

THE HAMILTON PROJECT AT BROOKINGS
PAUL H. NITZE SCHOOL OF ADVANCED INTERNATIONAL STUDIES

THE ECONOMIC COSTS OF CLIMATE CHANGE
A HAMILTON PROJECT POLICY FORUM
FEATURING U.S. TREASURY SECRETARY JACOB J. LEW

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Introduction:

ROBERT E. RUBIN
Co-Chair, Council on Foreign Relations
Former U.S. Treasury Secretary

Keynote Remarks:

THE HONORABLE JACOB J. LEW
U.S. Treasury Secretary

Roundtable Discussion:

THE HONORABLE JACOB J. LEW
U.S. Treasury Secretary

ROBERT E. RUBIN
Co-Chair, Council on Foreign Relations
Former U.S. Treasury Secretary

MICHAEL GREENSTONE
The Milton Friedman Professor in Economics,
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P R O C E E D I N G S

MS. KEARNEY: Good afternoon. On behalf of the Hamilton Project, thank you for joining us this afternoon for a public discussion of the economic costs of climate change. It is our privilege today to host U.S. Treasury Secretary, Jacob J. Lew, who will give featured remarks on the challenge of climate change. These remarks will be followed by a roundtable discussion among Secretary Lew, former U.S. Treasury Secretary, Robert Rubin, and Professor of Economics at the University of Chicago, Michael Greenstone.

Before I turn the podium over to Secretary Rubin, I would like to give a very brief introduction to the Hamilton Project and our interest in this issue.

The Project, housed at the Brookings Institution, is named after Alexander Hamilton, the nation's first Treasury Secretary, who laid the foundation for the modern American economy. So it is fitting that today we welcome two U.S. Treasury

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Secretaries. The Project's vision and intent is to promote evidence-based policies that work to secure economic growth, shared prosperity, and economic security. Our goal is to foster innovative, nonpartisan ideas and ultimately to introduce new and effective policy actions into the national conversation.

We at the Project acknowledge that a defining feature of our nation's history is that succeeding generations of Americans have enjoyed standards of living higher than the generations that came before. But looking around us today, we see that America is failing to make critical investments in areas that would contribute to our nation's economic growth and security. Within this vision, we recognize climate change as posing real and present challenges to our nation's and indeed our globe's economic future.

Climate change is fundamentally about risks to our safety and our economy. We need serious policy conversations about what actions to take to address

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those risks. That is what we are focused on here this afternoon.

Again, thank you for joining us. I now invite Secretary Rubin to introduce our featured guest.

SECRETARY RUBIN: Thank you, Melissa. Let me apologize for starting a little bit late. I had to fly in from LaGuardia and if there's ever any doubt in your mind about our desperate need for infrastructure, take that flight. Now, a separate question is how we pay for it, but we'll leave that aside for the moment.

Our topic, obviously, is climate change. I'm just going to make two substantive comments and then ask Jack Lew and Michael Greenstone to join me.

One is I've gotten pretty involved in this, and the reason I've gotten pretty involved really is twofold. One, as I learned more about it, I began to realize that you have not only the most likely scenarios, which are pretty serious and in many cases severe overtime, but you also have the real possibility, I think unfortunately, maybe even a

fairly high probability, that what ultimately happens are consequences that are vast multiples of the base case and that the effects instead of just being severe -- I shouldn't say just being severe -- but in addition to being severe, in the long run become catastrophic. And I think we can expand on that a little bit in our conversation.

Secondly, I said to a friend of mine the other day who's a very well-known New York businessman that I had developed this intense concern about this. And he said, well, you know there are a lot of pressing issues and I think you're right, but we can deal with this some decades down the road. And I said no. The reason no is that -- and many of you may know this -- that a K-rate of greenhouse gases in the atmosphere is hundreds of years, and what we do today is going to affect us for hundreds of years. Greenhouse gas emissions in the atmosphere are cumulative, they're irreversible, and as a consequence, this is an issue that cannot wait and that has to be dealt with now. And as Hank Paulson

observed to me the other day -- and he's right about this -- if you look back over the last ten years and see the kinds of projections climate scientists have made, they'll periodically bring forward the times when they think their more severe -- and I think at least quite possibly catastrophic -- effects occur. So this is an issue of immense urgency, and it's an issue that we have to deal with now.

In that context, let me invite to the podium the Secretary of the Treasury, Jack Lew, and Michael Greenstone. No? I guess not. I'm going to uninvite Michael, and I will invite Jack.

Jack, as you know, is the Secretary of the Treasury and a distinguished Secretary of the Treasury. I will not, in accordance with the Hamilton Project practices, go into his résumé. It's in your materials someplace or other, but I will say just one thing. When Jack was in the Clinton Administration and head of OMB, he was a pleasure to deal with. He's immensely substantive, as you probably know, and also very sensitive to the politics of the issues that he

deals with. He knows Washington, and he also knew how to work with all of us Cabinet members as we dealt with our issues. And it's very seldom that you'll find a fellow Cabinet member say something nice about someone who's the head of OMB or CBO for that matter, Bob Reich, which is even worse.

So with that, I introduce the distinguished Secretary of the Treasury, Jack Lew.

SECRETARY LEW: Thanks, Bob, for that introduction and for your strong leadership on the important issue of combating climate change, and thank you to the Hamilton Project and Brookings for hosting this event.

This is an issue of great significance to our economy and to our nation's future. I want to talk today about the economic implications of a changing climate, but before I begin I'd like to say just a few words about the U.S. economy.

The U.S. economy emerged from the financial crisis that triggered a devastating recession, pushing our economy to the brink of a second Great Depression.

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Through effective policy responses and the resilience of the American people, our economy is now 6.6 percent larger than when the recession began in 2007. GDP increased at a 4.2 percent annual rate in the second quarter of this year, and our private sector has created 10 million new jobs over the past 54 months, the longest stretch of job growth in our nation's history. While more work remains, confidence in America's future is strong at home and internationally, something I saw over the last few days in Australia at the G-20 Finance Ministers meeting.

In addition to discussing the need to take decisive action to grow the global economy and create jobs, we discussed leveling the playing field on tax policy so that we would stop the erosion of the corporate tax base and avoid a race to the bottom in international tax policy. Later today I'll have more to say about our ongoing efforts to address a glaring loophole in the U.S. tax code - inversions -- an unfair practice in which corporations acquire foreign

businesses and then switch their citizenship outside the United States to avoid paying U.S. taxes.

In addition to our leadership on a host of global economic issues, the United States used the G-20 as a forum to drive progress on climate change policy. The need for action is clear. The world can either choose to ignore the challenge today and be forced to take more drastic action farther down the road at greater cost, or we can make sensible modest and gradual changes now and in the process create jobs, reduce business and household expenses, and drive innovation, technology, and new industries. This choice should also be clear.

As an economic matter, the cost of inaction or delay is far greater than the cost of action. Costs associated with extreme weather events like rising sea levels, drought, heat waves, wildfires, floods, and severe storms demonstrate the scope of economic exposure. The Council of Economic Advisors estimates that if warming above preindustrial levels increases to 3 degrees Celsius instead of 2, there

could be a 1 percent decrease in global output annually.

The economic cost of climate change is not limited to one sector of our economy. It threatens our agricultural productivity, our transportation infrastructure and power grids, and drives up the incidence of costly health care problems. We're facing historic levels of extreme weather from a range of conditions. Some parts of the country face extreme flooding and others face severe droughts. Our agricultural regions are threatened with some states facing a potential loss of up to 50 to 70 percent of average annual crop yields and livestock productivity is threatened as well.

Nowhere is the economic cost of climate change more clear than in the area of infrastructure, which is fundamental to our economy's productivity and competitiveness. The fact is our water and sewer systems, our power plants and power grids, and our roads and airports were not designed or built for the extreme climate conditions that we're facing now and

expect to face in coming decades. Super Storm Sandy in 2012 closed every tunnel and most bridges leading into New York City while a large part of the subway system below 34th Street, including all seven tunnels under the East River, was flooded by storm surges.

Increased health care costs associated with pollution and extreme heat are well documented. Very high temperatures, for example, threaten the health and safety of construction workers, farmers, and others who work outdoors, while putting entire industries like housing and agriculture at risk. Extreme heat will also lead to more heat-related illness. Dangerous air pollution creates the risk of similar negative consequences for the health and safety of Americans across the country.

On the other hand much less has been said about the impact of climate change on our nation's fiscal situation. When the federal government has to step in and do things like provide disaster relief, crop insurance, protection from wildfires, health care, taxpayers pay the cost. Already the National

Flood Insurance Program has had to borrow \$24 billion from the Treasury Department because of payouts resulting from Hurricanes Katrina, Rita, Wilma, and Sandy, all of which occurred over the past nine years.

If the fiscal burden from climate change continues to rise, it will create budgetary pressures that will force hard tradeoffs, larger deficits, or higher taxes. And these tradeoffs would make it more challenging to invest in growth, meet the needs of an aging population, and provide for our national defense. As former Secretary Rubin has said, whatever your public policy views, whether you care about our national debt and deficits, our tax rates, our government investing in everything from national security to job creation, you should care about the cost of coping with climate-related damage. In short, we must do all we can to limit this burden and to manage the fiscal risk.

President Obama understands what's at stake and after years of talk in Washington about facing up to the challenge of a changing climate, he's taking

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action by reducing carbon pollution, increasing energy efficiency, and investing in American energy, including natural gas, solar, and wind power. I know that some view combatting climate change is a choice between investing in our future and growing our economy in the near term, but that's a false choice. Making the right investments will make our economy stronger today, create tens of thousands of new jobs, and position the United States to lead the world in technologies and the industries of the future.

And we've already seen this work. Our new fuel economy standards will double the distance our cars will go on a gallon of gas by the middle of the next decade, and we've doubled the amount of renewable energy we produce. This means that our cars, trucks, and renewable technology will compete effectively in a world looking for energy efficiency, lower costs, and lower emissions. The fact of the matter is, over the past few years solar installations have increased by 500 percent and now every four minutes a home or business goes solar in the United States. At the same

time, with the President's Better Buildings Initiative, the energy efficiency of America's commercial buildings is improving. Making buildings more energy efficient creates jobs, lowers business costs, and reduces pollution. So far this initiative has led to \$300 million in energy savings for organizations and businesses.

To be sure, changing how we power our country is good economic policy. Today, the fastest growing source of electric generation is renewables, which already account for a fifth of generation globally. Indeed, renewables now produce as much electricity worldwide as gas and more than twice that from nuclear. In the coming years an expanding world will depend more and more on electricity and renewables are expected to be the fastest growing source to meet that increased demand. So the more we do at home to encourage low carbon energy generation, the better positioned our companies and workers will be to take advantage of these new business opportunities.

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To build on what we have accomplished as part of the administration's climate action plan, the President announced new rules this summer for existing power plants. These rules represent the most significant policy to arrest climate change that the United States has taken to date, and they'll help us cut carbon pollution and increase clean energy production. Though much remains to be done, these policies represent our nation's commitment to meeting the challenge of climate change head-on. And tomorrow the President will join more than 120 heads of state in New York to mobilize global action to address climate change because this is a global problem that requires collective action.

Global action is imperative and it's a good investment in global economic growth. First, making these changes is cost effective. Look at the new power plant rule that I just mentioned. This policy will reduce greenhouse gas emissions from power generation by 30 percent relative to 2005 levels. And meeting these standards will cost a fraction of the

benefits associated with increased efficiency at coal power plants and the greater use of renewables in natural gas. The health and climate benefits from producing more clean energy and reducing our use of dirty energy is expected to be worth between \$55 billion and \$93 billion in 2030.

Second, if we fail to make changes now, it will be much more costly to deal with the problem later and some options may be foreclosed entirely. The right approach going forward is to use market forces that balance the cost of reducing emissions with what the latest science tells us we need to do to keep temperature increases below dangerous levels. The alternative, allowing greenhouse gas emissions to reach increasingly dangerous levels, will require expensive and more difficult action later. In a recently released report, the Council of Economic Advisors found that for each decade of delay, the cost of hitting a given climate target goes up on average by approximately 40 percent. We must adopt a risk management approach to climate change. We must do

what we can to substantially lower the risk of the most catastrophic climate impacts and that means reducing emissions.

As former Secretary of the Treasury, Hank Paulson, wrote recently, there is a time for weighing evidence and there's a time for acting. And if there's one thing I've learned, it is to act before problems become too big to manage. The fact that Secretary Rubin and Secretary Paulson have taken leadership positions in making the case to address climate change underscores the economic urgency of action.

Let me close with two points. The first is that we cannot do this alone. We must work with the rest of the world to address this challenge. We must work with other industrialized economies so that everyone is cutting carbon pollution in a sustainable way. The G-20 last week discussed the importance of this issue and agreed to continue its work to study ways to effectively mobilize resources for climate finance. And we must work with developing countries,

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many of which are the fastest growing carbon emitters, so that as they grow they move to cleaner energy production. That's why Treasury has made the case to finance clean energy programs and substantially reduce support in the multilateral development banks for new coal projects. This step is helping to level the playing field for clean energy alternatives and supporting low-emission power generation worldwide. And we are actively working to secure the agreement of other countries and the multilateral development banks to adopt similar policies as soon as possible. We're also strong supporters of the Green Climate Fund, a multilateral fund created to help developing countries limit or reduce greenhouse gas emissions and adapt to the impacts of climate change.

Second, we must continue to seek the most efficient, market-oriented ways to reduce carbon pollution. Congressional action based on market-based approaches is the most efficient way to reduce emissions and transition to a cleaner economy.

With that let me say climate change is one

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of the most important challenges of our time. What we do in the next few months and years to address this challenge will determine our nation's future and if we take the right steps, we will leave the next generation with a stronger country, a better economy, and a brighter future.

Thank you and I look forward to the discussion.

SECRETARY RUBIN: Jack, thank you very much. Let me introduce Michael Greenstone now. Michael was the Director of the Hamilton Project at the same time he was a Professor at MIT. He is now the Milton Friedman something or other Professor at the University of Chicago and also head of some institute. What's that?

PROFESSOR GREENSTONE: Thank you, Bob!

(Laughter)

SECRETARY RUBIN: I thought that was a good introduction. In any event, let us start with sort of two related questions. Jack, I spent a fair bit of time over the last now more than a year, probably

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couple of years, talking about climate change. And almost everybody says to me that I run into either in the political world or the business world, yep, you know it's a problem. Now let's talk about something else. Do you get any greater sense of urgency than I'm -- people will acknowledge it's a problem, but they don't seem to be -- and they'll make all kinds of wonderful speeches. They've been going on all week this week in New York. I was at some this morning. In fact, I gave one myself, which I rather liked. But do you get a sense that this is going -- that people have finally gotten to the point where they recognize it has to be real?

And then once we get finished with that, I want to ask you one other thing and then ask Michael to sort of elaborate on the realness of this.

SECRETARY LEW: I think I'd say there's two pieces of evidence I can give you that it is being taken very seriously. One is the action we've taken in the administration.

SECRETARY RUBIN: President Obama's been
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terrific.

SECRETARY LEW: Yeah, it is a very substantial policy that we've put into effect. It is I think going to have a very serious impact both on power plants and on motor vehicles. And it is real policy. Frankly, I think the work that you and Hank Paulson and Michael Bloomberg and others have done on "Risky Business" brought together the business community and people who are looking at it from a kind of public-private perspective in a way that puts it higher on the radar for ongoing policy debate.

The question of whether or not legislation can be enacted is separate from whether or not the public is focused on it and whether or not we can take action to deal with it. I think meetings like the meetings in New York this week are very important because the commitments that we make internationally matter and the commitments that leaders make they take home. That's true in the United States and it's true around the world.

SECRETARY RUBIN: Jack, what do you say to
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the -- I know the argument that the Indians make and I guess the Chinese and many others is, you created this problem, now we're growing. So sure we're adding more than you are, but you've got to compensate us in some way or other or in some way make us good for doing what you want us to do given that you've really created the problem. What is our answer to that?

SECRETARY LEW: You know, I --

SECRETARY RUBIN: I may have misstated it slightly, but I think that's sort of the gist of it.

SECRETARY LEW: I think that one of the reasons that we are so much supportive of international climate fund instruments and direct bilateral support is that there are a lot of countries that will need help to take the measures that are both in their interest and in the global interest.

I think for the largest economies in the developing world, for an economy like India's and China's, there's more that they can do and there's more that they need to do. I think they don't fit into one easy single pattern. China, I think, is

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embracing the challenge of climate change and pollution in a different way than it did even a few years ago. There is a domestic demand because of the problems of smog and asthma and other health issues. It is an issue of internal debate, not just international debate.

I think we have to lead by taking action where we take burdens on ourselves and certainly our power plant rules reflect an important step in that direction. So I think there's not going to be a one-size-fits-all answer to how we deal with every country internationally, but there's no doubt that the fastest growing largest economies are going to be a very significant factor in addressing global emissions because that's where the emissions of the future will be coming from.

SECRETARY RUBIN: But don't they say to us - - it's my impression at least -- you want us to do something, but we expect to have you sort of fund it to some extent since you're the ones that created the problem and now we're trying to get what you've

already gotten, which is a more developed state?

SECRETARY LEW: Look, they are correct that they are at a different stage of development than we're at and they need to add more generating capacity, but that also creates an opportunity for them that we didn't have when we were at a similar point of development. We didn't have the renewable options when the United States was building its first generation of power plants. We have to go back and deal with a lot of existing facilities. If going forward we all deal with the challenge of putting new generating capacity in place that meets high standards, that would be a big help. And we're going back on existing power plants and saying we've got to make sure that our existing power plants do better.

So I think we're entering the international discussion with good bona fides, but it's going to be a hard discussion. We also have more natural gas resources than a lot of other countries do, so it's not a completely equal situation even in terms of going forward. I know that if countries like China

don't address this issue, in a few years it won't matter what we say. They will have domestic problems that are just beyond the current imagination. So they're going to have to deal with this and setting ambitious goals is the only way we're going to take on this challenge.

SECRETARY RUBIN: Thank you, Jack. Let me complete the introduction of Michael. He is the Milton Friedman Professor in Economics and a Director of the Energy Policy Institute at the University of Chicago. Right?

PROFESSOR GREENSTONE: Thank you, Bob.

SECRETARY RUBIN: Right, good. Michael, why don't you give us a little bit of a sense of the magnitude of the possible risks, not just the baseline, although the baseline is very important, but what might lie beyond that. What troubles you most about this issue?

PROFESSOR GREENSTONE: I think what troubles me most is although there's great scientific certainty -- there's a consensus among scientists that what's

happening is related to human activity -- there's a lot of uncertainty about the extent of the changes being unleashed by the greenhouse gas emissions.

So one key is -- to get very, very wonky -- in my view it all kind of turns on what they like to call parameter, which is how much temperature will change in exchange for doubling of CO2 in the atmosphere, and it's a really wide range. They put kind of the middle two-thirds of the probability somewhere between 3 and 8 degrees. If it was just 3 degrees Fahrenheit, that would be okay. I think it would change the way we live and it would pull some hardships.

But if we really ended up at the high end, I think that's where life as we understand it in the United States and lots of other countries becomes a lot more complicated. You could see huge parts of the United States be roughly uninhabitable outside during the summer. You would see large crop declines and tremendous demands for new energy. And that's to say nothing of the very painful discussion that we could

have of which parts of the United States are we going to build dams to protect and which parts are we going to let go? And so I think it's that risk of the really bad stuff that drives a lot of where the concern is.

SECRETARY RUBIN: Jack, you want to add to that?

SECRETARY LEW: I think I tried to cover it in my introduction where I said if the debate is how bad it's going to be, but we know it's going to be bad, that's enough of a case to act. The fact that there's no uncertainty about the direction and legitimate debate about exactly how bad it is, shouldn't be a reason not to act.

PROFESSOR GREENSTONE: Well, Secretaries, can I speak on one thing that I think there's not enough appreciation of -- sorry to interrupt, Bob -- this is payback for not getting my introduction right.

SECRETARY RUBIN: Okay. (Laughter)

PROFESSOR GREENSTONE: That's a line that people have that there's near consensus among the

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scientists. I think one thing that people don't fully appreciate is there's consensus among economists about what to do about it. And that ranges -- well, the name of my chair, the Milton Friedman -- it ranges all the way to Milton Friedman to fill in your favorite leftwing economist, maybe they write for the *New York Times*. (Laughter) There's a clear consensus about what to do and that is when you are engaged in an activity that is harming other people, that activity should be pricey. We shouldn't allow -- we shouldn't have a society where it's okay for me to go dump garbage in former Secretary Rubin's front yard.

SECRETARY RUBIN: As you look beyond that, Michael, what are the -- I heard somebody the other day, actually a well-known person. I won't use his name, but he's a very well-known figure in American technology who said he thinks there's a high probability -- I mean I'm saying what he said, I'm not -- that technologies will develop at some point that will pull this stuff, these emissions, out of the atmosphere and that we can kind of try to bridge our

way to that. On the other hand I've asked other people about that and they say that's a heck of a risk to take.

PROFESSOR GREENSTONE: I think the private sector's going to play an enormous role in fixing this problem, but that's conditional on one thing, which is them having the incentive to do it and that comes down to creating a market price for carbon emissions. Without it, you know I'm not a businessman, but without it, you just don't see companies engaging in expensive investments.

SECRETARY RUBIN: But I guess what struck me, Michael, that even with it, with all the incentives, you're taking a risk on something that nobody's yet figured out how to do. And if it doesn't happen, then you get into the world that we've been talking about.

Jack, when you speak to the Indians, I'm told -- I don't know if this is right or not -- that they're less receptive to moving forward than the Chinese, for example. What is their possible response

to the kinds of scenarios that we've all been discussing? I don't understand how anybody can look at this and not say we're all going to be engulfed by this.

SECRETARY LEW: I do think they're a bit farther behind. I don't think it's as much of a domestic issue in India as it is in China, but I think it's only a matter of time. And to wait until you can't breathe in India in cities is probably waiting too long. So it's a question of working on rules that don't interfere with the ability of a country like India to grow, and part of that is going to come down to how do you finance the investments in the future? To the extent that we have technology that's available to meet the electricity needs of a growing economy at an affordable cost, it will help a lot. They're not going to be able to not have more electricity, just like China's not going to be able to avoid growth in electricity. So the challenge is going to be to meet that load with new technologies and that's where I think we can work together, but I think it helps when

there's a domestic pressure for it. I see more of that in China than I do in India right now, and I think that explains some of the difference.

On the question that Michael's raising on market forces, we earlier in the administration made a proposal on a cap-and-trade kind of approach. It got through part of Congress, not through all of Congress. It would be a very good discussion to get back into with Congress on how to have market forces work to help shape this to a better solution. What I think we can't do is wait until Congress acts to take the steps that we can because what we're doing, while it's incremental, is very significant in terms of changing what U.S. emissions will be over the next decades.

SECRETARY RUBIN: Given that our political system seems to be somewhat less than perfectly functional, to say the least, if you take a look at what you've done, which as I said before, really President Obama's heroic in going forward on these actions. If you take that in its totality, what percent -- this is very rough guess kind of question --

- what percentage of the total response we're going to have to have does that constitute?

SECRETARY LEW: I'm better at the economics than I am at the science. I know on the auto side, doubling fuel economy kind of speaks for itself. I mean I'm seeing it in gasoline tax receipts already. I mean we're using less gasoline than we were expecting to and that's good in terms of emissions. The power plant rules will dramatically reduce emissions. I'm not sure what percentage of the problem it solves. Michael may have --

SECRETARY RUBIN: I think what I was driving at -- because I think the way you responded sort of clarified the question in my mind. If you take the CAFE standard changes and you take the coal plant changes, is that close to sufficient to address the U.S. piece of this problem?

SECRETARY LEW: It's sufficient to keep us on track towards meeting the commitments we've made in the international negotiations on climate policy. We'll have to do more to get to the next level. So it

certainly accomplishes a great deal. I don't think we can stop where we are. We're going to have to keep putting more policies into place, but it builds a foundation where -- there was a lot of skepticism that we could meet the commitments that we made at the last round of climate negotiations and because of the actions we've taken, we're on track. So this is not a problem that we're going to solve in one action, and I think what we have to do is take the steps that we can that are clear and concrete. And if we were able to have a debate on the broader policy that would require legislation, I think we could do more. But using the administrative authority we have, meeting the international commitments we've made, I think is a pretty substantial accomplishment.

We're not resting on our laurels. It's certainly sufficient for the President to go to the international community and say we're doing our part. And there were a lot of skeptics just a couple of years ago that we'd be in a position to do that.

PROFESSOR GREENSTONE: I wonder if I could
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step back in time, if we go back to previous iterations of greenhouse gas treaty efforts. Every single time the United States has had to show up and basically say hey guys, you guys should really do something and if you do it, we'll go back and we'll confer for a little while and we'll get back to you, and that was a tough position that existed in 2009 as well. I think Secretary Lew's exactly right. The commitment that was made in 2009 by the Obama Administration and now with these new rules will be met, which I think is a 17 percent reduction by 2020 relative to 2005. The longer term commitment of 83 percent reduction by 2050 will require a lot more effort.

But I think for the first time the United States can go to these international negotiations and say we have done something. And I think the noises that one hears out of China about a potential nationwide cap-and-trade for carbon in a Communist country -- which is asthma here, but in a Communist country it's okay -- starting in 2016, I think that's

partially a reflection of the efforts that the Obama Administration has made.

SECRETARY RUBIN: But if you take -- and I won't dwell on this, but I'm just curious -- if you look out over the decades as to what we have to do, what percentage of what we have to do we accomplished? Not an exact number. Is it more like 20 percent or 50 percent or 80 percent?

PROFESSOR GREENSTONE: You know the way I think about it is the problem has been for decades that the effective price on carbon, so that is the penalty for emitting CO2 in the atmosphere was zero basically around the world. You now have all these bright spots. You have the power plant rules. You have the state of California. You have the northeast states in the United States. You have China doing things. And it's a huge step to get the price above zero. Now, we have to get the effective price at a higher level to achieve the levels of reductions that are necessary, but it's an enormous step.

And back at that one thing, this is

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happening at the exact same time that -- it's the Golden Age of fossil fuels with respect to fracking. And so it is really an enormous accomplishment I think to make progress on CO2 emissions at the same time that that's happening.

SECRETARY RUBIN: What's going to happen in Paris next year, Jack?

SECRETARY LEW: You know there's going to be a lot of bilateral discussions between now and Paris. We're going to work very hard to get an agreement with both the developed and developing countries to set ambitious standards. I don't think going to Paris without progress on some of these bilateral discussions will be as useful, so even in November when the President's in China, this will be one of the topics that he and President Xi discuss. It will be on the agenda when we meet with India. I can't put a number out there. I mean we want the goal to be as ambitious as realistic and probably push a little beyond realistic. The challenge is going to be substantial because everyone is worried about

maintaining economic growth in their own country. So we're going to have to be in a position where we can demonstrate that dealing with climate change is compatible with economic growth. If it becomes a choice between economic growth and climate policy, it will be a much more difficult hurdle in Paris.

SECRETARY RUBIN: When you frame the question, Jack -- that strikes me as exactly right -- when you frame the question, do people in other countries look at the question as a tradeoff between growth now and climate change now, or do you look at it with a longer term perspective? If you look at it with a longer term perspective, it seems to me that if we don't deal with this, we're going to create havoc for our economy.

SECRETARY LEW: I think that's exactly the challenge. I mean I think we're experiencing now that it doesn't have to be a choice. That's I think perfectly apparent in our CAFE rules, in our fuel economy rules. I mean by taking a lot of the weight out of U.S. pickup trucks, we're going to sell more

U.S. pickup trucks. It's creating more jobs in the United States. It's completely consistent with growing jobs right now. At some level that can't be true in every product everywhere, but overall being more efficient should lead to more growth and more jobs even in the short term.

The fact that we are recovering and growing at different rates makes the challenge also more complicated. The need for short-term growth is an independent challenge of dealing with climate change in a lot of parts of the world.

SECRETARY RUBIN: That's a little bit of what I was driving at. When it's a question of a little bit of short-term versus long term, it's always difficult to get political systems to focus on the long-term goal.

SECRETARY LEW: It is, especially when there are short-term challenges where it seems that the long-term goal is inconsistent with the short-term objective. I mean we have been very much -- I just spent the weekend in Australia making the case again,

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making the argument that we need to worry about increasing demand in a good number of parts of the global economy. I actually think that's consistent with trying to make progress on climate change. Doing a little bit better on short-term growth will expand the likelihood of an openness to dealing with the long-term issues.

I don't think we can wait until everyone is feeling well in the short term all over the world to deal with climate change; otherwise, we'll have waited too long. So this is going to be a case of making the argument to do as much as we can as fast as we can and in different countries that will play out in a different way. I think for a country that is looking at being an exporter of technology in the future, they should want to be at the cutting edge of this, not the last adopters. They should want to be competing with us in solar and wind, and they should want to be able to reduce their demand for fuel, which is both a strategic risk for a lot of countries and an economic risk.

So I think we can make the case to overcome the short-term issues, but I think realistically the fact that there are a lot of parts of the world that are not experiencing the robust growth that they would like makes it more challenging.

SECRETARY RUBIN: I should know the answer to this, Jack, but I don't. In the administration's program and in your budget, are there resources being devoted to incentivizing research in this area in DARPA or NSF or whatever?

SECRETARY LEW: Yes. We have increased research both in the Department of Energy and we've used tax credits to create incentives for renewables. We have some more proposed than have been enacted, but we've seen a lot of them already put into effect. An interesting conversation at the G-20 over the weekend was what kind of expenditures should countries prioritize if they're interested in long-term growth? And everyone agreed it was research and development and education. There wasn't a voice at the table that didn't say this isn't how we create the greatest

economic potential for our future. And this is a double win if countries put it into an area where they reduce their need for both dirty and expensive fuel.

SECRETARY RUBIN: Michael, describe a little bit if you would the dynamics with the ice sheet, with methane gas, with the various specifics of what could become catastrophic impacts.

PROFESSOR GREENSTONE: Yes, so I think my high school science teacher will be slightly appalled that you're asking me to explain that, but as I understand it, a lot of what is going to happen turns on this thing they call the climate sensitivity parameter. And then the temperature increases we get -- depending on what that proves to be -- if it's higher than we expect, it could lead the ice sheets to melt more rapidly than we would expect. That will cause increases in sea level. It could also cause the Arctic permafrost to melt, which would have massive releases of methane, which would speed up -- would kind of have this reinforcing effect on the rate at which the climate is changing.

So those are really the draw we end up getting for the climate sensitivity parameter. A lot is at stake with that.

SECRETARY LEW: In the months after Super Storm Sandy, there was a kind of heightened awareness of how the impossible may not be so impossible. I mean the amount of New York City that was under water, if you'd made it up before Super Storm Sandy, people would have said you were exaggerating. But we experienced it and it's not that any of us are hoping for another natural disaster, but the pace of major storms, major floods, major droughts in the last decade has increased in an undeniable way. So it doesn't even have to get to the next level of extreme developments, which are highly credible if not certain, to know that we have to deal with this.

SECRETARY RUBIN: Let me ask you -- I think we have time for another question. Let me ask you this, Jack. I had the notion, but I don't know if the notion is right or not, that there just isn't -- and as I said before, you've done a terrific job and the

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President certainly has -- but there just isn't this sense of urgency that permeates our political system and our business.

Now, if we had a parallel GDP that took into account externalities and if in the fiscal projections that you as Director of OMB used to have to make, you had a separate set of projections that took into account potential climate effects. And if we had disclosure requirements with respect to business with regard to the effects that climate change could have on them, would all of that increase awareness and perhaps help motivate action?

SECRETARY LEW: Well, each of them in a different way would play a role. Let me start with the piece that I've had the most experience with, the budget piece.

By its nature, budget projections are backwards looking, so as we go through a decade of dramatic weather experiences there's more and more being built into the projections. And you see it in the size of the Disaster Relief Fund, which has grown

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dramatically over the last decade. I'm not sure that it encompasses every risk out there, but it is kind of catching up.

GDP, as you know better than I, is a complicated model that is imperfect, but does bring in both direct and indirect effects with a very high degree of utility. The projection that I referred to that the Council of Economic Advisors did that looks at the impact of a 3 versus a 2 degree Celsius increase in temperature on global GDP, reflects the indirect impact of climate through the GDP model. An econometrician might be able to figure out a way to do it more directly, but I think it's already being reflected in a way that makes the case and to some extent it's a question of recognizing that and dealing with it as opposed to the lack of transparency.

On the disclosure side, the basic standard of disclosure is materiality, and I think that the more investors make clear that they consider climate risks material, the more firms will have to under current rules and current law make these disclosures.

And our experience with special subject-specific requirements of the SEC has not been as successful as the general materiality standards. So while I will actually discuss with the Chairman of the SEC this idea and get a sense of their reaction to a separate standard, I think the challenge first and foremost is for investors to say they need to know more about the risks and then firms will have to make the disclosures under current law.

SECRETARY RUBIN: Yeah, I agree. I mean that is absolutely right. Maybe I'm being unduly concerned, but it just doesn't seem to me there's a sense of urgency in the world that I live in.

SECRETARY LEW: Well, I don't disagree about the sense of urgency. I do think the work that you and others did on "Risky Business" raised it for a period of time to a level where it was on the top of people's minds. I think we have to keep making -- it's not a lack of analysis or information, it's a question of repetition. At the risk of sounding like a pessimist, one has to say that this is serious and

we have to deal with it until it's dealt with.

Politically, I'm not sure that you want to wait until the public stands up and demands action because it will be too late when people are feeling it that personally. So it's going to be a measure of leadership to get to the solution before it's out of control.

SECRETARY RUBIN: Which you and the President have done. Yes, Michael?

PROFESSOR GREENSTONE: I just want to join in this conversation about how do you get people engaged on this question. And the GDP idea I think is an excellent idea and I think the corporate disclosure is also an excellent idea. And the challenge in all of that is how do you monetize it? How do you come up with a value for that? And actually there's a solution, which is that the U.S. government has an official social cost of carbon. It's the dollar value of the estimated damages from each extra ton of emissions in the atmosphere, and in principle that number could be applied widely. It could be used for

the GDP number. It could be used for corporate disclosure. It could be used by state public utility commissions who are trying to figure out what kind of plants to save. It could be used in the treatment of our natural resources in how we sell them. In principle that exercise you're suggesting is not difficult to do.

SECRETARY RUBIN: Jack, I am being threatened with being fired. You apparently have to go back to the White House. Anyway, thank you and you've been terrific. Thank you for joining us.

SECRETARY LEW: Thank you, Bob.

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