

Hudson Institute

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Environmental Policy in the 21st Century: The Future of the Kigali Amendment



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Environmental Policy in the 21st Century: The Future of the Kigali Amendment



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Editor-in-Chief, Forbes Magazine

Kenneth Weinstein *Speaker*

President and Chief Executive Officer, Hudson Institute

Chris DeMuth *Speaker*

Distinguished Fellow, Hudson Institute

David Banks *Speaker*

*Former Special Assistant to the President for Energy and the Environment,
National Economic Council**

Marc D'Iorio *Speaker*

*Director General, Industrial Sectors, Chemicals, and Waste at Environment and Climate
Change Canada*

Dr. James Hammitt *Speaker*

*Professor, Economics and Decision Sciences, and Director, Harvard Center for Risk Analysis,
Harvard University*

Jeff Holmstead *Speaker*

*Partner, Bracewell LLP, former Director, Office of Air and Radiation, EPA (2001–2005), former
Associate Counsel, President George H.W. Bush (1989–1993)*

Thomas J. Duesterberg *Moderator*

Senior Fellow, Hudson Institute

David Doniger *Speaker*

Senior Strategic Director, Climate and Clean Energy Program, National Resources Defense Council

Patrick Michaels *Speaker*

Director, Center for the Study of Science, Cato Institute

Paul Camuti *Speaker*

Chief Technology Officer, Ingersoll Rand Corporation

Stephen Yurek *Speaker*

President and CEO, Air-Conditioning, Heating, and Refrigeration Institute (AHRI)

**At the time of the conference, Mr. Banks was serving as Special Assistant to the President for
Energy and the Environment, National Economic Council.*

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Executive Summary

THOMAS J. DUESTERBERG, HUDSON INSTITUTE SENIOR FELLOW

Overview

On February 5, 2018, a group of environmental and energy experts as well as industry and government officials gathered at Hudson Institute for a conference addressing the Montreal Protocol. Formally the Montreal Protocol on Substances that Deplete the Ozone Layer, it is regarded as the model treaty for international cooperation on global environmental issues. The Montreal Protocol (formally, the Montreal Protocol on Substances that Deplete the Ozone Layer) is widely regarded as the model treaty for international cooperation on global environmental issues.

As Hudson Institute President Kenneth Weinstein remarked in his introduction, the treaty was negotiated for the United States by the Reagan Administration and approved by the U.S. Senate in 1987. Since then, it has been amended four times with the advice and consent of the Senate. In all, it has been ratified by 197 nations, including all United Nations member states.

Under the Montreal Protocol, many potent ozone-depleting chemicals have been phased out, and others are scheduled or proposed for phasing out in future years. While some dispute the treaty's effectiveness in improving the environment, the ozone layer has clearly stabilized and begun to recover since the treaty was implemented. A key to the treaty's success has been its provisions for making future adjustments. The most recent amendment to the Montreal Protocol is the Kigali Amendment, named after the capital city of Rwanda where it was agreed to at an international conference in 2016. The Kigali Amendment to the Montreal Protocol aims to phase out hydrofluorocarbons (HFCs), which have been used as an alternative to the ozone-depleting

chlorofluorocarbons (CFCs) the original Montreal Protocol phased out. HFCs are now used widely in refrigeration and air conditioning. The trouble is that HFCs turn out to be extremely potent greenhouse gases believed to affect global warming.

The Kigali Amendment raises several important questions, as Kenneth Weinstein observed in his introductory remarks at the conference. For example, is the amendment both low-cost and effective at reducing greenhouse gas emissions, as proponents argue? Is it as effective as other, more controversial, approaches to global warming? Can it be implemented by the U.S. without amending the Clean Air Act, if it is submitted by the Trump Administration and approved by the Senate? These and related issues were the subjects of a conference convened at the Hudson Institute on February 5, 2018. A full transcript of the proceedings, which consisted of a keynote address and two panels, follows this executive summary.

Steve Forbes Keynote Address

Steve Forbes, the editor-in-chief of *Forbes* magazine, gave the keynote address. He provided a full endorsement of the Kigali Amendment, and recommended that the Trump Administration support the amendment and submit it to the Senate for ratification. He argued that the amendment will please Americans on both the political left and right: "For the U.S., it is an opportunity to grow the economy and create jobs while doing something good for the planet." Forbes favors the regulatory approach, which avoids imposing top-down directives, and instead sets goals for reducing HFCs while allowing industry flexibility on how to achieve them. He reminded the audience that the Montreal

Protocol was a model of both bipartisan action and international collaboration, and he proposed that Kigali will offer the same level of cooperative effort. He also said that by setting a clear path for the transition to less harmful chemicals, the amendment gives industry the certainty it requires for major investments in new technology. Finally, he argued that U.S. industry has “first-mover advantage” in creating new technologies to replace existing HFC-based systems, giving America a competitive edge in a post-Kigali Amendment market.

Panel I: The Origin of the Kigali Amendment and Current Status of Ratification

After Forbes’ keynote address, the first panel discussed how the Kigali Amendment was established, legal questions pertaining to its ratification in the United States, the White House’s current thinking on it, and how it is perceived internationally.

Professor James Hammitt of Harvard University, an expert in cost-benefit analysis, noted that the “very long atmospheric lifetimes” of CFCs and HFCs, as well as their potent effect on the atmosphere, are the main reasons to address the problem without delay. He noted that the Montreal Protocol’s phase-out of CFCs set a good example for international cooperation and the effective use of regulation, as it allowed industry to find the most cost-effective ways to eliminate the relevant compounds, which resulted in good cooperation between industry and governments and led to economically efficient solutions. Hammitt also highlighted how Montreal set up a system of emissions trading credits, allowing low-emitting developing nations to trade credits to the developed countries who are the main producers and users of CFCs. This promoted cooperative efforts between developed and developing countries instead of acrimony and demands for expensive subsidies. According to Hammitt, Kigali promises to bring advantages similar to the original Montreal Protocol, and it already enjoys the support of industry and almost all nations.

Dave Banks, a member of the White House National Economic Council until March 2018, who was charged with overseeing international aspects of energy and environmental policy, provided a view into the White House’s thinking on Kigali. He stated at the outset that his own thinking on the issue is guided by the President’s stated number-one priority, namely, to “protect and enhance U.S. competitiveness, particularly in the manufacturing sector.” Banks said that he and his colleagues are studying ways to find the right balance between improving the environment and creating jobs and growth in the U.S. industrial sector. He noted that American firms are still leaders in the chemical and machinery technologies that are used in refrigeration equipment and are well-positioned to remain leaders if they must transition to new chemicals and to related equipment that does not rely on HFCs. He stated that the White House is still studying the legal issues surrounding the amendment, as well as the economics of moving to new technologies.

Jeff Holmstead, a partner at Bracewell LLP and the former Director of the Office of Air and Radiation at the Environmental Protection Agency (EPA), gave an overview of the legal status of the Kigali Amendment. The major question is whether the Senate will be required to amend the Clean Air Act to ratify the Kigali Amendment. He argued that no further legislation would be required if the Senate ratifies Kigali because Title VI of the Clean Air Act leaves room for amendments to the original Montreal Protocol. In the case of any adjustments to Montreal, such as the need to limit replacement chemicals or ban certain classes of chemicals, Title VI provides the necessary flexibility. Although a recent court case raised doubts that Kigali is compatible with the Clean Air Act since it specifically addresses the climate change impact of HFCs and not the ozone-depleting impacts, Holmstead nonetheless argues that both Title VI and the legislative history make clear that there will be no impediments to Kigali’s implementation. Holmstead

predicted that if the President backs the Kigali Amendment, it will easily pass in the Senate.

Marc D'Iorio, Director General of Industrial Sectors, Chemicals and Waste at Environment and Climate Change Canada, said that the Montreal Protocol was a model for international cooperation on global environmental issues for three reasons. First, the Protocol won widespread support when it was ratified. Second, it employed trading and regulatory tools, which allowed developing countries to benefit from and support the agreement. Third, because of its regulatory flexibility and stability, it had the full support of industry. He noted that Kigali has a regulatory structure similar to the Montreal Protocol: it allows for a gradual phase-out of HFCs over a prolonged period and thus gives both developing countries and industry confidence that major disruptions can be minimized. He concluded by reminding the audience that 20 countries, including Canada, have already ratified the agreement and that it goes into effect in 2019.

Panel II: Economic and Business Perspectives on the Kigali Amendment

The second panel covered the economic aspects of the amendment as well as questions about its potential effectiveness to ameliorate the environmental problems associated with HFCs.

Paul Camuti, the Chief Technology Officer of Ingersoll Rand, addressed the industry's efforts to find new technologies to replace the HFC systems. He said that what drives innovation and investments in the \$100 billion-per-year refrigeration market are: regulatory certainty, size of markets, and the potential of new technologies to raise living standards and achieve consumer acceptance in both developing and developed countries. He noted that since Kigali is already going into effect, the regulatory environment in much of the world is already set, whether the United States ratifies the amendment or not. By ratifying the amendment, U.S.

firms would be well-positioned to lead the world in developing new technologies and to assure that standards set by other countries would not disadvantage them. He said U.S. firms are already investing in the new systems and chemicals needed to achieve the Kigali targets, and that many of the new systems will be more energy efficient than the current generation. Such efficiencies are large enough to offset any higher costs for replacement chemicals for HFCs, and the cost of replacements will come down as markets grow and efficiencies of production are developed.

David Doniger, Senior Strategic Director of the Climate and Clean Energy Program at the National Resources Defense Council (NRDC), began by noting that cooperation between industry and the environmental community on the ozone issue has been exemplary for over 30 years and that the two are already working together to secure ratification of Kigali. When discussing the legal situation of the amendment, he observed that from the very beginning in the 1980s, it was recognized in Montreal and the Vienna Convention, that CFCs and "these classes of chemicals are not simply ozone depleting," but have "other health and environmental effects." Both Vienna and Montreal, and the Clean Air Act, he argued, give explicit authority "to attend to the side effects" of these chemicals. He agreed with Holmstead that no new legislative authority is required after the Kigali Amendment is ratified.

Patrick Michaels, Director of the Study of Science at the Cato Institute, argued that the environmental benefits of the Kigali Amendment are likely much more limited than official estimates predict. Most estimates on the Kigali Amendment's impact in reducing the warming effect of HFCs center around 0.5 degrees Celsius. Using a variety of models and comparing those outcomes to recorded temperature increases in the 20th and 21st centuries, Michaels concluded that a reduction closer to 0.16 degrees Celsius is more likely. He also questioned

whether the Montreal Protocol on ozone depletion even covers the impacts of greenhouse gases.

Stephen Yurek, President and CEO of the Air-Conditioning, Heating and Refrigeration Institute (AHRI), stated that industry is fully behind Kigali because it outlines a clear path to developing technologies to replace HFC-based systems, and that the regulatory structure allows industry adequate flexibility to achieve the most cost-effective and energy efficient solutions. Yurek emphasized the latter point, saying that the savings from more energy efficient systems would more than offset the higher costs of introducing new technologies, which in any case will be phased in over a

long period of time. He noted as well that, unlike the 2015 Paris Agreement, Kigali does not give undue subsidies or other advantages to developing countries such as China and India. He also emphasized that the amendment does not dictate technology solutions, but instead allows industry to innovate to find the best paths to phase out HFCs.

The discussion over how the United States should approach the Kigali Amendment will continue and intensify in the coming months. It is Hudson Institute's goal that the expert insights that were shared at the "Future of the Kigali Amendment" conference, which are memorialized in the following pages, will help inform a thoughtful debate.

Introductory Remarks

KENNETH WEINSTEIN, PRESIDENT AND CHIEF EXECUTIVE OFFICER, HUDSON INSTITUTE

Kenneth Weinstein: Good morning, I'm Ken Weinstein, President and CEO of Hudson. Hudson Institute is a think tank dedicated to U.S. international leadership and engagement for a secure, free and prosperous future

The Montreal Protocol, the full name is the Montreal Protocol on Substances that Deplete the Ozone Layer, is widely regarded as the gold-standard for international cooperation on global environmental issues.

It was negotiated for the United States by the Reagan Administration and approved by the U.S. Senate in 1987. Since then, it has been amended four times with Senate advice and consent. In all, it has been ratified by 197 nations, including all members of the United Nations.

Through the Montreal Protocol, many potent ozone-depleting chemicals have been phased out, and others are scheduled or proposed for phasing out in future years. While the environmental effects are not entirely free from controversy, the ozone layer has clearly stabilized and begun to recover, and the treaty has put in place mechanisms for pursuing further progress.

The most recent amendment to the Montreal Protocol is the Kigali Amendment, agreed to at the capital of Rwanda in 2016. This amendment aims to phase-out hydrofluorocarbons. HFCs are widely used in refrigeration and air conditioning, where they have replaced ozone-depleting chemicals that the Montreal Protocol phased out. The trouble is that HFCs turn out to be extremely potent greenhouse gasses.

The Kigali Amendment presents several new and important issues. Is it, as its proponents argue, a relatively low-cost means of reducing greenhouse gas emissions? Does it hold advantages over other, more controversial approaches



Hudson President Kenneth Weinstein provides introductory remarks at the conference.

to global warming? If submitted by the Trump administration and approved by the Senate, could it be implemented by the U.S. without amending the Clean Air Act? These and other related issues are the subjects of today's conference.

We're absolutely delighted to have representatives of the executive and legislative branch, the diplomatic corps, the media, the think tank world and industry here with us today, and we're especially grateful to the Air Conditioning Heating and Refrigeration Institute for their partnership and support.

ACHRI graciously supported this event knowing full well that we at Hudson are fully responsible for the intellectual content of the proceedings and have a diversity of views represented for and against this amendment.

We're pleased to have the input of the American industrial community to this important issue.

Our keynote speaker is literally someone who needs no introduction: Steve Forbes, the Chairman and editor-in-chief of Forbes, the venerable business magazine that recently feted its 100th anniversary. Forbes has grown significantly as a global brand and with new platforms under his leadership.

Though he's at heart a businessman, and a magazine mogul, Steve Forbes is a policy intellectual. Trustee of Heritage Foundation, former Board chair of Empower America and Americans for Hope, Growth and Opportunity someone who, throughout his career in public life, has boldly championed ideas that have challenged the direction of the debate here in the US.

He, most notably, twice ran for President of the United States in 1996 and 2000 to promote pro-growth economics via the flat tax and medical savings accounts. One of the key campaign platforms in both of his races was the need for the United States to

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maintain its economic leadership and its technological leadership in order to help free societies around the world. It is my great pleasure to welcome Steve Forbes to Hudson Institute.

Conference Transcript

STEVE FORBES KEYNOTE ADDRESS

Steve Forbes: It is good to be here at the Hudson Institute, which is out to promote the right ideas, get a very real discussion, which in too many institutions in America today, you don't get. Think tanks have been around for decades, but they've really flourished over recent years precisely because America is an open society where if one set of institutions are failing in their mission, others can fill the breach and get good discussion, good principals on research, and policy, and open discussion and debate. So thank you, Ken, and your colleagues. You are stepping in the breach. The universities can go and be intolerant, but in terms of moving progress forward, which is through knowledge, I think it was Tom Sowell and others have asked, "What is the difference between us today and people of the Stone Age?" Same human body, same planet, same resources, same appetites. The difference between them and us is, we know more; we have more knowledge. That is the difference, and knowledge comes from experimentation. Knowledge comes from—whether in the laboratory, the marketplace, debate—that's how you move things forward.

So even if you have great catastrophes, whether they're natural or war, as long as knowledge is not destroyed and as long you have an environment where knowledge can be created and preserved and created, we will move forward. You saw that after World War II: immense physical devastation, tens of millions of people killed, nuclear weapons used. People thought it would be a couple of generations before Europe and Japan could recover, yet with the U.S. security umbrella, within a handful of years—within a handful of years—Western Europe and Japan exceeded prewar levels of production. Why? Because knowledge was not destroyed. Knowledge could flourish and move forward in people who had the freedom to act on it.



Forbes editor-in-chief Steve Forbes gives the keynote address at Hudson Institute's conference.

So the question today is, should the U.S. ratify and implement the Kigali Amendment to the Montreal Protocol, which as Ken told you is—was promoted around the world in the 1980s vigorously by President Reagan, passed unanimously by the U.S. Senate, also had the enthusiastic support of Margaret Thatcher. Now, the answer to the question is, despite all the debate, the Kigali Amendment should be formally ratified and implemented by the United States. As Ken talked about and as all of you know, more than 30 years ago, nations recognized around the world the huge danger posed by ozone depletion, hence the 1986 Montreal Protocol, which addressed ozone-depleting chemicals, principally, CFCs—chlorofluorocarbons. In that sense, CFCs were like no-knock additives to gasoline. I mean, there—it was a great, great chemical, great things it did for products, but it had very undesirable side effects—i.e., we're going to all fry. And additives to gasoline—no knock, great performances for automobiles, but it turns out, it was pouring lead into the air, not a good thing.

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STEVE FORBES

One of the great achievements of the environmental movement was getting lead out of the air. So there are times when things that look like they're progress turn out to have more side effects that undo the good of the progress, and you have to change. So developed countries did so, phasing down CFCs, starting an era of innovation, and the danger has been sharply reduced. This is one of those rare things that government does that actually had some success. It happens occasionally. It's eliminated over 98 percent of ozone-depleting substances, putting us on the track to repair the ozone in the decades ahead, avoided millions of cases of skin cancer, tens of millions of cases of eye cataracts, prevented significant crop loss around the world, encouraged industrial innovations that have given us environmentally friendly technologies. Now, the problem with the hydrofluorocarbons—HFCs—is that while they did a good thing, they also have, as Ken indicated, greenhouse gas concentration effects. In other words, they contribute to global warming.

Now, whatever you think of global warming, this is a case where this is human-made. This is not from sunspots or volcanoes or whales or whatever. This is indisputably human-caused. Now, fortunately, by contrast, HFOs, many of them—hydrofluoroolefins—have a global warming potential that is utterly minuscule compared to what we are doing now. So the Kigali Amendment will reduce these HFCs enough to slow global warming. And I know this is controversial in terms of how you measure these things, but I've seen as high as 0.5 degrees Celsius by the end of this century. Now just think of that for a moment. The whole Paris accords, which would hugely devastate the U.S.

economy, give China and India a free pass to 2030, cost the global economy trillions of dollars, would have 0.5 Celsius maybe by the end of the century and do enormous damage. This could go up to 0.5 and do some good. I don't know what the debate's about. So it's simple. CFCs have had a nice effect on products but bad in terms of what it was doing to the ozone. HFCs helped us solve the problem. But it had its own side effects. So HFOs are the way to go. The Kigali Amendment to the Montreal Protocol is indeed, then, one of those rare environmental policies that almost offers something to everyone.

You know, Abraham Lincoln was besieged during the Civil War by office seekers and never could satisfy everyone. They lined up in those days. You just went to the White House always, and he couldn't satisfy all these job seekers, all of these favor seekers. And so when after the Gettysburg Address he came down with a mild version of smallpox—very mild, so it wasn't lethal—and he couldn't help remark to one of his aides, he says, "Now I have something I can give to everyone." And—but the Kigali Amendment—liberals can like it. Conservatives like it. Business people, environmentalists, politicians, all something for everyone, one of those rarities. For the U.S., it is an opportunity to grow our economy and create jobs while doing something good for the planet. Now, like the Montreal Protocol, the Kigali Amendment has been supported from the beginning by industry. This is not one of those top-down approaches to environmental issues driven by technocrats and ideologues. There's been a cooperative effort. It provides industry with the certainty it needs to continue its leadership in this manufacturing space. This is an innovative,

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technology-driven approach to environmental problems supported by the likes of sensible approaches.

This kind of approach is supported by environmentalists like Bjorn Lomborg. He's a Dane. He was the former director of the Danish government's Environmental Assessment Institute. He's achieved global, I think, fame, in some eyes, infamy, because he takes—in terms of environmental challenges, he takes a cost-effective, practical, result-oriented approach. So, for example, he opposed the Paris accords because it's going to do a lot of harm for a very dubious good—a miniscule good. You couldn't do a cost-benefit analysis. This was a bad deal. The president had it right on that one for you. Lomborg, who is no Trump fan, totally agreed with it.

So the key is innovation, as he and others point out, where they call it innovation, green innovation, since we're talking about the environment today. But you'd talk—go back to whale oil—depleting the whales of the world. Now, we didn't subsidize alternatives to whale oil. We had the technology, and it came in the form of kerosene—much more plentiful than whale oil, didn't kill the whales. And it went down in price over the years, became much more affordable. Horses—we all know what horses do. So we got automobiles—great. So you didn't have that problem. Manure problem—now we had environmental problems. So you've got a catalytic converter. Didn't subsidize—problem with subsidies is they keep

technology the same. And in terms of knowledge, you learn from failure what works and what doesn't work. When the government does things like they did in the previous administration, and you get these scandals, it was those failures, those multibillion, hundreds of millions, billions dollars of failure, these companies they set up with these subsidies is—as somebody said, the real crime is not the waste of money. It makes us stupid. We don't learn from these failures—the knowledge.

You take for example in the late '80s, early '90s, Apple came out with a product called the Newton. People who invented it had IQs that could boil water. But it failed in the marketplace. But a technology came along with it and created a company. Technology came through to provide the basis for the iPod, the iPad, and the iPhone—what you might call noble failure. So in the marketplace, you want the ability to learn, fail, and move ahead. So we've got catalytic converters. We forget today—famine not caused by politicians but caused by nature—real part of life in India and other parts of the world. Then came the Green Revolution—enormously increased yield crop outputs. No more famines in India, the first time ever. So technology is the key.

Now, the pluses are enormous. We have representatives of the industry here today. The heating, ventilation, air-conditioning, refrigeration industries together are immense. They employ 1.3 million people, have over \$80 billion in labor compensation, over a quarter trillion dollars of economic activity. And members of the Air-Conditioning, Heating, and Refrigeration Institute are here today—AHRI. This and—they encompass most of the industry. They point out that the industry has spent over \$2 billion on research since 2009, has committed \$5 billion of research by 2025. So this is a multibillion-dollar industry where the U.S. has first-mover advantage in delivering a new technology that meets a global demand. And by ratifying the Kigali Amendment, we'll stake our claim as the global leader in this emerging technology. As you know, developing countries are choosing now what generation—next-generation technologies to

select. We shouldn't lose this by default. So the growth potential is enormous. Since the Montreal Protocol was signed, certainly in this country, air-conditioning has more than doubled. But the real market is around the world. It's already gone from 20 billion to 70 billion. And as the world—the global economies—grow, and they will—what we've been through in the last decade was caused by policy, and those are beginning to be changed. The world economy will grow in the next few decades mightily. You get more middle class as demand is going to grow exponentially—far more than those crazy computer models can predict.

And by the way, on those computer models that made such a hash of the tax bill—those artificial constraints—I'll just say this, since I've already had my free bagel. I'll say this—is if the Congressional Budget Office really knew the future, they would not be working for the Congressional Budget Office. They'd be buying lottery tickets or buying stocks or speculating in commodities. They don't. You'll learn more from your daily horoscope. That's just an amendment—nothing to do with the Kigali Amendment.

So we have a golden opportunity here to compete in developing economies. Although the transition from ozone-depleting substances is, for the most part, complete in developed countries—only in the early stages in emerging economies. More than 80 percent of the transition away from ozone-depleting substances still has to occur in these developing economies. There's particular concern of ones that are going to become humongous polluters. There are already semi-humongous on a per capita basis that are going to become more so—China—but even on a gross basis, India.

So additionally, in the vision of the treaty—this is important—countries that are not signatories will be prevented from products containing HFCs—from selling HFCs into those countries, which means this: that we'll be artificially hurt in terms of an orderly transition—not a good thing to do. So this will clearly have an impact on U.S. manufacturers, who will not be able to make those orderly transitions. So, the

THIS IS A MULTIBILLION-DOLLAR INDUSTRY WHERE THE U.S. HAS FIRST-MOVER ADVANTAGE IN DELIVERING A NEW TECHNOLOGY THAT MEETS A GLOBAL DEMAND. AND BY RATIFYING THE KIGALI AMENDMENT, WE'LL STAKE OUR CLAIM AS THE GLOBAL LEADER IN THIS EMERGING TECHNOLOGY.

STEVE FORBES

amazing thing is, business is supportive of Senate ratification of the Kigali Amendment, since it establishes a schedule for both developed and developing countries. It's enforceable to begin an HFC phasedown and creates certainty for industry. So unlike Paris, which was the most lopsided thing ever invented, this is much more stable. So knowing what will be required for each region of the world over the next 30 years will enable the investment necessary to implement these new technologies.

The schedule under the amendment provides companies the time needed to adjust their designs to incorporate next-generation compounds and get them in the market in time for the transition. This is why this is a smart, win-win environmental policy. It supports human health, supports the environment, and supports industry. Fortunately, we have some administration members here. A few months ago, Judith Garber, official of the administration, said, "the U.S. believes the Kigali Amendment represents a pragmatic and balanced approach to phasing down the production and consumption of HFCs. And therefore, we support the goals and approach of the amendment." Now, not being an expert in chemistry, I can say this—the administration should be

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supportive and doing it from the rooftops. This is a way to show, in terms of the environment, if it makes sense, if it allows for innovation, allows for practicality—it is very supportive. If it's an idiot agreement like the Paris accords—not going to do it. We're taking the Bjorn Lomborg approach. We want a clean environment. Let's do it in a way that plays to our strengths rather than bureaucratic, top-down approaches that are costly and ineffective.

Just as an amendment on that one we all have, smartphones. We used to call them cellphones. Now they're handhelds—whatever you want to call them—smartphone devices. Thirty-five years ago, we got the first one. It could only do voice. First one cost—well, it was the size of a shoe box, weighed like a brick, had a 40-minute battery life. First one from Motorola was \$3,995. Now, if they had a cellphone department in government then that said everyone must have access to cellphones and did a top-down approach, today, they'd cost \$9,995, still weigh like a brick and still do only voice. And everyone would be wailing about the profiteering of these corporate capitalists—crony capitalists.

By having a free market today, many of these devices are virtually for free. Even Apple, which puts on new stuff, raising the price, you can get it for \$40 bucks a month. So it becomes more affordable to over 7 billion around the world, becomes ubiquitous. So we have to play to our technological strengths. So Kigali does show that we can move forward on a problem that was very real 30 years

ago and do something sensible about it. So let's move forward. Perfect? Nothing is perfect in the world.

You really know something about this. And then you can go to the next subject. But with that, in this imperfect world, this is about as good as it gets. We should move forward on Kigali, get it done and move forward. Thank you.

Audience Question: I agree with you 100 percent that the Kigali Amendment is a treaty requiring Senate approval. And I also agree with the free-market comments you have made 110 percent. So a two-part question: One, a previous administration did not submit Kigali for treaty at ratification because they didn't think they had the votes. So do you think you have the votes? Secondly, how is the Kigali Amendment not a regulatory form that's going to interfere with the free market? Without it, there would be competition between HFCs and HFOs. With it, HFCs have to go away.

Forbes: Well, first, on the Senate, when this was done in 2016, nothing was going to go through the Senate. And so the environment is very different today. And if the administration supports it, that will change the—which it already has, given what that statement made last fall would indicate—that they are supportive. So that would go a long ways, and I think Republicans want to show that they're not anti-environment. They agree with the goals of a better environment, higher standard of living, better quality of life. They just profoundly disagree with the top-down totalitarian, anti-science approach that has been taken by the previous administration. So in terms of a regulatory environment, you do need to have ground rules and some certainty, but it does not prevent somebody from the outside who can come up with something even better from breaking in. That's what a free society is about. Not that they are comparable, but I just want to make the point: in cities around the world, you had a real talk about regulation.

The cab industry was a very, very rigidly regulated cartel—didn't prevent Uber, Lyft and others from coming in and showing there are different and better ways to do it. So if you have a free economy, if somebody comes up with something

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STEVE FORBES

super-duper on the outside, it will be amended. And yeah, incumbents may try to fight it, but in a free society, they don't ultimately succeed. And right now, there are stories—just as an aside, there are stories about the evils that show us—when, in America, when you reach a big size, and government and pressure groups come after you, you know you've succeeded. That's a sign of success. You saw with Walmart: Early 1960s, tiny northwest Arkansas retailer, how can you compete with companies like Walmart—I mean, Kmart and others—Sears—50, 100 times your size? Well, Sam Walton recognized that by using these post-World War II—invention that came out of World War II, which was the mainframe computer, originally designed, by the way—originally designed to make it easier to calculate the trajectory of artillery shells—well, mainframes had many more applications than artillery shells. But Walton recognized that with specialized software and using this computing power, he could manage inventories better than the big people. He had that insight first with the inventories and then with the whole supply chain. So Walmart became the big guy and the big villain.

Now, today, the villains are—whether you call them FANGS—you know, you got Facebook. People don't like Facebook. Google—very discriminatory against conservatives in terms of content. So these giants now have some real issues to address. But—and I read a piece in—I think it was maybe the *Journal* or the *Post* or something—*New York Post*—the

good *Post*, make that clear—but about the need to break them up. Whenever a company or a group of companies start to get—or there's talk about the need for antitrust policy, you know they've reached their peak. IBM: government was going to break that up. Who knew, 15, 20 years later, it'd have one foot in the corporate graveyard, which it did in 1990? GM was once the big, evil company. Oh, break it up. Have Chevrolet go off as a separate company. Well, we saw what happened to GM. And on and on it goes.

And so, if you want to see what's going to undo the FANGs or whatever you want to call these big companies, high-tech companies, the stocks, at least until last week, kept going up and up—Amazon and others—is look at what is happening. Look at what is happening not to bitcoin, but to blockchain technology. It's about to go to a new generation, which'll have profound impacts in terms of—terms of security and in other—in terms of what can be done. And big companies, even one as nimble as Amazon, have a hard time doing a second act. Now, Microsoft today—big, strong company, but not the evil, take-over-the-world, crushing everybody—that it was in the 1990s when the government came after it. So, too, this technology's coming along in a way that's going to be profoundly disruptive to these companies today that seem to be doing everything—content creation, everything. They always, in a free market, will get upended in ways that we can barely see today. You see it time and time again.

You have to have faith in people, faith in entrepreneurs. To answer your question, it does not prevent these outsiders from coming up if they find a better way to do it. Eventually, it'll get adopted. There's people always looking to do things better, and we have a free environment. I can't emphasize this enough. When you have a free environment, they'll always be able to upend seemingly entrenched, government-beloved entities. With that, I see Ken about to come up with a polite hook, so I will get down and let the real show proceed. Thank you.

PANEL I: The Origin of the Kigali Amendment and Current Status of Ratification

Participants:

David Banks, Former Special Assistant to the President for Energy and the Environment, National Economic Council, The White House

Christopher DeMuth, Distinguished Fellow, Hudson Institute (moderator)

Marc D'Iorio, Director General, Industrial Sectors, Chemicals, and Waste at Environment and Climate Change Canada

James K. Hammitt, Professor of Economics and Decision Sciences and Director, Harvard Center for Risk Analysis, Harvard University

Jeffrey R. Holmstead, Bracewell LLP; former Assistant Administrator, Office of Air and Radiation, Environmental Protection Agency (2001–05)

Kenneth Weinstein: I now have the distinct pleasure of introducing my friend and mentor, Hudson Institute Distinguished Fellow Chris DeMuth, who's going to be moderating a panel of noted experts momentarily. Chris set the gold standard for think tank management as president of the American Enterprise Institute for a quarter century. Before heading AEI, Chris ran the deregulation task force at the Kennedy School of Government. And that pedigree notwithstanding was named to be executive director of the regulatory task force—the deregulation task force of the Reagan White House, and eventually became director of the Office of Information and Regulatory Affairs at OMB. Since joining Hudson six years ago, Chris has written widely on the need to end executive feedback and rollback—reverse the



Christopher DeMuth introduces panelists (from left to right) Marc D'Iorio, Jeffrey Holmstead, David Banks, and James Hammitt.

unaccountable administrative state by regulatory rollback and a return to accountable and constitutional governance. His work has deep resonance in the Trump administration and on Capitol Hill. And it's for those reasons and others that I'm delighted to welcome Chris to the podium.

Christopher DeMuth: Ken, thank you very much. The first of two panels is on the origin of the Kigali Amendment and the current status of ratification. And then our second panel on economic and business perspectives on the amendment will begin. Let me say a few words about each of our panelists in the order in which they will be speaking.

Jim Hammitt is professor of economics and decision sciences at the Harvard School of Public Health and director of the Harvard Center for Risk Analysis. His research applies quantitative methods to the management of environmental issues with important scientific uncertainties, such as global climate change and stratospheric ozone depletion. He is the author of more than 100 academic papers on these and related subjects

and has served on numerous government advisory committees and National Academies of Sciences panels.

Dave Banks is special assistant to President Trump for energy and the environment at the White House National Economic Council and National Security Council. During the George W. Bush administration, he served in senior positions at the State Department and at the White House Council on Environmental Quality on international environmental energy and climate change issues. In the years before joining the Trump administration, he was senior fellow at the Center for Strategic and International Studies and executive vice president of the American Council for Capital Formation. Jeff Holmstead is the senior attorney at the Bracewell law firm for energy, environmental, and climate-change matters. In the George H. W. administration, he was intimately involved in the drafting of the Clean Air Act amendments of 1990. In the W. Bush administration, he was head of EPA's Office of Air and Radiation in 2001 through 2005, where he fathered several important innovations in EPA's complex air pollution control programs. In my humble opinion, Jeff knows more about the Clean Air Act than any other living person.

Marc D'Iorio is director general of the industrial sectors, chemicals, and waste directorate at Environment and Climate Change Canada. A research scientist, he has been an adjunct professor at the University of Ottawa and at the Université de Montréal. Within the Canadian government, he has held a number of senior positions in environmental policy, energy policy, and geology and has been head of delegation and chief negotiator for the Montreal Protocol and other major international agreements. We begin with Professor Hammitt.

James Hammitt: Thank you. It's a pleasure to be here today. I might comment—one of the first things I did professionally, I was working at the RAND Corporation, and we were working for the Environmental Protection Agency, trying to estimate the costs and consequence of phasing out chlorofluorocarbons. These are some of the scientific

A FUNDAMENTAL POINT FROM A POLICY PERSPECTIVE IS BOTH CFCs, CHLOROFUOROCARBONS, AND HFCs, HYDROFLUOROCARBONS, HAVE VERY LONG ATMOSPHERIC LIFETIMES. SO ONCE THEY'RE IN THE ATMOSPHERE, THEY PERSIST FOR DECADES OR CENTURIES.

JAMES HAMMITT

workshops leading up to the Montreal Protocol. So I've been with this issue for a long time now. A little bit of background. A fundamental point from a policy perspective is both CFCs, chlorofluorocarbons, and HFCs, hydrofluorocarbons, have very long atmospheric lifetimes. So once they're in the atmosphere, they persist for decades or centuries, which means they're completely well-mixed in the atmosphere, which means it doesn't matter where they're released from on the earth, which country, it also means it doesn't matter very much when they're released. Five years, 10 years, earlier or later won't have a big effect, since they'll be up there for a century anyway.

Another point is both CFCs and HFCs and related compounds are classes of compounds that tend to have the same effect. They differ in their potency, either their ozone-depletion efficiency or their global warming potential, but that means it makes sense to think about managing these as classes of compounds. So you put a cap on all CFCs or some class of CFCs. And then industry can innovate and figure out which are the ones that are least costly to reduce the emissions of and reduce those emissions a lot and maintain the productive uses of the other compounds where it's more difficult to substitute away. So going back to the



James Hammitt discusses the environmental ramifications of ozone-depleting gases.

Montreal Protocol, the scientific history here is the key paper was published in 1974 by Mario Molina and Sherry Rowland, who identified that chlorofluorocarbons, because they're so chemically stable, would remain as they are until they reach the stratosphere, where they'd be broken down by intense ultraviolet radiation. And a consequence of that would be they would then catalyze the destruction of stratospheric ozone, increasing ultraviolet light penetration to the surface of the earth, causing more skin cancers, cataracts, a variety of ecosystem effects, potentially severe effects on the phytoplankton of the oceans, which are a food base for the marine ecosystems, and so forth. So once this news got out, there was a pretty quick consumer reaction. In the United States at the time, about half of the chlorofluorocarbon was used as propellants of aerosols like hairspray and other personal-care products. And that seemed kind of frivolous compared with this big environmental catastrophe.

So there's a big consumer reaction to shift away from aerosols, CFCs. It was easy to do. We could substitute pump sprays or other propellants. And that was effectively ratified later by the Environmental Protection Agency and other agencies imposing a ban on aerosol use. Canada, Norway, Sweden, and perhaps a few other countries also restricted aerosol use at the time. So we sort of thought we'd done a lot of good at that point. And then with

economic recession, chlorofluorocarbon use was stable or declining for a while. But then in the '80s, the economy started growing again, CFCs started growing again and science raised new concerns about how potent these chemicals were. So that led to ultimately the negotiation of the Montreal Protocol. Among other things, there was a strong growth in mobile air-conditioning in cars. Back in the '60s, very few cars had air-conditioning. By 1970, fewer than half of the new cars in the U.S. had air-conditioning. By 1980, it was up to 70 percent. And now it's probably essentially all new cars. One thing that was important is car chlorofluorocarbons were produced by only a handful of firms, about 20 in total at the time. So we don't know so much about what was going on in the Soviet Union and the former Soviet states. But setting that aside, there was one plant in India. But all the others were in the OECD countries, the U.S., Europe, and a few others—Japan. Another thing that was important was the firms that produced chlorofluorocarbons, like DuPont, Allied, and the like, CFCs were not their major profit center. They produced lots of other things.

They were maybe 2 percent of profits to DuPont. And it wasn't worth kind of bearing serious reputational consequences to fight against CFC regulation if it wasn't really that important. Also, they foresaw that by shifting the playing field, by regulating CFCs, that would give an opportunity for the sophisticated firms like DuPont to develop substitutes, to develop other ways to serve their consumer needs. So it might actually be more profitable for them to stop producing these low-markup bulk chemicals and shift to more competition and innovation. So Montreal Protocol, as Steve Forbes said, was passed and negotiated in 1987. And what it did was capped production and consumption of chlorofluorocarbons and some related compounds. Now notably, it didn't regulate emissions directly. So we only care about these chemicals once they're released to the atmosphere. So if they stay in a refrigeration system and never leak out, there would be no problem. But it would be much more difficult to

THE MONTREAL PROTOCOL WAS AN OPEN FRAMEWORK THAT ALLOWED COMPETITION TO IDENTIFY NEW SUBSTITUTES, DRIVE DOWN THE PRICE OF THESE NEW SUBSTITUTES, AND OFFER ALTERNATIVE TECHNOLOGIES. IT WAS A HUGE SUCCESS BECAUSE OF ITS SIMPLICITY.

JAMES HAMMITT

regulate emissions than to regulate production. And consumption was just production plus imports, minus exports. So it's also easy to monitor.

This was implemented in the U.S. through a cap-and-trade system where the producers and importers had permits to produce fixed quantities of CFCs that were tradable among the different compounds and tradable within firms. So Steve Forbes said, this is a way that allows industry and entrepreneurs to compete on technological development, finding better substitutes and the like. And this cap-and-trade system was the first major implementation of that idea in the U.S., paved the way for the 1990 Clean Air Act amendments that set up the sulfur dioxide trading program associated with electric utilities and the like. At the time, the U.S. produced about 30 percent of the CFCs. Other OECD countries produced about 56 percent, and the former Soviet Union and China produced the remaining 14 percent. So this is really a kind of first-world problem at the time. There's—in the Montreal Protocol, while there's lots of trading within the U.S. and within the European Union, there was not trading between the blocs, which could have been useful but

probably not so important given the similarity and cost of compliance between the two places.

So the Montreal Protocol was an open framework that allowed competition to identify new substitutes, drive down the price of these new substitutes, and offer alternative technologies. It was a huge success because of its simplicity of the rule setting these caps, it was easy to amend it over time, which happened—there were four subsequent amendments in pretty short order, reducing the allowable caps and expanding the set of compounds that were regulated. So it's really quite incredible that by 1996, worldwide production of chlorofluorocarbons was basically zero. So that's only 22 years after the '74 paper identifying the problem in the first place. So it's really quite incredible success.

Now the Kigali Amendment is somewhat similar, but I think there are a few differences that are relevant and challenging. As for CFCs, there are a modest number of producers. From some reports I saw, there are apparently six producers in the European Union, so it's—while there are many, many users of these chemicals, there are not so many producers, so it's easy to get a handle on production. Unlike the days of the Montreal Protocol, now the world is much flatter, the developing—formerly developing countries have developed a lot. They're much richer than they used to be. And it looks as if at present, the developing countries produce and consume more HFCs than the industrialized countries by a ratio of about 60 to 40 percent. And of course, we expect rapid growth in those countries, less rapid growth in the industrialized countries.

This suggests there could be greater benefits to allowing trade, at least in the form of tradable permits or something, between the different regions in the world. So I discovered a paper written this year by people at the Institute for Applied Systems Analysis, which is one of these very productive think tanks that's been mentioned. And that suggests that by 2040, 2050, the marginal cost of compliance with Kigali in OECD countries will be



David Banks, along with panelists Jeff Holmstead and James Hammitt, discuss the role of innovation in energy policy and the manufacturing sector.

something of—on the order of 100 euros per ton of CO₂ equivalent or maybe a little bit higher, whereas the cost in the developing countries will be more like 50 euros per ton of CO₂ equivalent. So it might make sense for, essentially, the rich countries to buy emission permits or to have tradable emission permits between the developing and the developed countries.

One final point to make here is that if what we care about is the global warming impact of these chemicals, there's the global warming effect from the release of the chemicals, but there's also the energy efficiency effect of the chemicals while they're in use. So for something like the fluid in an air-conditioning system or a refrigerator—if you had a high-global-warming-potential HFC that was much more energy efficient than a low-global-warming-potential alternative, it might be better on that to have the high HFC efficient fluid rather than the alternative. Let me point out, though, that a number of the alternatives that have been suggested are actually more energy-efficient than the HFC. So here we would get two benefits by substituting from the HFC to some alternative. So let me stop there. Thank you.

Demuth: Dave Banks.

David Banks: Oh, thank you. I'm going to sound like a political hack after you. It's good to be here. Lots of familiar, friendly faces. It's a small world—this Montreal Protocol. I've got some clear remarks. My domestic policy colleagues took a look at these. This is important to note. I want to make sure that everyone understands that, you know, so I'm half the coin in the energy environment space in the executive office. I do international, but—and then my domestic policy colleagues are certainly very much engaged in this issue. But let me thank the Hudson Institute for hosting this event. It's a really important issue, and it's something that we're going to have to figure out. And I'm honored to be part of this panel with such distinguished guests, even this guy Jeff Holmstead here. But as noted, I'm the president's special assistant for international energy and environment. In this job, my work is guided by perhaps the president's number one priority—protect and enhance U.S. competitiveness, particularly in the manufacturing sector.

The president wants to make sure that any international energy, any international environment agreement does not harm U.S. workers. That's why he rejected the Obama administration's Paris Pledge, which would have required onerous regulations across the American economy and would've certainly hit our manufacturing sector really hard. However, as he said multiple times, including in the Norwegian state visit, he's open to reengaging in the Paris Agreement if it's a fair deal that can be worked out—again, a deal that does not harm U.S. workers and manufacturing. And this is through the lens that our team is viewing Kigali. Our domestic policy colleagues are looking at other facts, and I'll get into that later. Let me cover briefly—I know that we talked a little bit about the history of the Montreal Protocol, really great points made. But I'd like to focus specifically on some of the U.S. participation angles in the Montreal Protocol because I think it's important. It gives us some context here, and then I'll share with you some thoughts on what is the administration's stance.

IT'S NOT ENOUGH TO IDENTIFY THE ENVIRONMENTAL PROBLEM. INNOVATION CREATES THE FACTS ON THE GROUND THAT ALLOW US TO MAKE POLITICAL PROGRESS. WE NEED THE CONFIDENCE THAT THIS NEW PATH WILL APPROPRIATELY BALANCE ECONOMIC GROWTH AND ENVIRONMENTAL CONCERNS. THIS, IN MY OPINION, IS WHAT IS LARGELY MISSING FROM THE CLIMATE DISCUSSION.

DAVID BANKS

Look, everyone here understands that the Montreal Protocol is a remarkable success story of international cooperation. That path has had its challenges, especially when we've had enormous commercial interests at stake. Keep in mind that maybe someone brought it up, but U.S. industry and industry in other parts of the world were, at first, strongly opposed to taking international action to end the production and consumption of CFCs. But then in the mid-'80s, U.S. industry achieved some remarkable breakthroughs in innovation. That, not surprisingly, brought about a shift in the U.S. negotiating position. And this is one of the key issues or key lessons that I draw from the protocol and from our experience. It's not enough to identify the environmental problem. Innovation creates the facts on the ground that allow us to make political progress. And then we need the confidence that this new path will appropriately balance economic growth and environmental concerns. This, in my opinion, is what is largely missing from the climate discussion.

But believe it or not, the biggest hurdle to the Montreal Protocol was in Europe—not to call out my European colleagues who are here—but whose industry questioned the science. European opposition flowed largely from the fact that their companies were not as competitive as U.S. companies. They knew that U.S. companies were leading the way in innovation, and they opposed enhancing the U.S.'s competitive advantage. Now today, environmental

and climate policy largely drives economic policy in Europe—or at least that's my perspective, I suppose. So it's no surprise that they support Kigali. But needless to say, the Trump administration has a different perspective on the climate agenda. Our companies, however—and again this is—it's important to note—still lead the way in innovation, especially when it comes to Montreal Protocol-related issues. And this again is what our foreign policy team's focused on. How much would Kigali ratification enhance U.S. competitiveness? What happens to our domestic manufacturing subsector if we don't ratify Kigali? Again, one of my responsibilities is to help ensure that U.S. companies are allowed to continue to lead in innovation and do not face discriminatory practices and international fora that unfairly disadvantage them. And that's again one of the most important issues as we think through the Kigali Amendment.

Now, if the president does decide to support Kigali—question there—but if he does, it will be largely because he wants to protect and create U.S. jobs and advance commercial interests—U.S. commercial interests. So needless to say, before we provide a recommendation to the president, we will need to have really, really good economic information. We're going to have to have a real command of it. We understand that there's broad industry support, but we really want to understand in a more concrete way a few things: how this benefits U.S. companies, how it preserves and creates U.S. jobs, and

how it can help the trade balance and foster exports to other countries. Oh, and we want to emphasize that—and I think Mr. Forbes brought this up—but Kigali must go to the Senate for advice and consent. If it is to move forward, is this consistent with the protocol and all four prior amendments? This administration is not going to circumvent the Congress. But first, again, we need to know the economic impacts. I don't want to sound too repetitive, but I can't stress how important that is.

Now let me say a little bit about the domestic policy folks and where they are. A key question for them is how the United States would implement the amendment. We don't join agreements that we cannot implement. Maybe that's done in other parts of the world but not here in America. And I understand, Jeff, you're going to talk a little bit about that, right? But as I think many of you know, part of EPA's rules on HFCs were vacated and remanded to the agency by the courts. And just a couple of weeks ago, the U.S. Court of Appeals declined to rehear the case. So our domestic colleagues are working to determine if available authorities exist. And I think some would say the court has rejected at least some of them—or it appears to have rejected—or if there is a need for additional legislative authority to implement Kigali. These are important questions that are valid concerns. And we, the foreign and domestic policy teams, are working closely together to figure out an approach to the amendment that is consistent with the president's priorities. Again, while the administration recognizes that Kigali enjoys broad industry support, we need to carefully think this through and do our best to ensure we understand the economic, the legal, political, the environmental aspects of the amendment. We're continuing to work on this. I expect NSC and NEC—National Security Council and National Economic Council—will be working closely with the inner agency, will be working closely with State, EPA, Commerce and other colleagues in the coming months to consider whether to move forward and if so, how would we go

about it? We, the foreign and domestic policy teams, obviously welcome all stakeholders to engage us during these deliberations. My thanks again for the invite. I appreciate the opportunity and look forward to any questions. Thank you.

DeMuth: Thank you very much, Dave.

(Applause)

Jeffrey Holmstead: Well, I'm delighted to be here, and I have the unenviable task of talking about some more obscure issues that may not be quite as interesting to policymakers. But I'm going to do my best to explain them in a way that I think should bring some reassurance to Dave and his colleagues at the White House. As he mentioned, any time the United States is negotiating or going to enter into an international environmental treaty, one of the big questions is whether the United States has authority under existing law to implement that or whether there will need to be additional legislation adopted by the Congress. There are some people, who are maybe not down in the details, assume that once the United States enters into a treaty, if ratified by the Senate, that becomes the law of the land. But that—even though it's the law of the land as a constitutional matter, until there is an implementation mechanism—there's no self-implementation in these international agreements. So there needs to be domestic authority. And if not, oftentimes, Congress will pass legislation that goes along with the ratification.

The Montreal Protocol is, I think, unique in this regard. Right now, the United States probably doesn't have authority to implement Kigali because it hasn't been ratified. But once it is ratified, there is a provision in the Clean Air Act that makes it very clear that the United States Environmental Protection Agency, under Title VI of the Clean Air Act, has authority to implement that amendment. You might think that this is a little strange that—and for those of us who are—who have thought a

lot about the constitutional separation of powers, and I know Chris has—it's a little odd that an international agreement can provide legal authority to EPA. But Congress determined in 1990 that that's the very mechanism they wanted to have. Now, I'm sure you've all been looking forward to having a lawyer read some statutory provisions to you. I'm not going to go on at great length, but I want to just read three snippets that I think are enormously important here. So as again, several of the panelists have mentioned, when Congress adopted the 1990 Clean Air Act amendments, it specifically adopted Title VI to implement the Montreal Protocol.

So Title VI was all about the Montreal Protocol. In that title, they defined the Montreal Protocol not just as what existed at that time, but also—and this is from the definition of Montreal Protocol—adjustments adopted by the parties thereto and amendments that have entered into force. So the definition of Montreal Protocol specifically incorporates future amendments. Now some people would say that's kind of a thin reed on which to hang your legal theory, but actually it's more specific than that because that's in the definitional section, and then in another section—and again I'm sure you're all going to want to write this down—Section 614B of the Clean Air Act specifically says that in the case of a conflict between any provision of Title VI and any provision of the Montreal Protocol, the more stringent provision shall govern. And then there's legislative history, and this is real legislative history. You know, Justice Scalia often complained about people cherry-picking statements in the Congressional Record from one or two people. There's actually official legislative history for the 1990 amendments. You may remember that that was discussed and negotiated for about a year and a half. And the final conference report says this about Section 6.14B. It says if—and so this is explaining the language that I just mentioned—in the case of a conflict between any provision of Title VI and any provision of the Montreal Protocol, the more stringent provision shall govern.

THE UNITED STATES PROBABLY DOESN'T HAVE AUTHORITY TO IMPLEMENT KIGALI BECAUSE IT HASN'T BEEN RATIFIED. BUT ONCE IT IS RATIFIED, THERE IS A PROVISION IN THE CLEAN AIR ACT THAT MAKES IT VERY CLEAR THAT THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY ... HAS AUTHORITY TO IMPLEMENT THAT AMENDMENT.

JEFFREY HOLMSTEAD

So this is what the conference report says. If the protocol is modified in the future to include new provisions that are more stringent than this legislation, such more stringent provisions will be controlling. There was an—I think an important court case, and I think one of our future panelists was involved in that court case. It was an NRDC v. EPA decision back in 2006, I believe. And I'm not going to go through the facts of that case, which are important, but it would take me a long time to do. But in essence, there had been an informal agreement among the parties to implement—to take certain actions. And it was a decision of all the Montreal Protocol parties, including the United States. The DC Circuit said that that was not U.S. law in essence because it hadn't been ratified formally by the United States. But in making that decision, they—and one of the things that they said was look, without sort of a formal process either for Congress to act or for the U.S. Senate to ratify something that had been submitted by the president, it would raise serious

**THE 2006 NRDC CASE MAKES IT
PRETTY CLEAR THAT ONCE THIS
AMENDMENT IS RATIFIED, EPA WILL
HAVE THIS AUTHORITY TO
IMPLEMENT THE PROVISIONS OF
THE AMENDMENT.**

JEFFREY HOLMSTEAD

constitutional concerns if an international body could create law in the United States. But it went on to say specifically that where the president has submitted an—submitted a treaty for ratification to the Senate and that has been ratified, then that overcomes those constitutional provisions.

So very specifically, the 2006 NRDC case makes it pretty clear that once this amendment is ratified, EPA will have this authority to implement the provisions of the amendment. So some people say to me, well, why is that important? I mean, you still have to go through the Senate, right? I mean, you still have to—in fact, you have to get a two-thirds vote of the Senate. The Senate's always harder to get legislation passed. Why is it important that you don't need implementing legislation? And that is when you submit something for ratification. It's an up or down vote. As much as I would like to amend the Clean Air Act—because I think there's some real problems that should be addressed by legislation—doing that is a Herculean task because of all of the other people who have their own ideas about the way the Clean Air Act should be amended. And the act really hasn't been amended in any meaningful way for many, many years. So that's why, as a political matter, it's important that what you need is an up or down vote. And I believe if the administration submits the

amendments for ratification, it will easily be ratified by the United States Senate. Thank you.

(Applause)

DeMuth: Marc, please.

Marc D'Iorio: Thank you. So the advantage of being the fourth speaker is you don't have to repeat everything else that's been said before, which is great.

And so I'm here to provide the voice from the Great White North. So first, the Montreal Protocol. I mean, it is a great success. It is the most successful environmental treaty, perhaps the most successful UN treaty, of any kind. And you have to wonder why that is. So to me there's three fundamental reasons. The first one is it has universal ratification. So everybody's in. The second one is that, in fact, there's a mechanism to help developing countries meet the targets. And that's important because then there's a way of achieving what we need to achieve. And you know, the World Health Organization has estimated, as was said before, that by 2010—and we're already avoiding a million new cases of skin cancer every year and about the equivalent number of cataracts. So really, as far as an outcome, it is great. And the third, and perhaps the most important reason is that industry was involved. And there was a need for innovation and it did result in innovation and economic growth in that particular area. So those are the three main factors that made the Montreal Protocol successful. A few months ago, in Montreal, we did celebrate the 30th anniversary of the protocol with the meeting of parties. And we had our former prime minister—Brian Mulroney was a conservative who made a speech on the Montreal Protocol. He said, he worked with Reagan and he worked with Thatcher. And they were all involved in the ratification.

So it wasn't—environment is not a partisan issue. It is an issue of mankind. So he made that point and it was interesting to see him side by side with a Liberal minister

talking about the environment and about the Montreal Protocol. So now moving to Kigali. Kigali does a few things. First, we're dealing with some of the unintended consequences of these substitutions as we go through reducing and eliminating ozone-depleting substances. And by doing so, then we use HFCs, which has some other consequences while it's not—it's been shown that it's not a major ozone-depleting substance in and of itself. Some people argue it does not at all. It does have global warming potential. So dealing with that, it made sense to do it through the Montreal Protocol. And it was done as well with the leadership of the U.S., Canada, Mexico, and a number of other nations in order to drive this. The Kigali amendments have been now ratified. Over twenty countries have deposited their instruments of ratification, so it will come into force the first of January 2019. In Canada, we ratified it last year.

And for us to ratify the agreement or the amendment, we needed to first get our own house in order, that is, change our regulations. So we changed the ozone-depleting and carbon regulations which controls import, export, and production. So we made those changes in our own sort of way. We start this by the end of 2019. We need to reduce by 10 percent the amount of HFCs we're using and—or the whole calculation, the whole balance. And then it's a reduction. So it's a phasedown, not a phaseout. So a phasedown of 85 percent by 2035. Our regulations are built in a certain way that they're not prescriptive in the substitution, but they have targets so it cannot have—it has a limit per category of product on the global warming potential, and it can be ozone depleting. And that's the way the regulations are built. So those are the few comments I must make about the way we've gone about things in Canada. We're strong proponents of the amendment and of its ratification. And our own house is in order, which expect the regulations as we're going to bring forward. Now, thank you.

(Applause)

DeMuth: Marc, thank you very much. I'm going to begin by asking members of the panel if they have any questions for others, if they want to amend their remarks in consequence of what they heard other people say.

Banks: Amend my remarks.

(Laughter)

Demuth: Jeff.

D'Iorio: No, I can just say that I'm glad that we're not the only ones who have always challenged and looking at regulation, who has the authority to amend treaties. And it is a question that came up with respect to the federal cabinet and who has the right to do what within that framework. But our treaty amendments do go through the federal cabinets.

DeMuth: Yes.

Holmstead: But I was kind of hoping that Dave would say after my brief talk, the United States government was convinced that they have authority to implement my...

DeMuth: Yes. No.

Banks: So I know my lane.

Demuth: (Laughter) You know your lane.

Banks: I do foreign policy.

DeMuth: (Laughter) I have one question. The Montreal Protocol has a mechanism in it—I think it operates through the United Nations, I'm a little fuzzy on this—where essentially developing countries are making contributions that are transferred to—excuse me—developed countries to developing countries. There are some transfer mechanisms. How important is that for Kigali? And wouldn't a trading mechanism that was international—such as Jim described—wouldn't that substitute for that in some sense?

Hammitt: I'll comment. There is a lot of technical assistance and financial assistance through the Montreal Protocol. And some of it flows through GEM, which is—I forget—something—

Banks: Global environmental...

Holmstead: Multilateral fund and the...

Hammitt: Right. Right. Thank you. Which comes out of the Framework Convention on Climate Change. So in addition to kind of the country-level caps that were implemented within the U.S. through this tradable permit system, there are a lot of product-specific regulations, guidance on best practices, training. There's a technical assessment panel and a lot of explicit aid by the U.S. government and other parties, both to U.S. industry and to developing countries. But in principle, as you suggest, if we had a global tradable permit system, and if, in fact, it's true the production consumption could be reduced at lower cost in developing countries than industrialized countries, then the industrialized countries could buy permits from the developing countries. And that would create this financial flow you're suggesting.

DeMuth: We're going to turn to questions and comments from the audience. I will call on you. Please wait until the microphone has come your way. And it would be nice if you would introduce yourself before asking your question, which is a statement that ends with a question mark. Yes, sir?

Audience Question: I have a problem with something called the rule of law. And the instrument we're talking about is the Montreal Protocol on ozone-depleting substances. HFCs are not an ozone-depleting substance. They are a radiatively active trace gas, but it is not the protocol on ozone-depleting substances and radiatively active trace gases. By the logic that I'm hearing here, and I hope I'm hearing it wrong, I don't understand why there could not be an amendment to the Montreal Protocol on, say, PM 2.5, particulate matter, very small particulate matter because that's a radiatively active substance also. I'm kind of wondering if there isn't a little bit

of fear that someone is withstanding—and I don't know who that would be—is going to enter into a proceeding and saying, whoa, this is about ozone-depleting substances and these aren't. And I'm sure that all the very, very bright people, much smarter than I am in this room, have figured this out. So if you guys can answer this for me, I'd like to know. That's a question, not a statement.

DeMuth: Yes, very good. Thank you. Thank you very much. I think I'll ask Jim and Jeff both now on this.

Hammitt: So my initial reaction was like yours. I was surprised by this. But if you look at the Montreal Protocol, the initial text, which I won't quote exactly, says basically being mindful of concerns about stratospheric ozone and being mindful of other consequences to the stratosphere. We the parties convene to do this. But I think Jeff probably knows it better than I.

Holmstead: So here's my answer. And I think we could come up with outrageous hypotheticals, but the idea you're going to get not only the hundred and whatever it is—90-some parties to the Montreal Protocol and the United States president and 66 votes in the Senate to do something crazy, it just seems—so as a practical matter, I'm not sure your concern is a legitimate concern. Now, you've been around longer than me. We've both seen how the regulatory state has sort of advanced over the years. But as a practical matter, I just don't see how that would ever happen. And I think that's one of the reasons why the court in the NRDC case made it clear that just an agreement among the parties that had not been submitted by the president, ratified by the U.S. Senate would not trigger this authority under the act.

The other thing I would say is I initially had a similar concern. Look at Title VI, we all know it's about ozone-depleting substances, but that's not what the statutory language says. And so if you believe in the rule of law, it's pretty hard to argue. You may think that was a bad decision by Congress and the president. And we all think that there's

IF THE PRESIDENT STOOD UP AND SAID THIS IS GOOD FOR U.S. MANUFACTURING, THIS IS GOOD FOR U.S. TRADE, I THINK FOR THE VERY REASONS THAT DAVE IS TALKING ABOUT, I THINK YOU'D HAVE THE REPUBLICANS.

JEFFREY HOLMSTEAD

been some of those. But in terms of rule of law and constitutional issues, I don't think they are—I just don't think they exist here because that was a very explicit decision that was made by the Congress and the president who signed the 1990 Clean Air Act amendments. And that authority is pretty clear in the '90 amendments. And it's not limited to ozone-depleting substances.

Hammit: One quick remark. And maybe I should have said that the HFCs are a consequence of regulations dealing with ozone-depleting substances. So it makes a lot of conceptual sense to say, if we're going to worry about ozone depletion, we ought to worry about all the consequences of the things we do to reduce those depletions. It's not illogical that treating adverse side effects of the Montreal Protocol within the protocol would be a good way to do it.

DeMuth: Thank you very much. I'm going to this woman in the back, please. Yes?

Audience Question: Mr. Banks, would you be able to give us some kind of timing on when you expect to advise the president on when—when you expect to give the president any recommendations on the Kigali Amendment and when you expect the White House would send it to the Senate for ratification? Thank you.

Banks: Thank you. That's a good question. Look. I think that we have a lot more work to do. I mean, we need to figure out—and again, I talked about this a number of times in the—you know, up there. But we need a better understanding of the economic analysis, right? What's the

impact on our manufacturing subsector if we ratify versus if we don't ratify? So we're going to—the president, and by the way, just back to Patrick's earlier question. So I've certainly—there are certainly those concerns, right, that are expressed, regulatory overreach, etc. The president is not ideological on these issues. The president—and I've told folks, No. 1, No. 2, No. 3, No. 4, No. 5, those top five priorities—trade, manufacturing, trade, manufacturing, trade, manufacturing—and I think all of us know that—but we have to have a better understanding of the economics of this issue before we can move forward with any type of recommendation. No? No timeline.

Audience Question: Mr. Holmstead, question for you. I think if we were to poll the Senate now on Kigali, the major answer would be, huh? So why are you so confident that an up-or-down vote would pass?

Holmstead: So a couple of reasons. The president has a lot of influence with 51 senators, at least. And if the president stood up and said this is good for U.S. manufacturing, this is good for U.S. trade, I think for the very reasons that Dave is talking about, I think you'd have the Republicans. The other thing is, all of us have been in Washington long enough to know that the business community has a fair amount of clout. And based on what I have seen, the vast majority of the U.S. business community supports this. And oh, by the way, you happen to have environmental groups who support it as well. And so I think given this unusual confluence of events, I think it really is essentially up to the administration to decide because if they believe that—if they submit it for

ratification, I am very confident that it would get ratified. Although I agree with you. If you polled senators right now and said, Do you support ratification of the Kigali Amendment to the Montreal Protocol? You'd get a lot of blank stares.

Audience Question: Mr. Banks, we heard that the DC District Court has thrown out the appeal. I think a comment that they made in throwing out the appeal may be useful. The industry interveners are rent seekers trying to use the government to foreclose their competitors' products. The word crony comes to mind. HFOs are now \$70 a pound versus \$4 a pound for HCFCs. That raises the price of a car a hundred bucks, raises the price of

fixing your air conditioner in your car a hundred bucks. So the question is, do you see President Trump in front of his base making a speech saying I approved this on the thin thread of Title VI that's never been tested and we're going to raise your price of your car?

Banks: I don't see him saying it that way. But to your point, you do raise a really important issue. And I should have probably included that in my list of things that we have to understand on the economics side. We do have to—we have to have a really good or firm grasp on the—regarding the impacts on consumers, right? No question about that.

PANEL II: Economic and Business Perspectives on the Kigali Amendment

Participants:

David Doniger, Senior Strategic Director, Climate and Clean Energy Program, National Resources Defense Council

Patrick J. Michaels, Director, Center for the Study of Science, CATO Institute

Stephen R. Yurek, President and CEO, Air-Conditioning, Heating, and Refrigeration Institute (AHRI)

Paul A. Camuti, Chief Technology Officer, Ingersoll Rand Corporation

Thomas J. Duesterberg, Senior Fellow, Hudson Institute (Moderator)



Hudson Institute president Kenneth Weinstein addresses the audience, along with panelists (left to right) Paul Camuti, David Doniger, Thomas Duesterberg, Patrick Michaels, and Stephen Yurek.

Thomas Duesterberg: Welcome back, ladies and gentlemen. I'm Tom Duesterberg. I'm a senior fellow here at the Hudson Institute, working on various economic issues. We're pleased to have some very knowledgeable, distinguished guests for our second panel here. What we're going to do is I'll introduce each of them in turn. We're going in alphabetical order. They'll have up to 10 minutes to give some opening remarks. Then we'll have plenty of time for questions, and I encourage you to have questions. We were a little light on the first panel. But there are some very interesting issues here. It's a very important topic, so be creative.

So let me just introduce in order our panelists. First, to my right is Paul Camuti. He is the senior vice president, innovation and chief technology officer for Ingersoll Rand, one of the great American manufacturing companies. He oversees the full spectrum of innovation, technology, and

growth initiatives within the company, including advanced technology's products system and solution design, engineering and product service, and sales commercialization. He's also responsible for cultivating key alliances with external constituents to enrich the advanced technology and innovation capabilities of the business. Paul joined Ingersoll 10 or 12 years ago after a distinguished career in Siemens Corporation. He has degrees in engineering from Lehigh and completed the Siemens Advanced Management Program at the Fuqua School at Duke.

To my immediate right is Dave Doniger, the senior strategic director of the Climate and Clean Energy Program, National Resources Defense Council. Dave has been at the forefront of the battle against air pollution and global climate change since he joined NRDC in 1978. He was one who helped formulate the Montreal Protocol as

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OF REFRIGERANTS.**

PAUL CAMUTI

well as several essential amendments to the Clean Air Act. In 1993, he left NRDC to join the White House Council on Environmental Quality, followed by some key postings at the U.S. Environmental Protection Agency. He rejoined NRDC in 2001.

To my immediate left is Pat Michaels, the director for the Center for the Study of Science at the CATO Institute. Pat is the past president of the American Association of State Climatologists and was program chair for the Committee on Applied Climatology of the American Meteorological Society. He was research professor in environmental sciences at the University of Virginia for 30 years. He was a contributing author and a reviewer of the UN Intergovernmental Panel on Climate Change. He's written widely over the course of the years. He's author and editor of six books on climate and its impact and was an author of The Climate Paper of the Year awarded by the Association of American Geographers in 2004. He was educated in biological sciences from the University of Chicago and then received a PhD in ecological climatology from the University of Wisconsin, Madison.

Finally, to the far left is Steve Yurek, the chief executive officer and president of the Air-Conditioning, Heating, and Refrigeration Institute. He joined AHRI in 2002 as vice president of policy and public affairs and general counsel, then was promoted in 2006 to vice president of business development and public affairs. Steve has degrees in—bachelor of science in chemistry and a JD degree.

So I want to invite Paul to start things off. You can feel free just to speak from your chair or to use the podium as you are comfortable.

Paul Camuti: So it's—I really appreciate the opportunity actually to talk today. I feel a little bit like a duck out of water. You know, I work for a company—we make a lot of stuff. And I think it's really important to kind of get the perspective from the manufacturers on this issue. The earlier panel talking about competitiveness and economic opportunity—I think really, are the points that all want to make. Just by way of introduction, Ingersoll Rand, about a \$14-billion-a-year global company. We have about 20,000-plus employees here in the United States. At Ingersoll Rand, we generally are making 99 percent of the equipment that we sell in North America here in the United States, and we operate factories in about a dozen states around the country. And we've been adding to those jobs over the last several years. About 60 percent of our business is derived from the application of refrigerants—whether that's in transport refrigeration or in residential or commercial air-conditioning. And so this topic of refrigerants and the regulatory environment around it is really important to the company.

As I was doing some research on this, I'm trying to figure out the person to blame that we're having this conversation. It actually goes back to 1805. An American inventor, Oliver Evans, invented the vapor compression cycle. And since really that time of that invention, the folks that are kind of the innovators in our company and a lot of the companies in this industry have really been balancing a number of different performance elements around

refrigerants and these systems. And it starts with performance or energy efficiency, a very important aspect of what we do, safety, which comes up in toxicity or flammability of the chemicals that we use, the environmental aspects, which is really the focus of what we're talking about today and, obviously, the costs of those things. So if you look historically back to that invention of vapor compression cycles, its application into refrigeration and air-conditioning, that the industry and the innovation have really been driven by balancing what I would argue is this multivariable equation. And you can look back and see that there's been various waves of innovation around the refrigerants, which are an important but not dominant factor in the economics of the system overall, and that as things have changed or knowledge has been gained, we've moved from a series of refrigerants, and the one that we've been talking about with the Montreal Protocol is really the orderly phasedown of CFCs in this equipment.

And what's been really important to the industry overall is that there's been certainty around that, and it helps us to drive global scale the innovation that we do. The second thing that I think's important as you just talk generally about the issue is the size of this industry. So we're talking \$100 billion-plus of equipment delivered to the market every year on a global basis, and generally driven by demographic change. So as you know, we have more and more people, more and more people who are raising their living standards—they're demanding comfortable environments, they're demanding security and reliability of their cold chain for delivering foods and pharmaceuticals. And you know, it's quickly evolved from being sort of a multinational game to a really global game. And so our competitors today are global companies—the largest HVAC companies, in fact, are not based here in the United States. But arguably, the companies that are based here in the U.S. with their supply chains are leading the technical innovation in these industries. And it's really working together, balancing this equation that I referenced that really gives us the competitive advantage.

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PAUL CAMUTI

The topic of whether HFCs were going to be banned or not—and it's not really a new conversation, it's not—I don't think with regard to Kigali that we're actually having a conversation as to whether or not there's going to be a move afoot in the global environment to phase out the use of HFCs. That ship, so to speak, has already left the port. And we are now working at various rates around the world in order to be able to adapt our technologies and, in fact, have solutions in the market today that are lower-global-warming-potential solutions, that are not ozone depleting, that are safe, that are reliable and that meet performance and cost targets of our customers' requirements. So in a lot of cases, you can replace our current products with the next generation of refrigerants and get economic benefit from their application today.

The question really for me comes down to, where is the United States going to fall on this conversation? So whether it's ratifying Kigali or as what was described earlier today, putting some certainty around the orderly phaseout of HFCs—that provides certainty for the U.S. manufacturers and it's, in fact, something that we should do in short order because as I had already pointed out, we have the solutions today. It's a question to whether or not we're going to start driving them on the performance curve and the scaling of these solutions because with any change in technology, as more and more volume aggregates to these new solutions, the costs of those solutions come down over time. And so clearly, you'll hear



David Doniger addresses the policy implications of environmental protection and regulatory reform, with panelists Paul Camuti and Thomas Duesterberg.

from others that industry is supportive of this. There's sort of unanimous consensus actually, which is extremely rare in our organization. You know, we compete fiercely in this market due to the nature of the market that I already talked about, and to have consensus on a topic like this is somewhat rare for us. But the industry in general believes it's the right path to go on. And we really are looking for that certainty, an orderly phasedown of equipment over time. And so that's sort of why we've come out in support of Kigali and this phasedown of HFCs. And I'll leave it there and open it up for questions when we get to that.

Duesterberg: OK, thanks. Dave.

David Doniger: Well, thank you very much for the opportunity to be here. And I want to note that this is an area where the environmental community and the industries which are here for different reasons, but parallel reasons, have come to support the same approaches. And we've worked—I've worked with this particular industry productively for more than 30 years as the Montreal Protocol has—came into creation and evolved. Now, you know, to reprise a talk that I gave in 1986, I think—the environmental solution, if that were the only thing that were at issue here, would be to phase out these chemicals—

CFCs then, the HFCs now—very fast, almost immediately because the damage is—that was done by the CFCs—is still being done, is immense. And the damage that the HFCs are contributing to in the way of enhancing climate change is very serious. But we recognized from the very start that if we're going to have a productive path forward here, there had to be a pathway—a phasedown, phaseout pathway—phaseout for CFCs, phasedown for HFCs—that gave time for industry and created a structure in which industries have the time and interest and incentive to invest in and bring to market and compete with one another over the alternative approaches, some of which are in the fluorocarbon family and some of which are outside the fluorocarbon family. And there's a very vigorous, totally healthy, economically productive framework and competition going on and has been for more than 30 years. And we have been very proud to be part of that framework.

I think I would also like to extend a little bit on Jeff Holmstead's presentation. Now, I completely agree with him that—in his analysis that the Clean Air Act as it is written now provides the authority to implement a production and consumption phasedown of HFCs if and when the Senate gives advice and consent and the president ratifies the treaty. And that was, as he explained, a provision that was put into the Clean Air Act anticipating that the Montreal Protocol would evolve, and it would evolve properly through the diplomatic negotiation of amendments and then the adoption of them by the United States through the ratification process. And Congress in 1990 equipped EPA with the tools to carry out those amendments as that ratification happened. Just as an aside on Pat Michaels's question, the Montreal Protocol itself and the Vienna Convention which preceded it recognized that these kinds of chemicals are not simply ozone depleters. They have multiple kinds of effects, from health and safety concerns, from direct exposure to potential other environmental side effects of which they were aware that the greenhouse gas potential of all these chemicals was an important feature from the very

THE MONTREAL PROTOCOL ... RECOGNIZED THAT THESE KINDS OF CHEMICALS ARE NOT SIMPLY OZONE DEPLETERS. THEY HAVE MULTIPLE KINDS OF EFFECTS, FROM HEALTH AND SAFETY CONCERNS, FROM DIRECT EXPOSURE, TO POTENTIAL OTHER ENVIRONMENTAL SIDE EFFECTS THE GREENHOUSE GAS POTENTIAL OF ALL THESE CHEMICALS WAS AN IMPORTANT FEATURE FROM THE VERY BEGINNING.

DAVID DONIGER

beginning. And the Vienna Convention and the Montreal Protocol give the parties the jurisdiction to attend to the side effects of the replacements as well as to deal with the effects of the chemicals that were initially the focus. The Clean Air Act does the same thing in my opinion.

And there's been this mention of a court case. So I need to clarify a little bit about that. In addition to this authority that Jeff correctly summarized to implement amendments as they are ratified, the Clean Air Act, Title VI provides other authorities to do things on U.S. initiative, as domestic-only matters. And one of those is the significant new alternatives policy, which is not required by the treaty but is a requirement of U.S. law, that there be a surveillance or review of safety and environmental impacts of alternatives—replacements to CFCs and other ozone-depleting chemicals. And that program has been used to clear on a safety and where necessary, imposed safety conditions for lots of alternatives that have come along in the years past. But the Congress also contemplated that in addition to listing chemicals and adding them as approved, there could be a list of disapproved or unapproved or prohibited chemicals—is actually the term used in the statute. And the legal dispute that was just mentioned is whether the authority to put something on the prohibited list extends to the current users of those chemicals. The court actually upheld the EPA in putting the HFCs on the

prohibited list and upheld having done so because they contribute to climate change.

The court then said that that provision could not be enforced against incumbent users of the HFCs. That's the part we disagree with. And we're seriously considering whether to ask the Supreme Court for review of that decision. That's something we'll decide in the next few weeks. The decision not to rehear the case at the DC Circuit level occurred only last—a week ago Friday. And, you know, it bears observing that the DC Circuit rehears—it's harder to get the DC Circuit to rehear one of its own opinions than it is to get the Supreme Court to take a case on appeal—not to say the Supreme Court will take this case, but it may be of interest because there's some important legal interpretation principles at stake. The other thing that's going on is that California, and potentially other states—there were 11 that supported our position in the court case. But California is already working on regulations to implement the use-by-use limitations contained in the significant new alternatives rules that EPA had issued—to do that at the state level so as not to let the benefit of those rules be lost. And the California rules, if adopted, would be applied in that state to current users of the HFCs, not just future users. I think you could expect a number of other states—big states—which have important shares of the air-conditioning and refrigeration market to be interested in

[THE MONTREAL PROTOCOL IS] THE MODEL OF HOW WASHINGTON USED TO WORK AND MAYBE ONE DAY WILL WORK AGAIN.

DAVID DONIGER

doing what California does. There's always the risk that they might do something different from what California does. And you end up with patchworks and uncertainty. So we will pursue that course with the states if we have to, if we're not successful in getting the Supreme Court or maybe, in parallel, trying to get the Supreme Court to review the SNAP case.

But most importantly, what we want to do is work with the industry and with members of Congress on both sides of the aisle to—with the Senate, to the administration to get the agreement up to the Senate and to get the two-thirds of the Senate to approve it. I agree with Jeff that between the industry's interest and the administration's interest, it should be possible to get virtually—well, to get a lot of the Republicans engaged. And I have no doubt that the Democrats will also support this. So this is an agreement which makes a lot of sense. It took 10 years to negotiate it. It's the model of how Washington used to work and maybe one day will work again, where industry and environmentalists can have productive and serious conversations and constructive relationships with each other. And I hope that doesn't hurt the prospects of this agreement with this group to know that the NRDC is in support of it as well. But I'd like to see a day when we could work together on climate change issues more generally and get out of the tribal encampments that we too often find ourselves in. Thank you.

Duesterberg: OK. Over to Pat Michaels—and I understand Pat has a few slides. [The slides can be accessed at www.bit.ly/KigaliAmendment]

Patrick Michaels: Yeah, I don't—I'm a nerd. And the climate game is one, because it's very data rich, in which a few pictures are worth—you don't want to hear 10,000 of my words, I assure you. I was amused and intrigued when I first heard the claims that the Kigali agreement would mitigate one-half of a degree Celsius of global warming because I knew from the United Nations Intergovernmental Panel on Climate Change that their figure was on the order of a few hundredths of a degree. And I started to ask myself, well, what on earth is this based upon?

Now, I will leave the economists in the crowd to discuss with us in the course of a hundred-year time frame if nations like India and China are going to switch all to a certain type of refrigerant, given the way that technology changes and is adopted over time. I'm not so sure about that. But I'd like to talk to you about that .5-degree figure and to show you what it's based upon. It is based upon an emissions pathway called representative concentration pathway 8.5. That means that we have a forcing, a net increase in downwelling radiation of 8.5 watts per meter squared. That's the high end. It is—in fact, even the UN says that that's an extreme scenario. And where—what was added onto that was the assumption that that would cause 4.5 degrees C of warming caused by human beings by the year 2100. I would like to point out that means there will be 3.5 more degrees of warming in the next 82 years. That's an extreme warming rate, which is nowhere close to what has been observed. And that is based upon an assumption that—strange credulity to say the least. This is the well-known temperature curve from the University of East Anglia—the one the scientists tend to use the most.

It's got two warmings in it. About four-tenths of a degree of warming from 1910 to 1945, and then about four-tenths to 1998. And God knows what happens after that. It's very debatable. It looks like it's going up, but there are other

simulations that say maybe not. Anyway, the 4.5 degrees assumes that this was caused by atmospheric carbon dioxide. Now, just to point, the background atmosphere of carbon dioxide concentration was 280 parts per million. In 1910, it was 298 parts per million. You can run the equation. Its radiative forcing equals 5.35 times the natural log of the chain CO₂ over the background CO₂. When you get a forcing of three-tenths of a degree or three-tenths of a watt per meter squared, that's not enough to raise the temperature like that because Stephens—very highly cited—gives a negative forcing for the crap we put in the air called sulfate aerosol of .3 watts per meter squared, giving you a net forcing of zero. And scientists, including myself, generally thought that this was not a result of greenhouse gases.

But when we got into the modeling era, the modern modeling era—and I draw your attention to an article by Voosen et al.—Paul Voosen in *Science* magazine about 15 months ago. It turns out that every one of these climate models is tuned to mimic the 20th century. Tune is a nice word. If it were a freshman chemistry lab, it would be budgeted to get these two humps in it because, otherwise, as Isaac Held from Princeton said, otherwise they would be worthless. So you take a minor forcing and force it in there. Well, that doesn't really have anything to do with greenhouse gases. So we're going to have to adjust that 4.5 degrees down a weeny little bit. And then what's the future going to bring? Each one of these pieces of colored spaghetti is a climate model. And these are all the climate model families that the United Nations has. This is for the lower troposphere. These guys here are the observed temperatures—weather balloons, satellites, and something called the reanalysis data, which is really, really clever stuff where now we take the fact that there is incomplete global coverage and run, actually, a general circulation model—but it's a forecast model—to fill in the blanks. And boy, they all look the same.

WHEN YOU USE THE MODEL THAT WORKS AND YOU ADJUST FOR SOMETHING CALLED REALITY ... YOU GET .16 DEGREES CELSIUS FROM KIGALI.

PATRICK MICHAELS

And this, by the way, ends in 2016 with the big, old, hot El Niño. Every one of these is wrong except one. You can see it right here. Now, I don't want to give Mr. Mueller too much ammo. But this dotted line here—that's the Russian model. And let me just show you how bad it is in the vertical, which is really important. This is a complicated graph. It's early. You can do this. Surface—about 50,000 feet—all these colors—spaghetti—is the rate of warming predicted in degrees C per decade by every one of these climate models. And this is the average of that. Get to about 16,000, 18,000, 20,000 feet—they're predicting huge warnings—four-tenths of a degree Celsius per decade—egad. If that were true, I wouldn't have a job. OK? And here are the observed values with their error terms. And by God, there's one model that works. And which model is it? It's the Russian model.

And so there's another problem. This is the representative concentration pathway 8.5. That ignores the Shale Revolution. It was put out in 2011. The reviewer should have known at climatic change that the Shale Revolution was out of the tubes by then. Look at what it does to gas. It hardly changes it at all. Look what it does to coal. It increases it a lot. Well, just a few months ago, the International Energy Agency came out with a big white paper that says shale is going to replace gas worldwide for an electrical generation and for manufacturing. In fact, they said 40 percent of that change is going to be from China. So you've got to drop RCP8.5 to RCP6.0. That's going to drop the warming off of 4.5 degrees also. So let's just do it.

Does it say 4.5? That's what it says. Five degrees—it assumes a 4.5-degree warming by 2100. Let's adjust for the early 20th century, which didn't have anything to do with it. That drops it off four-tenths of a degree. Let's use emission pathway 8.5. Let's adjust for natural gas. That drops it off seven-tenths of a degree. And now let's use a computer model that works, INMCM4.

By the way, if you think that's a bad idea—that weather forecast from yesterday, that was a damn good forecast. There are eight global models. Do you think that the forecasters took all eight models and averaged them up to come up with the forecast? Or do you think they took the high end of one of them? No. They took the model that was working the best, which happened to have been NAM high resolution, and made the forecast. The best scientific practice is to use the model that works. And when you use the model that works and you adjust for something called reality, which there seems to be a paucity of in this town, you get .16 degrees Celsius from Kigali. Well, that's my story and I'm sticking to it. Thank you.

Duesterberg: OK, Pat. Thank you very much. Steve, floor's yours.

Stephen Yurek: Thank you. Well, there's been a lot discussed today. And you know, and I think one of the things that we have to look at is, as an industry, is really reflective of what I saw after the Kigali was adopted and agreed to in October of 2016. And that was when I was asked to be interviewed afterwards by the BBC. And the first question, rather than what this grand accomplishment was and what it meant was, you must be dismayed, being from industry, that they adopted this amendment. And I think that shows what we as an industry, as environmentalists and others, have in front of us to educate people on—why we as an industry are supportive of this amendment. And why are we? Despite the perception by some that this industry is against energy efficiency, environmental and other things, we're very supportive of and want to make sure that whatever we manufacture limits the impact on our environment, so much

so that even in the last decade, many of the products that we manufacture are 50 percent more efficient than they were just 10 years ago. And we're constantly working to innovate, as Paul said, to provide comfort, safety, energy efficiencies that the consumers want while still working to keep their products affordable and their homes safe and comfortable.

We also as an industry want this because we want the predictability. Industry thrives when they have a predictable business atmosphere. We've seen that this year on many things as we look at some of the regulatory issues and the tax issues that we've seen put forward by this administration. With a known target and time frame, they can plan their R&D dollars. They know what they need to invest in. They need to—they can look at what kind of staffing they need and how they're going to produce these new products that they develop. Third, we want to be the global leaders like we always have been in this industry. We want to be the source of global innovation. The products that they're looking at when we first adopted the Montreal Protocol were those that were adopted by U.S. industry, the same ones as we started 10 years ago working on this amendment. The alternatives were those that were being developed by the U.S. industry. And we want to be—to continue to be that global leader.

And I can tell you that we have many competitions from around the world. We have the Chinese, Koreans, Japan, Europe are heavily involved. And they see if we step away from this leadership that they will step into that breach wholeheartedly. And so we must be able to be out there advocating for what we see as the solutions so that we can continue to develop products here and export for use around the world. Now, the U.S. not adopting this amendment and failing to ratify will not mean that our companies will not develop products. However, when we represent such a huge portion of the global industry and technology, the acceptance of that technology by the other parties that have adopted it might be brought into question, will they pick our

products and technology, or will they pick those developed by the other countries that have ratified this amendment? We began advocating for this global phasedown more than 10 years ago. AHRI and its members' companies at that time started doing research. And we've been doing research and paying for that to look at alternative refrigerants and technologies.

And I can tell you that this research that we've done collectively, as well as individually, has developed alternatives, both in refrigerants and technology, that will be available not only to Americans to meet these obligations, but also the time frames for others around the world. And so our industry is committed to the ratification of this amendment and for providing the global leadership by the U.S. industry in meeting and exceeding the commitments made under it, just like we did with the original Montreal Protocol. And so we're very grateful that we're having this conversation. And we'd like to have further conversations. And I'm open to any questions. Thank you.

Duesterberg: Thanks, Steve. OK. I think we're going to—I'm going to see if any of the panelists would like to respond to what other panelists have asserted here this morning.

Yurek: I think one of the points that David made about the SNAP program is not only is it seen as driving the program here in the U.S., but it is recognized and relied upon around the world for evaluating the refrigerants used in our equipment. And so it is a basis and relied upon not just in the U.S., but you see it relied on in Europe, Canada, and Asia as they look at what refrigerants should be used in equipment. And they use that evaluation. They make their own determination, but they really see that as a valued resource in evaluating refrigerants and what is acceptable use of those refrigerants in different applications.

Michaels: I have a question for Mr. Yurek. I may be a nerd, but I'm also technologically illiterate. So the two go hand in hand. You mentioned other countries are doing

research on alternative refrigerants. The one that seems to be coming up here is the olefin-based one. What's the acronym for that?

Yurek: HFO.

Michaels: HFO. Are—in other countries, are we seeing work on non-HFOs that may be less expensive than HFOs, or are they going in the HFO direction also?

Yurek: I think a lot of the research in what people are looking at is trying to find the best refrigerant for the application with the lowest impact on the environment and the safest to use in the equipment. There are alternatives that are not HFOs that have certain issues. One are the hydrocarbons that are potential, but with using the hydrocarbons, you might have a cheaper refrigerant, but you're going to have more cost because of the technology necessary to use that safely and hopefully without an explosion or other things that would be used. You have CO₂, that...

Michaels: That's high temperature, right?

Yurek: CO₂ is high pressure. And with CO₂, there are great opportunities that have been developed here as well as in Europe for using CO₂ in a lot of commercial refrigeration applications, and that will continue to grow where appropriate. And then there hasn't been much with water yet just because you can use it but the energy necessary to deliver the efficiency is too much.

Camuti: Steve, let me jump in a little bit. I think, again, it comes to this multivariable optimization that we're doing around performance, safety, environmental impact, and cost. And, you know, there's also a lot of research going on outside of vapor compression cycles for being able to provide that. So you can think about thermoelectric cooling as an example or evaporative cooling. And there's a lot of digital technologies being applied in order to be able to optimize these systems. The point where we are right now is that the HFOs are really at a sweet spot of being able to

satisfy the requirements today and probably a step on the way. But earlier, it was mentioned like we're going to change from HFCs to HFOs. Well, actually, there's a lot of technology used to cool things, and HFOs is one alternative. So it's not like the competition is switching en masse from one to the other. There's a lot more fit-for-purpose technologies for heating, cooling, and refrigeration applications.

Doniger: If I could just add one thing. The history of—if you were to try to graph out where have the uses gone, which used to be using CFCs, I don't remember the percentages but there's a very good chunk that went to the HFCs and the HCFCs and are now gone to the HFOs. But there are categories of use that have dropped out and gone to other solutions entirely. Solvents, for example. One of the CFCs used to be used to clean circuit boards. That's not done anymore to my knowledge. There are other solutions to that. Hydrocarbons have a role in some categories of refrigeration, again, with proper attention to safety and sparks and so on. But, you know, we use flammable compounds in the back end of the car. And we also use flammable compounds in the stove and the kitchen and under the sink. So flammable materials can be managed and need to be managed for safety, but they're an important part of the set of solutions. And then there are some oldies but goodies for industrial applications, like ammonia still has a serious niche for many applications and yet you wouldn't want to be too close to an ammonia leak. So we count on the makers and users of this equipment to engineer them to take care of these safety concerns.

Duesterberg: Steve, one last comment.

Yurek: Yeah. I think Paul probably can talk about this more, but what this has done and what the protocol has done is driven research and development. And it has really—we're looking at technologies and other things that in the past, we might not have looked at and sat back. And I think you have to look at this as one, driving it, but also driving the U.S.'s continued leadership in this area of developing some of these new technologies, be it the refrigerants or different

technologies for cooling and refrigeration, or to be able to use these refrigerants, hydrocarbons like we started. You know, when Carrier developed the first air-conditioning, it was with hydrocarbon refrigerants. And it was not the safest thing to do. Now we're looking at R&D so we can use these things more safely and effectively.

Duesterberg: I have a couple questions and trying to drill down on the economics of this transition. Let's go to a basic level. Paul, you may be the right one to answer this question. But tell us—you know, I'm a homeowner. When this—presuming this is adopted, do I have to go out right away and change my systems? Number two, what do commercial systems have to do? Number three, what are sort of the costs involved in the transition?

Camuti: I think just some of the background of how this works practically for customers, I guess, is sort of how I interpret the root of the question. So, first of all, the equipment in a homeowner's case usually lasts 10, 15, 20 years of service life. So the decision that you're making today to put something into a home is going to have a service life, operational life of, let's just say 15 years. And so, you know—and again, those systems are designed so that the refrigerant doesn't leak, just to be clear, right? That's a key part in our design intents, never to have a refrigerant leak. And, in fact, when it gets serviced, there's protocols to reclaim that refrigerant and to use it again.

So whenever there's been a refrigerant transition and we're talking about new equipment and what we're talking about in terms of certainty, there's usually a future date that begins to step down the use of this refrigerant. So we can look out into the future and know with a high degree of certainty that we're going to work our way down from new equipment. Usually the service life of that equipment goes well in extent of those deadlines. So today, we're still servicing the majority of the installed base actually with CFCs. And we would reclaim that CFC from unused systems and have it available to maintain systems. And so there's a really well-managed path to be able to do that. I

think the second thing that's important about that is that the economics that I talk about is that for that period up to the transition, for most customers there's a clear choice, right? You can buy CFC-based equipment. That was actually the case or is the case in a lot of places. Or you can buy the new technology. And it's incumbent upon the designers of that equipment that the new technology offers a clear value advantage to the old technology. And that's, in fact, what's happening with these low-global-warming-potential solutions today is they're available in the market. A customer can make a choice to switch to that right now. What do they get for that? Well, in a lot of the cases, in our cases, we've done a lot of other tweaks to the design to give a higher-performance piece of equipment. So you're getting a more efficient piece of equipment—right?—with the certainty that the refrigerants that you're using are not going to fall under any regulatory uncertainty, given the current dialogue with regard to banning HFCs. So customers can choose to go do that today.

And in fact, that's one of the areas of our business where we're seeing the highest growth. And then, for the customers that choose to go another path, they're going to have a long time—20, 30 more years—of service life for that equipment where it really doesn't impact their operating. Now, they will be exposed over time. And what you do see is, as certain of these refrigerants come out of the market, the cost follows an economic curve. You know, usually the new materials are more expensive. The older materials are less expensive. But actually, the curves invert when you get to the end of the life cycle.

So right now, you'll probably see in the press or whatever that some of the CFCs are seeing some price increases because the supply—manufacturers taking supply out. The demand is going down. And the prices are starting to float up. That's a natural progression. And actually, in the overall life-cycle costs, the refrigerant is not the dominant cost for a customer. You know, to save a few points of energy efficiency and electric bill costs over a 30-year life

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PAUL CAMUTI

is a far more dominant part of the total life cycle of a piece of equipment than the cost of the refrigerants that we're reclaiming and reusing. So I don't know if that hits some of the economic factors for customers.

Doniger: I just want to add one point to illustrate how the technologies have improved here. Back in the '80s, when we started on this, if you had an air-conditioned car, you could plan over the 10-year official life of a car to have to replace the refrigerant three times because the automakers—because the chemical's very cheap. There wasn't much attention to—at the time to the side effects of the CFCs. And as a result, the carmakers didn't put very much attention into making the systems leak-tight on a durable basis. They are—they have since then. And the several cars that I've owned since then, I've never had to replace the refrigerant. And this is not just anecdotal. Studies show that these cars leak a lot less and need far fewer trips to the shop for refills or maintenance of the air-conditioning system. And that those are good things.

Duesterberg: OK. I'm going to ask one more question, then we'll turn it over to the audience. But let's try to do a public service here and answer Dave Banks's questions that he and his colleagues have to answer. So number one,

is American technology the superior technology? And do the Chinese, for instance, have a competing technology that they are going to try to win in the marketplace or impose on their huge domestic audience? And number two, do developing countries, which China still considers itself to be—and India—get any sort of a break like Steve Forbes argued this morning that they get under the Paris Agreement, right? So who wants to take that one on?

Yurek: Well, I'll answer the last question first. No, and that's the beauty, just like Steve Forbes said this morning and others—Jeff and other things. The 197 countries that agreed to the amendment, those that are ratifying it, once they ratify that amendment, they're obligated—and they have the obligations to perform and there are set deadlines. And what happened under the original one is that we were successful, and what makes the Montreal Protocol such a beautiful instrument is that it had the original goals, and we actually were able to accelerate the phaseout of ozone-depleting substances because there's also a technological review part of the protocol. And with that, they found out that there were alternatives available sooner and faster than what was originally proposed. And so we were able to bring those years up five years. We'll be able to do the same thing most likely with the Kigali Amendment as well because there is a required five-year review of that protocol.

But again, everybody that ratifies and agrees to that is obligated, and they have set dates they need to meet. The other question related to technology—or other—I can tell you that the Japanese, the Chinese, Europeans are all working to develop technologies that will meet and exceed the obligations under the Kigali Amendment in using other technologies in refrigerants. We're continuing to do that. My understanding in talking to all of my members and everything else is that we'll develop technology, and we'll compete with them out in the open market, and we'll win because we'll have not only delivering the better refrigerants and technology but also the energy efficiency with that in performance. So I think—I don't know—Paul or...

Camuti: Yeah, I mean, you know, this conversation of where does technology come from has been, for me, a lifelong set of paranoia, actually, because if you think about the time that I was trained in the universities, the U.S. had sort of an undeniable and an insurmountable lead in a number of different advanced technology areas. And I think generally economies around the world hadn't really cracked the code. Technology and innovation and investment really helps economic development and so today, the world has leveled up a lot not only related to regulation, in an amendment to the Montreal Protocol, but actually some fundamental policies around R&D in these countries.

And so, yeah, we see competition in this in just about every technical area accelerating outside the United States at a time where we're, for other reasons, sort of backing away from some of the investments. And so, yeah, I worry about that every day. I think, today, if you think about this next step of transition that I've been referring to, I think that the U.S. companies are well positioned to lead this next sort of wave of technology that we're talking about here. I think some of the competitiveness actually comes farther down the line. And frankly, I personally just have a sense of urgency about getting this specific conversation on HFC phasedown in an orderly way behind us because there's sort of momentum outside the United States, through the number of countries that are there, that it's in our best interest to get on that train because it's the next train that I'm sort of worried about.

Duesterberg: OK, let's turn it over to the audience. And I would repeat Chris DeMuth's admonition: Please state your name, your affiliation, and everything you say should have a question mark at the end.

Audience Question: The key question seems to be, to me, what is the difference in the sales forecast of American companies with and without the Kigali ratification?

WHAT USUALLY HAPPENS IN CLEAN AIR ACT LAND IS THAT WHEN THE FEDERAL CONTROLS ARE GOOD ... THE STATES DON'T FEEL A SUFFICIENT DRIVER TO DO THEIR OWN THING. BUT WHEN THE FEDERAL CONTROLS FALTER, STATES STEP IN TO FILL THE GAP, AND YOU END UP WITH THE NEED TO ADDRESS MANY DIFFERENT JURISDICTIONS AND THE POTENTIAL THAT THERE COULD BE DIFFERENCES AMONG THEM.

DAVID DONIGER

Yurek: I'll go for it. We were hoping to have some numbers. But in our conversations with the administration and others, we are working along with the alliance on developing an economic forecast of what the impact of the Kigali Amendment would be for the U.S. industry and manufacturing, in particular. And we hope to have that available sometime in the very near future. But we don't have it today.

Audience Question: What's the practical implication if the domestic regulation on HFCs is done via the court case that potentially could go to the Supreme Court, versus if it's done by the provisions of the Clean Air Act that Jeff explained in the last panel?

Doniger: Well, one difference is that the SNAP program, which regulates end uses of chemicals—not chemicals per se but chemicals in particular uses—one difference is it's a use thing versus upstream production and import-related regulatory scheme. Now, the two could work together. Second difference is that the use scheme is entirely domestic. It's not contingent on ratification. It's not contingent on there being a Kigali agreement at all. The United States could decide, and has at different points, to prohibit certain uses of certain chemicals because of the dangers that they pose. So there is a case, a good case, to be made for doing both—for having a production limitation and specific use limitations. I think what the previous

administration did was start with the SNAP program because it could be implemented domestically and as a consequence of those, when you add up the reductions associated with the use limits that they put in, which are now in question because of the court case, that would have put us on a trajectory to comply with the Kigali agreement for a number of years, probably into the early '20s.

And this shouldn't come as a big surprise because the same institution, EPA, and the same industries were involved in the back and forth over what the pace of those use restrictions could feasibly be, and which ones to do and which ones not to do. And we were involved in that, too. And it was fairly well thought out. But if we—the number-one consideration from the environmental point of view is to get these reductions and to get—to stay on the schedule that all of the real parties at interest negotiated. And if it takes going to the state level to implement the use controls as a means to do that, then we'll do that, and we are doing that now. What usually happens in Clean Air Act land is that when the federal controls are good, are what they need to be, the states don't feel a sufficient driver to do their own thing. But when the federal controls falter, states step in to fill the gap, and then you end up with—I have some sympathy for the way this seems to the industry side—and you end up with the need to address many different jurisdictions and the potential that there could be

differences among them. And it's not as convenient and as certain and as well organized as having a national regime. So if we get to the production consumption phase down on the Kigali schedule, it lessens the pressure to keep working at the use end of the spectrum and at the state end of the spectrum. But if we don't get the federal buy-in to the overall production and consumption scheme, it increases the pressure to work at the use level and at the state level.

Audience Question: If agencies are already regulated under the SNAP program, isn't it likely that any state efforts would be preempted by the regulation or the Clean Air Act?

Doniger: No, there's no preemption of state activity in this area. The Clean Air Act is quite clear when there is preemption, and this is an area where there isn't, so that's not a worry. For example, California, with respect to the car standards, it's the only state that's allowed to do its own thing, but it does need to get a waiver from the federal government. The waiver comes on legal terms that are highly tilted towards granting it. Congress wanted a strong presumption that California could do its own thing. And then other states are allowed only to choose between the California standards or the federal standards. They can't do their own thing. That is not the case in this field. And California, New York, Florida, Massachusetts, they can all do different things—not that I would necessarily recommend that. But I can't guarantee that there wouldn't be differences between these state programs.

Audience Question: Mr. Yurek, about three years ago, I participated in a workshop at your organization, and I got the impression that it was quite controversial, at least among the members that were in the panel that I was on. I think they were mostly contractors and users. What's happened in the past three years that this—apparently everybody's singing from the same hymnal? They clearly weren't three years ago.

Yurek: Just like everything, with time and a lot of discussion and negotiations and listening to each other, the industry has come together. We have seen, as Paul said, the handwriting on the wall that the phasedown of HFCs was going to be occurring globally. And we needed to be able to sit at the table and negotiate what that schedule is going to look like. And so we came together to do that. We still have a lot of work to do in the actual implementation. And right now, a lot of the discussion has been at the producer and manufacturing level. The next, once it's ratified, is the implementation. And that's when you really start impacting again, the people downfield, the distributors and the contractors installing in the field. And we've promised and have been working with those groups to say, as these products started coming out, which in most instances is going to be several years down the road yet, we want to make sure that your members, one, are educated and trained on that equipment, but also they have the knowledge so that they can then inform the consumers as well. But I think it's a lot of conversation and other things. But there's still—as any industry through the supply chain, there can be disagreements. About 95 percent of the time, we probably agree with each other. And I'm looking at Bart and others that are here. And it's that 5 percent that you probably were witnessing as we were going through that phase of trying to figure out where we wanted to go.

Camuti: Yeah. Let me just jump in because I think it's important those stakeholders that you mentioned—right?—the customers and the installers are key stakeholders for manufacturers, right? So I can tell you right now just coming back to the idea of certainty in this area, that's driven really from the installer side of things. You just think about somebody who's having to go out into the wild, as we say, and service this equipment. They don't want to have to have 10 or 12, if I happen to—I'll take the California example here. If I'm on the border of California-Nevada and I have to have a certain set of chemicals to go left and a different one to go right and I've got inventory costs and training costs. And so, I mean, I think the reason why there

THE BEAUTY OF THE MONTREAL PROTOCOL IS THAT IT DOES NOT DICTATE THE TECHNOLOGY THAT'S GOING TO BE USED. WHAT IT DOES IS IT LAYS OUT THE TIME FRAME FOR, IN THE CASE OF OZONE-DEPLETING SUBSTANCES, THE PHASEOUT OF THOSE IN A SCHEDULE AND WHAT IT DOES FOR THE HFCs IN THE KIGALI AMENDMENT, AGAIN, LAYS OUT A SCHEDULE FOR PHASING DOWN TO 85 PERCENT BY 2035. IT DOESN'T SAY THAT YOU NEED TO USE HFOs.

STEPHEN YUREK

hasn't been convergence on these topics is that every time we go through one of these transitions, there's a little bit of that sausage-making process to understand, you know, how are we going to manage the variability? And again, I think, just coming down one more time on this idea of certainty—right?—that applies across the whole value chain, right? It starts with chemical suppliers into the manufacturers, the manufacturers working with our installers and servicers. And yes, so there's definitely parts of this process that seem a little bit choppy than others.

Audience Question: Does the Montreal Protocol and/or the domestic regulations dictate the technology solution, number one, or is the choice still to the user community? And number two, is the HFC phasedown likely to take place with or without U.S. ratification? And if so, what are the impacts if it's without?

Yurek: Again, the beauty of the Montreal Protocol is that it does not dictate the technology that's going to be used. What it does is it lays out the time frame for, in the case of ozone-depleting substances, the phaseout of those in a schedule and what it does for the HFCs in the Kigali Amendment, again, lays out a schedule for phasing down to 85 percent by 2035. It doesn't say that you need to use HFOs. It doesn't say you need to use hydrocarbons or ammonia or anything or other technologies. It just says you need to make sure that the global warming potential is

phased out over this period of time. So it allows the markets to decide. So there might be different solutions depending upon the risk analysis by certain countries where they might use hydrocarbons much more than we do here in North America. And then—what was your second question? Yes.

Duesterberg: Just one more clarification. Are there any global standards in this arena, or is it all done at the national level?

Yurek: There are—depending upon which standards you're talking about, there are global standards related to the classification of refrigerants. There are relatively harmonized safety standards. And we're working on those safety standards to address these new HFO refrigerants as well as the hydrocarbon and A3 refrigerants. There are national variations depending upon where those countries are in belief. But there's kind of a general base, and then there's little modifications. And the same thing with energy performance, in that area, there is not a global standard, but most of them are based upon the U.S. or European-based standards, with modifications related to those standards.

Doniger: OK, can I add something and partly in response to Kevin's question, but generally about what's going on, to our knowledge, in China and India? As it was pointed out by the first panel speakers, China had no industry at all in this area in the 1980s. And now, they make more than half of the global production of HFCs. And they're very

interested in what comes next, and they are on it. They are going to be significant competitors. In India, India was very reluctant to join this agreement, negotiated for themselves a—sort of a slow track. They're now having an internal debate in India. First of all, they are developing something they called the National Cooling Action Plan, which is addressing the incredible rate of growth of air-conditioning demand in their country, the impact of that on their grid, the need for efficiency to reduce the impact on the grid, the occurrence in some of their cities of terrible heat waves which are killing people who don't have access to cooler places. They're trying to knit all this together across their own fractured bureaucracy. And they're also seriously considering accelerating their own phasedown schedule, in other words, abandoning the slow track that they identified for themselves. They haven't said this publicly in a big way, but I know because we have teams working in India that the government is seriously considering that move. They want to catch up with China. They want to catch up with us in the commercial sphere too. So if the United States turns its back on this, it's doing its industry and our economy a big disservice.

Duesterberg: OK. I think we've had a robust discussion here, and I hope it illuminated some of the issues that are involved in this transition and some of the economics of it. I would just invite if any of the panelists have one last thing that they've not been able to say yet, if there's anything else.

Michaels: I have something, if you don't mind. It's really demonstrable. It's kind of an easy demonstration that that half-degree figure was fanciful, to say the least. And the question becomes, how many degrees does it have to be in order to provoke a phaseout? And the impression I get from this room is zero. So why don't we just leave the climate thing out of it and say somebody has got a new product they want to sell? Because you can't measure 16 hundredths of a degree, and that's what the actual

numbers would give you. So stop the charade. We don't want HFCs anymore.

Doniger: Well, you provoked me now to say something.

Michaels: It was my idea.

Doniger: I won't—I don't want to get into a debate with you about this but it seems...

Michaels: You don't?

Doniger: No, I don't. It seems like the more you minimize the effect of other gases, the more you bring in the mitigating effects of reductions in coal production and so on, the more important these trace gases become because we are—this is my perspective—we're seriously overloaded with greenhouse gases in the atmosphere and in the prospect of the future atmosphere. Anything that we can do within economic reason to reduce the growth of these chemicals is going to be an important help. Most of that growth will occur if we don't do anything in developing countries. If the developing countries are starting to change their pathway—and they are—it's largely because the United States was after them for 10 years on the importance of this problem and that we needed a global agreement to go in on this together to make this transition in order to avoid that tremendous HFC growth. And we sold the rest of the world on the importance of that. It's important that we stick to it here at home.

Kenneth Weinstein: Thank you to our panelists. This has clearly been a very lively, informative, heated discussion at times. I think it's been very useful to flesh out all the arguments for and against. I think it's really been an excellent program. And without further ado, I'm sure that we will be hearing a lot more about the Kigali Amendment in the months to come. So thank you again, all of you for being here.

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