proceed.

However, you have to -- you've got to be able to enact it. You know, I'd like to say -- I've said this before that since carbon pricing is using the power of markets to drive emission reductions. It's really a way to think about it is the carbon pricing ensures that Adam Smith's invisible hand has a green thumb. So I'll stop there.

MS. MATHESON: All right.

MR. VAN DENDER: If I maybe could just add, you know, if you look at, for example, how Germany, which other people on the panel probably know more about. But if you look at how they went about an agreement.

So introducing their share of renewables in the electricity production. This wasn't tax driven, but they certainly were costs for years. And there are very similar types of policies now in other parts of EU. And the complaint in Europe these days is that the electricity bill increasing, it looks like a tax bill.

So it's not like alternative approaches which are not pure regulation but contain elements of regulation that they don't result in price changes. They definitely do. So and this is what was said already, Gilbert said it. What changes is the distribution of the costs. Who pays the bill? That might differ if you change policy mixes. So if you go for surcharges on electricity bills. Balance meaning the electricity you start paying if you would go for via a carbon tax then it's all taxpayers that pay. We can discuss what works better. This is partly a normative discussion except for the fact that if you do not have a reasonably uniform carbon tax in your policy package then it is very likely that the total cost of emissions is going to be significantly higher.

So that tradeoff exists. I agree with the point about obscuring costs being potentially politically expedient, but there is a cost to that which is real.

MS. MATHESON: Okay. On the topic of who pays what? I wanted to address the incidence of a carbon tax.

Carbon taxes as I'm sure you all know have been criticized as regressive which is to say they cost lower income households a larger share of their income. However, green tax credits such as the U.S. proposed expansion of tax credits per electric vehicles and residential energy have also been criticized as regressive because most of their benefit flows to upper income households.

So what is the best way to address climate change in a progress manner? Kurt, let's start with you.

MR. VAN DENDER: Thanks for that question which is one that we could talk about at great length, I think.

But I would like to start with some nuance. Carbon pricing is not always necessarily regressive. It's an empirical question. It depends on the type of energy that you look at. It depends on the country.

Maybe people know about the U.S., but we have some -- we did some work on this a

couple of years ago where we looked at the regressiveness of a carbon tax and found that in electricity, yeah, it's probably regressive. Household heating moderately, almost flat. In transport, it's not so clear. Large differences between countries. Sometimes, it progressive. Sometimes, it is regressive. So that's one thing.

There is an empirical question here. How regressive is it really? Progressive is only one feature, however. You also have energy affordability. You can have a very progressive carbon tax. But nevertheless, it calls energy affordability problems for people at the low end of the distribution. So energy affordability needs to be kept in mind, I think in addition to regressivity.

Now, how to do it progressively is your question? Carbon pricing raises revenue. The other policies that we talked about regulations, for example, does not raise revenue. The advantage of raising revenue is that you can deploy that revenue in a way that helps change the distributional outcome of the policy package. So I guess the point is if you talk about carbon pricing, carbon taxation for ETSs, you should not look at the direct effect only, but you should consider what happens after you have used the revenues from this instrument.

There's lots of flexibility there in what you could do. Carole actually also already mentioned Norway and other countries where revenue use was in the form of a tax shift, right? So we get the revenue from the carbon tax and you use this to reduce labor taxes or carbon income taxes. That's what has happened in these countries.

Is that something that would help for the U.S.? Or are there other ways to make it progressive? Better for the U.S., for example, lump sum transfers. So roughly equal transfers to households as it has been proposed by economists in the U.S. Maybe that's a more appealing option there. But the basic point is you should not evaluate the distributional outcome of your policy without considering the effect of revenue use.

You can design good revenue use. What we have learned in several European countries is that even with good revenue use, this is not a sufficient condition for acceptance. You can poorly communicate revenue use, all these kinds of things. Or people may just not believe you and then you have either your -- you have a vested type of rules, which, you know, the difficulty is not just in designing the policy well, but convincing people that this is a kind of policy, and you are taking care of distributional

effects.

So these are just some thoughts. We can discuss further. I'll stop here.

MR. METCALF: Yeah. I'll just add onto that. If we look at the U.S. where it's pretty clear that we're going to be using tax credits to encourage clean energy investment on a variety of levels. And these have been rightly criticized for providing benefits predominantly to higher income households in part because higher income households pay taxes. Lower income households don't pay income taxes.

But you can address this in a number of ways. For one, you can allow for a direct payment option for certain residential base credits so that you don't have to have tax liability but can receive a credit. If you are concerned about encouraging investments in lower income communities for environmental justice considerations, you can think about providing a bonus tax credit for investments in these communities.

You can think about a variety of options. Some of which are in the Biden plan for prevailing wage bonuses for programs that receive these credits as well as some support for apprenticeship. So I think there are ways to tweak the tax credits in ways either through refundability or other ways that can address distributional considerations.

MS. NAKHLE: Let me add here one more dimension. I wouldn't rule out a tax based on the simple base of it. Of the perception of it being regressive because it all boils down to the way you can design that tax and you implement it.

So you can – you have, for example, a tax which is regressive in theory, but when you tweak it in the implementation and the design then you can make it more progressive than regressive. So there's a whole design issue here that we can engage in on hours and weeks that is a longer discussion so there is a way around it.

And second point, I want to add is it's also -- I don't think it's quite comprehensive to judge about one tax instrument in isolation of the broader tax system in the country that applies, let's say, on a certain sector or on individuals, for example, industries. So maybe there could be a way where you can counterbalance whatever negative implications of one tax by improving efficiencies in other areas of the tax system.

And the third point I wanted to add is just in reference to Norway. It's interesting. It's a

nationwide tax that's not solely applied on the energy industry. However, they do kind of have different trades. For example, for certain industries, they pay lower taxes, for example, then the oil and gas industries as some households and remote areas, for example, they are exempt from that tax.

So there is different ways of designing the tax to overcome that issue of aggressivity.

MS. MATHESON: Thanks very much.

MR. VAN DENDER: Is there time to push that point a bit further?

MS. MATHESON: Briefly, yes.

MR. VAN DENDER: Okay. So agreed, it's the overall distributional outcome that matters but it's a very tough communication exercise to get that across.

The other point I wanted to make I mean I've said it at the beginning. We should not think about carbon tax or tax credits. You know, I think they should be combined ideally. And this becomes more important when you take a deep decarbonization perspective, let's say, instead of reducing emissions at the margin.

So the traditional view in this green tax shift discussion is we increase the price of pollution and then pollution declines and we use the revenues to basically fund a financial transfer through the tax system or through the social spending system. Usually not much of a reference for directed spending to adopt to reduce emissions.

I think in a low carbon transition perspective, there's stronger argument for using the revenues from a carbon tax or tax revenues in general if you don't have a carbon tax. To use these revenues to direct towards particular forms of spending, for example, improved home insulation buying EVs, full of EVs not hybrids, ideally.

So the extent of driving decarbonization is to, I think in deciding how to design the carbon dioxide tax credits.

MS. MATHESON: Yeah. And I would just add not only can carbon tax, for example, revenue be recycled. But it also matters what the money is spent on. It can be spent on other progressive expenditure programs. And also, it's important, I think to think about the real effects of reducing carbon emissions and air pollution more generally.

We have a very big issue in the United States about environmental justice. And to the

extent that carbon taxes or carbon pricing or climate policy, in general, reduces local air pollution that can also have -- doesn't necessarily always have but it can have progressive real benefits.

But I wanted to move on in into the next topic, which is here in the U.S. we've had various types of tax instrument proposals other than carbon pricing or green tax credits proposed to address the climate crisis such as higher profit taxes on fossil fuel companies. And also, potentially higher fossil fuel royalties or severance taxes.

So, Carole, I know this is an area where you've worked in a lot. What are the different effects of these different tax instruments at addressing climate policy? And which instruments are really the best?

MS. NAKHLE: You know, there no such a thing as an ideal instrument. And ideal fiscal instrument exists just in theory. But when I look at the U.S. If I look at, for example, at the system that applies on fossil fuel companies, let's say, oil and gas companies.

When you look at the headline tax rates, you can see that the U.S. is among the lowest taxing provinces in the world for better, say, other countries as you look at deep water off shore in the Gulf of Mexico and for their land. But actually, when you look at the detail of the fiscal system in the U.S., as applies on the hydrocarbon industry, you can see it is one of the most regressive system in the world where the government, say, is investing related to the profitability of projects.

You end up having the government take being higher from the less profitable projects and a lower than if you have more profitable project. And that is not an ideal or if you want it does not come close to one of the principles of taxation of fiscal systems. So instead of just going and piling on additional taxes. First of all, we have to consider how we can make the system more progressive? And that's why I mentioned earlier when I talked about what is perceived as subsidies, you wouldn't need those if you have, for example, a more profit based, more progressive regime applicable to oil and gas.

Because look, I know we're talking about climate change. We're talking about the energy transition. And I would like to see this happening sooner rather than later. But we have to be realistic about the pace at which this transition is happening. And we still need investment in oil and gas at least to meet our current needs at least for the next few decades, but you can do it responsibly.

You can encourage companies to reduce their carbon intensity of their operations. I

mentioned Norway earlier. Norwegian government take is around 78 percent, but it is purely profit based and it is one of the lowest carbon intensive when it comes to oil and gas exploration and production. So the method that they use, a combination of taxes that they use including carbon tax has encouraged operators to reduce the carbon footprint of their operations.

And in the U.S., there is plenty of room for improvement for those who don't know the U.S. does not rely on the typical profit-based instruments. So there is a corporate income tax and there are royalties and signature bonus. But unlike all OECD these countries which produce oil and gas, they don't have the profit-based tax. So there is room to -- like I say, the government wants to squeeze more revenues out of the industry, there is room to do that but it should be done in a more progressive manner and revisit the system to make it less regressive.

MS. MATHESON: In terms of try to target carbon emissions, however, it strikes me there is a big difference between tax policies that increase the cost of burning fossil fuels such as royalties and carbon taxes. And taxes that take a larger share of the profits of fossil fuel companies such as, you know, higher corporate income tax, surcharge or resource rent taxes.

Are either type of instrument more effective in addressing environmental goals?

MS. NAKHLE: You would need a combination of all these. What matters is how much weight you put on those instruments when it comes to the overall fiscal system. So you can have carbon tax applicable, but again for a carbon tax to be effective in helping the country achieving its broader planned agenda, a carbon tax would be more effective if it's imposed on a nationwide level and not on a sectoral level.

I go back also to the issue that we discussed about regulation side. That will also have. And for example, I know the U.S. is going big time in terms of tackling methane emission. That by itself is a major step to tackle the emissions from the industry, and that has to do also with regulations.

You know, a simple switch from coal to gas in our generation in the U.S. If you look at the trend in carbon emissions in the U.S. And that is that did not come, you know, from a specific industry measure. It was a pure market-based mechanism combined with technology. When we had the share evolution.

If you look at the decline in CO2 emissions and carbon dioxide emissions in last, let's

say, 10, 15 years in the U.S. A big chunk of that is attributed to the switch from coal to gas because gas became more available. So it's a combination of things.

I cannot single out one instrument being more powerful because again when I assess the tax that are applied, the tax system that apply on a sector like oil and gas for instance, there's so many bits and pieces that interact with each other. And it's difficult to single out the effect of one instrument.

MR. METCALF: So I would just say if you want to cut emissions, you should price emissions. So the methane fuel would be more effective than a profits tax.

But I also think that if you can't get an economy wide carbon price then go after sectoral prices. If you can get those, if you can get a methane fee then that's an improvement over not getting anything.

I'll just also note that at least in the U.S., it is true that the Fracking revolution for gas has really undercut coal production in the United States. But I think we're significantly overestimating the emission reduction from the switch from coal to gas because we're missing in the inventories a lot of methane emission leaks in the pipelines and in the fields and at the end of pipe as we've just seen with a recent Harvard study that indicated the amount of methane leaks in the Boston area is significantly higher than was previously thought.

So I think we want to be cautious to get to be too excited about this coal to gas switch without thinking about methane emissions.

MS. MATHESON: All right. And I just wanted to highlight Catherine's comment about our current tax breaks for the oil and gas industry, which she said are less effective at stimulating production. And they really are a subsidy to rent, to profits and rents rather than a subsidy to production.

So not only is the U.S. unusual in terms of not applying a higher tax rate to oil and -- to fossil fuel rents, but we actually tax them less than other countries. And it's not clear with climate change why we would want to be doing that.

Gil, I'm sorry, Gib. I was very interested by your idea of in tying the renewable energy production tax credit to the social cost of carbon. Could you expand on that a little bit and talk about how the current production tax credit which ranges from, I think 1.3 to 2.5 cents per kilowatt hour depending on energy source. How that relates to what you see as the current social cost of carbon?

MR. METCALF: So when you look at the initial law, it was 1.5 cents per kilowatt hour for wind and there's some variation in the rate, but let's just use that. Over time that has grown with inflation to be -- I think it's 2.6 cents per kilowatt hour now that wind gets and that's the biggest beneficiary of the production tax credit.

The problem is it -- the whole point of this is to sort of balance -- level of playing field between fossil fuels where we don't price the externality. So if we're not going to raise those prices, let's lower the price of the clean energy. Then you kind of like that production tax credit to be tied to the social cost of carbon.

So I did some calculations. So you want to think about what fuel is being driven out by wind and you can argue about the methodology but for a $50 per ton social cost of carbon. If we take roughly the U.S. official numbers that works out to be about 2.4 cents per kilowatt hour, so they actually are pretty close. But we know that the social cost of carbon is going up. And we know that there are lots of folks who think that the right number is more 100, 150 dollars which means we should be doubling or tripling the production tax credit.

And so, my view is let's tie them. Let's link them and that would be easy to do.

MS. MATHESON: And in terms of the investment tax credit which now ranges between 10 percent and 30 percent. You know, is that sufficient to deliver the kind of energy innovation that we're going to need to decarbonize at least the electricity sector? And what kind of reforms would you suggest there?

MR. METCALF: So I have a kind of a radical view on this because right now, you can either get the investment tax credit or the production tax credit. This started in 2009 with the American Recovery and Reinvestment Act.

My view is we have two market failures. We have an innovation failure, an R&D failure. And we have a pollution failure. And I think the innovation failure is really addressed by the investment tax credit. We need to bring these technologies to market. So let's use the investment tax credit for that. But because we have these two failures, let's let technologies take advantage of both of these credits, both the investment and the production tax credit where the PTC is really addressing the pollution problem.

Now, having said, I would say we should phase out the investment tax credit much more quickly for technologies that have sort of proven their success. I would say, for example, that Tesla has proven that we know how to produce electric vehicles. We know how to put solar modules on top of houses. So we could phase out the ITC more quickly as market penetration develops for certain technologies, but allow those firms to also -- but allow them to benefit from the production tax credit.

So I think there are ways you could -- I think that would be my approach to thinking about it.

MS. MATHESON: Thank you. I wanted to briefly address the issue of border carbon adjustments which have come up a couple of times in the course of our conversation.

Jurisdictions that are introducing significant carbon prices such as Canada and the EU are very concerned about the effect that that may have on the competitiveness of their domestic production and exports. So they are therefore designing border carbon adjustments or BCAs and these rebate carbon taxes and/or imposed tariffs on carbon intensive traded goods such as steel, cement, food.

So, Kurt, I wanted to address this to you initially. What are the pros and cons of BCAs as opposed to a global approach such as the Paris process itself that focuses on coordinated emission reductions across countries?

MR. VAN DENDER: Thanks for that question which is a very important one, but not a particularly easy one, unfortunately. Why is the European Union at this point proposing a border carbon adjustment?

Well, I mean part of the story is this very and increasingly uneven carbon crisis landscape, 60 years for some of the EU versus close to zero in the case of many of its trade partners. That poses a problem when that gap persists and then becomes ever larger.

The EU to date is aware of these leakages and competitive problems of course. And mainly, approaches them through free permits within the emission trading system. So instead of auction the permits companies can get free permits to the extent that they're exposed to trade risk.

Why not continue that approach? Well, first of all, I mean the main reason why they don't stick to free permits going forward is that as ambitions to cut emissions decrease, the main compliance method will be to reduce emissions and not to by permits. So giving away free permits becomes

increasingly ineffective in dealing with the cost effect on producers of imposing carbon prices.

So a shift from free permits to border carbon adjustments is envisaged. This has been an environment policy. If you look at that from a WTO perspective environment policy, this an environment policy so it has to be without carbon leakage. So the mechanism has to be designed to prevent or limit the risk of carbon leakage. Not so much to address competitiveness results. This means that there are no export rebates in that system as it is an environmental system.

What happens? This is triggering action. Some countries have extended Chinese type pay our interest in producing carbon tax or discussing them -- referring explicitly to the CBAN. Would an agreement on prices be better? Yes. But maybe a CBAN is a way to that end because clearly it is triggering debate. So that's the situation with the border carbon adjustments at this point being proposed a path to further dialogue on mitigation policies across countries.

MS. MATHESON: Thank you very much. We are almost out of time. If anybody has a very brief comment on BCAs, I wanted to offer that opportunity. Gib or Carole? Okay.

I guess I would just note also, we had a proposal here in the U.S. interestingly for a border carbon adjustment without a carbon price at which was rather problematic. And I would just note that the administrative complexities of border carbons are byzantine. So, you know, without a significant domestic carbon price probably not worth it, the hassle.

But anyway, that brings us to the end of our time. And I just wanted to thank all panel members and Catherine Wolfram and my cohost Sanjay Patnaik so much for what I think has been a really great dialogue on energy taxation leading up to this COP summit.

MR. PATNAIK: Thank you also from my side to everyone.

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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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