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BUILDING A 100 PERCENT CLEAN ECONOMY: PATHWAYS TO NET ZERO INDUSTRIAL EMISSIONS

WEDNESDAY, SEPTEMBER 18, 2019

House of Representatives

Subcommittee on Environment and Climate Change

Committee on Energy and Commerce

Washington, D.C.

The subcommittee met, pursuant to call, at 10:00 a.m., in Room 2123 Rayburn House Office Building, Hon. Paul Tonko [chairman of the subcommittee] presiding.

Members present: Representatives Tonko, Clarke, Peters, Barragan, Blunt Rochester, Soto, DeGette, Schakowsky, Matsui, McNerney, Ruiz, Dingell, Pallone (ex officio), Shimkus, Mc Morris Rodgers, McKinley, Long, Flores, Mullin, Carter, Duncan, and Walden (ex officio).

Staff present: Adam Fischer, Policy Analyst; Jean Fruci, Energy and Environment Policy Advisor; Caitlin Haberman, Professional Staff Member; Rick Kessler, Senior Advisor and Staff Directory, Energy and Environment; Brendan Larkin, Policy Coordinator; Dustin Maghamfar, Air and Climate Counsel; Nikki Roy, Policy Coordinator; Mike Bloomquist, Minority Staff Director; S.K. Bowen, Minority Press Assistant; Ryan Long, Minority Deputy Staff Director; Mary Martin, Minority Chief Counsel, Energy & Environment & Climate Change; Brandon Mooney, Minority Deputy Chief Counsel, Energy; Brannon Rains, Minority Staff Assistant; and Peter Spencer, Minority Senior Professional Staff Member, Environment & Climate Change.

Mr. Tonko. Good morning, everyone. The Subcommittee on Environment and Climate Change will now come to order.

I recognize myself for 5 minutes for the purposes of an opening statement.

Today's hearing will examine greenhouse gas emissions associated with the industrial sector, which includes a wide range of manufactured products and processes, including several energy-intensive and trade-exposed industries.

Many of these industrial products are critical to our economy, including steel and cement, chemicals and fertilizers, glass, paper, and aluminum products, to name a few. Despite their importance to our lives, they are also a large and overlooked source of emissions and projected to grow through mid-century.

We cannot achieve meaningful climate targets, such as our economy-wide net zero by mid-century goal, without significantly reducing industrial emissions but industrial emissions can be difficult to carbonize. They are often produced from high temperature long-duration heat production and chemical reactions. Unlike much of the power sector and light-duty vehicles, in many cases, cost-effective low-carbon solutions are not commercially available yet and there is no one solution to cut across all the diverse subsectors.

While decarbonizing industry certainly has its challenges,

there are near- and long-term solutions. In the near-term, there are well-developed technologies and strategies that, if given the proper incentives and policy certainty, industry can start to make investments. These include improving energy efficiency, deploying CHP systems, C-H-P systems, fuel switching, and increasing recycled content. The Federal Government could help form markets and provide assistance to incentivize these types of actions right now. For example, the public sector is a major purchaser of steel and cement. Through the power of procurement policy, we can drive market demand for low-carbon industrial products.

Longer-term options will require significant Federal investments in RD&D for technology development, such as: carbon capture, utilization, and storage; breakthroughs in chemistry and materials; and the use of hydrogen. Some of these innovative options may take several years to become widely deployed but will likely be necessary to achieve major reductions in the sector. It is critical that we focus Federal efforts today in order to achieve targets that are still decades away.

Unlike other sectors, many energy-intensive industries face global competition. Poorly designed policies risk the leakage of pollution, production, and jobs overseas. Many of us know the consequences of de-industrialization. I do not have to look any further than my own hometown in New York's 20th Congressional

District.

Manufacturing has always been a gateway to the American middle class. It was the lifeblood of my and many other communities across the country and, sadly, we know what happens to communities when production moves overseas. Our policy preferences should seek to both spur decarbonization and promote domestic advanced manufacturing.

Rebuilding, retooling, and reinvigoration American manufacturing must be a fundamental component of our climate response. That is why I believe it is imperative to understand and to seek to mitigate potential competitiveness concerns, rather than dismiss them. At the end of the day, it is good for both us and global climate action if these manufacturers continue to operate here, where they employ Americans and produce more cleanly than their foreign competitors.

In order to succeed, Congress must provide the assistance necessary to enable the United States' industry to achieve ambitious targets on a reasonable and certain time line. This will likely need to be done with a mix of incentives and requirements.

Without a doubt, decarbonization of the industrial sector will be challenging. And I hope today we can better understand those challenges and the potential solutions but, above all, we must recognize that industrial decarbonization is necessary and

possible with the right mix of well-designed policies, Federal investments, and market development.

Through smart climate and industrial policy, Congress can help American manufacturers transition to cleaner production while investing in the technologies, the practices, and the people that will make us globally competitive long into the future.

With that, I know recognize the ranker of the subcommittee, Representative Shimkus, for 5 minutes of opening statement.

Mr. Shimkus. Thank you, Mr. Chairman.

Whenever I hear an idea for what we can do to keep global warming in check, whether it is over a conference table or a cheeseburger, I always ask this question: What is your plan for steel? I know it sounds like an odd thing to say but it opens the door to an important subject that deserves a lot more attention than any conversation about climate change.

Making steel and other materials, such as cement, plastic, glass, aluminum, and paper, is the third biggest contributor of greenhouses behind agriculture and making electricity. It is responsible for a fifth of all emissions and these emissions will be some of the hardest to get rid of. These materials are everywhere in our lives and we don't yet have proven breakthroughs that will give us affordable zero-carbon versions of them. If we are going to get to zero-carbon emissions overall, we have a lot of inventing to do.

Steel, cement, and plastic are so pervasive in modern life that it can be easy to take them for granted. The first two are the main reasons our buildings and bridges are so sturdy and last so long. Steel, cheap, strong, and infinitely recyclable, also goes into shingles, household appliances, canned goods, and computers. Concrete, rust-resistant, rot-proof, and nonflammable, can be made dense enough to absorb radiation or light enough to float on water.

As for plastics, they have a bad reputation these days and it is true that the amount piling up in our oceans is problematic but they also do a lot of good. For example, you can thank plastics for making that fuel-efficient car you drive so light. They account for as much as half of the car's total volume but only ten percent of its weight.

So how do we cut down on emissions from all steel, cement, and plastic we are making? One way is to use less of all these materials. There are definitely steps we should take to use less by recycling more and increasing efficiency but that won't be enough to offset the fact that the world's population is growing and getting richer.

As the middle class expands, so will our use of materials. In a sense, that is good news because it means more people will be living in sturdy houses and apartment buildings and driving on paved roads but it is bad news for climate. Take Africa, for

example. Its emissions from making concrete are projected to quadruple by 2005 -- I mean 2050. Emissions from steel could go up even more because the continent uses so little now.

If using less isn't really a viable option, could we make things without emitting carbon in the first place? That is, in fact, what we will need to do but there are several challenges. First, these industries require a lot of electricity which, today, is often generated using fossil fuels. Second, the processes also require a lot of heat, as in thousands of degrees Fahrenheit, and fossil fuels are often the cheapest way to create that heat.

Finally, and this might be the toughest challenge of all, manufacturing some of these products involves chemical reactions that emit greenhouse gases. For example, to make cement you start with limestone, which contains calcium, carbon, and oxygen. You only want the calcium so, you burn the limestone in a furnace along with other materials. You end up with the calcium you want plus a byproduct you don't want, carbon dioxide. It is a chemical reaction and there is no way around it.

As brilliant as this opening statement is, it is not from me. It is from a blog post on August 27th by Bill Gates.

I have noted in previous hearings that we should keep appropriate perspective on the scale and source of the problem we are trying to address and this is especially important when

it comes to reducing emissions in the industrial sector. If we impose overly restrictive rules and regulations domestically, we raise the cost of energy and feedstock. We lose control over essential parts of the critical supply chains. We increase reliance on foreign industries and manufacturing and simply displace industrial emissions from the United Sates to other nations, along with our manufacturing jobs.

For emission reductions in this sector to make an impact on global greenhouse gas budgets, the reduction should occur where the industrial output will be growing the most. That will mostly likely be China, India, and the developing world. The trick for the United States will be to develop the cleaner technologies and practices to explore to developing nations, while avoiding cost and regulatory burdens that will make essential goods more expensive and drive our industries overseas. We do not want to put the United States at a competitive disadvantage to other nations or deprive our nation important opportunities to innovate and develop the new industrial sectors that promise cleaner future energy systems.

Today's testimony will note that reducing emissions across the sector is not easy or even possible, in some cases, based upon brute facts of physics, chemistry, and economics. But we will also note in this hearing that there are practical policies to pursue that can make a difference domestically and can help

set the U.S. industry to advance cleaner technologies and processes in the future.

Chairman Tonko, there are bipartisan legislative solutions we can sign into law this Congress that will remove some of the barriers to innovation in the industrial sector. If you want to start making progress on the industrial emissions, let's start with what we know we can do today to make a difference in the innovation landscape, while protecting our national interest and the interest of our workers and consumers.

And with that, I thank you for the time and I yield back my time.

Mr. Tonko. Thank you, Representative Shimkus. The gentleman yields back.

The chair now recognizes Mr. Pallone, the chairman of the full committee, for 5 minutes for his opening statement.

The Chairman. Thank you Chairman Tonko.

Combatting climate change is a top priority of this committee. That is why, in July, I joined Chairmen Tonko and Rush, and other committee Democrats in announcing a plan to address the climate crisis by achieving a 100 percent clean economy by 2050.

Recent reports by U.S. scientists and the Intergovernmental Panel on Climate Change paint a grim picture of our future if we do not get carbon pollution under control. We are already

experiencing record heat waves, flooding, sea level rise, intense wildfires, extended drought, and severe weather events that experts project would come with increased warming. These events are taking a terrible toll on our communities and the cost of inaction is growing.

We must act and our 100 by 50 plan is supported by scientific consensus. Scientists say we must limit global warming to 1.5 degrees Celsius by the end of the century to prevent the worst effects of climate change.

Now transforming our economy to one that is 100 percent clean will be tough and will take significant resources and ingenuity but it is absolutely necessary. Some sectors of the economy will be more difficult to address than others. So today's hearing will examine the industrial sector, an essential sector of our economy and one with some of the largest challenges, as we look to transition to a 100 percent clean economy.

The industrial sector is a source of good-paying jobs and critical products. These products make up our infrastructure and are essential to a wide array of businesses and services in our modern society. A vibrant manufacturing sector helps our economy flourish. At the same time, this sector is also the third largest source of all greenhouse gas pollution.

Compared to other sectors of the economy, emissions from the industrial sector come from a diverse mix of heat production,

power generation, and chemical reactions and that mix also varies widely across individual subsectors and facilities, from manufacturing cement and steel to producing chemicals and paper products. This diversity makes the industrial sector especially challenging to decarbonize.

There is no single policy that will curb carbon pollution from the entire sector. Switching to renewables and electrification will work in some areas but not others. Capturing and storing emissions, rather than eliminating them altogether, will likely be the most effective way to decarbonize certain parts of the industrial sector, since creating certain materials naturally produces carbon.

Transitioning the industrial sector to a clan future is challenging but possible. Pathways to industrial sector decarbonization do exist. We have many technologies available today that, with wider deployment, can improve material and energy efficiency in manufacturing and lower carbon and other harmful pollutants. We also need continued research, design development, and demonstration projects to lower costs and spur technological innovation.

Comprehensive climate action provides an opportunity to transform our economy for the future. The technologies we develop and demonstrate here in the U.S. can be exported to other nations, creating new businesses and millions of good jobs in

a climate-resilient economy. Climate action ensures our nation does not fall behind our global economic competitors but, instead, leads the world. The rest of the world is already taking the climate threat seriously, embarking on a major transition into a low-carbon economy. We can either lead that transition or watch as American workers and industries get left behind. Cleaning up the industrial sector is essential to meeting this challenge.

So I just want to mention again that I am committed, and our Democrats are committed, to the 100 by 50 target and to building widely-supported solutions that make the necessary pollution reductions while also strengthening our economy for the future. America has always been a leader in innovation. We can and must use our talent and resources to grow new clean industries here and employ our workers to deliver low- or zero-carbon high-quality products to the world.

So I look forward to hearing form our witnesses today, as we continue to hear ideas about how best to reach our 100 by 50 target.

And thank you, Mr. Chairman. I look forward to the testimony.

Mr. Tonko. Thank you, Mr. Chairman. The gentleman yields back.

The chair now recognizes Mr. Walden, ranking member of the full committee, for 5 minutes for his opening statement.

Mr. Walden. Thank you, Mr. Chairman. Good morning. Good morning to our witnesses and those in the audience. We thank you all for being here.

I think it is important to note that America has the most efficient energy usage, when it comes to manufacturing, probably in the world and we have led the world in actual reductions in carbon emissions over the last decade or 2. We should not lose sight of that.

It has been 7 months since Mr. Shimkus, Mr. Upton, and I wrote an op-ed highlighting the need to find common sense and bipartisan solutions to address current and future climate risk. It has also been 7 months since this committee held its first hearing on the climate change, where many members on both sides of the aisle expressed interest in working together to find common sense bipartisan solutions to address climate change.

Following that hearing, Mr. Shimkus and I sent a letter to Chairman Pallone and Mr. Tonko, requesting the committee work together on this important issue but, unfortunately, that has not happened. Our Democratic colleagues have not engaged with Republicans in a meaningful way and the politics of climate change, unfortunately, seems to have overtaken rolling up our sleeves and getting to work on really bipartisan solutions.

Regrettably, the loudest most radical voices in Congress and on the presidential trail are dominating the climate debate

in the party, the Democratic Party. And that is too bad because I think there is common ground and we could find solutions. The gap between rhetoric and reality, though, among my friends has simply gotten out of hand.

Leading Democrats are calling for the elimination of nuclear power -- elimination -- fortunately, not our chairman here but nearly every single major candidate on the Democratic side wants to eliminate or phase out nuclear power. I don't believe that is smart.

Nuclear is ideal for dealing with climate change because it is the only emissions-free energy source that is available 24 hours a day. Nuclear represents over half our nation's carbon-free energy and experts, from Bill Gates to former Energy Secretary Ernie Moniz, have said nuclear must be part of our energy mix going forward to reduce emissions. To reduce emissions, we need nuclear power. Democrats who are unable to say those simple words are not doing themselves or the climate crisis any good.

Leading Democrats have called innovation such as carbon capture, quote, unquote, false solutions. So if your goal is to reduce emissions, that logic simply doesn't follow. We need to be encouraging these technologies, just as we have with President Trump signing into law critical tax credits for carbon capture technology.

Leading Democrats have also called for a ban on fracking

and on natural gas development and yet, the production of natural gas helped the United States become a global leader in energy product and a major energy exporter. It substantially helped us reduce our overall emissions. In fact in 2017, U.S. carbon emissions were the lowest they had been since 1992 and they are projected to remain steady in upcoming years. The United States achieved these reductions while emissions were climbing in most of Asia and most of Europe. So such a ban would wipe out a major source, not only of American prosperity but also of fuel that has lower emissions, and it would lead to Americans paying higher prices for the same energy, and increase reliance, by the way, on foreign energy sources with no impact on the world's appetite for energy. So I don't think that is a serious approach.

Now I know that many of my friends on the other side of the dais don't agree with all these positions but, unfortunately, the all-or-nothing talking points for many are preventing us from building on the progress we made last Congress to reduce emissions, boost clean energy, and protect America's economy and workers. Maybe that is why E&E News reported, and I quote: House Democrats have little to show on climate. Closed quote.

Turning to the topic of today's hearing, as Bill Gates warned in a recent op-ed, we have a lot of inventing to do in order to achieve zero-carbon emissions overall. And I believe Mr. Gates rightly pointed out that we don't yet have any proven

breakthroughs that will give us affordable zero-carbon emissions of basic building materials like steel, cement, glass, aluminum, plastic, and paper, which account for a fifth of all emissions. Without more serious consideration of the scale of what would be realistically achievable here and abroad to reduce emissions, the 100 by 50 slogan is less of a solution and, frankly, more of a slogan.

So if Democrats want to tackle climate change, they should work with us Republicans because that is how we are going to get serious solutions that can become law and it is how we have done it in the past. There are bipartisan bills in Congress we could pass right now to ensure the United States remains a global leader in emissions reductions, economic productivity, and clean energy production. And there are more ideas we could explore together and I hope we will.

We are waiting at the table. We are ready to continue the work started last Congress with our Democratic colleagues on climate policy focused on innovation, conservation, and preparation. So let's work together.

With that, Mr. Chairman, I yield back.

Mr. Tonko. Thank you, Representative Walden. The gentleman yields back.

And the chair would like to remind members that pursuant to committee rules, all members' written opening statements shall

be made part of the record.

Before we introduce our witnesses, we are going to take just a quick moment to fix the clock. A technical problem.

Are we set? We are set. That was a quick moment.

So now I introduce our witnesses for today's hearing. We being with Bob Perciasepe, President of the Center for Climate and Energy Solutions, or C2ES; Dr. Jeremy Gregory, Research Scientist of the Department of Civil and Environmental Engineering and Executive Director of Concrete Sustainability Hub Massachusetts Institute of Technology, on behalf of the Portland Cement Association.

Next, we have Dr. Gaurav Sant, Gaurav Sant, Professor and Henry Samueli Fellow: Civil and Environmental Engineering, Material Science and Engineering, and the California NanoSystems Institute, Director, Institute for Carbon Management at University of California, Los Angeles. Next, we have Ross Eisenberg, the Vice President of Energy and Resources Policy at the National Association of Manufacturers.

Next, Dr. S. Julio Friedmann, Senior Research Scholar for the Center on Global Energy at Columbia University's School of International and Public Affairs.

And finally, Jason Walsh, who serves as Executive Director of the BlueGreen Alliance.

Before we begin, I would like to explain the lighting system.

In front of you are a series of lights. The light will initially be green at the start of your opening statement. The light will turn yellow when you have 1 minute remaining. Please begin to wrap up your testimony, at that point, and the light will turn red when your time has expired.

At this time, the chair will now recognize Mr. Perciasepe for 5 minutes to provide his opening statement. And thank you, Mr. Perciasepe, for joining us today.

STATEMENTS OF BOB PERCIASEPE, PRESIDENT OF THE CENTER FOR CLIMATE AND ENERGY SOLUTIONS; JEREMY GREGORY, EXECUTIVE DIRECTOR, MASSACHUSETTS INSTITUTE OF TECHNOLOGY'S CONCRETE SUSTAINABILITY HUB AND PORTLAND CEMENT ASSOCIATION; GAURAV SANT, PROFESSOR AND HENRY SAMUELI FELLOW: CIVIL AND ENVIRONMENTAL ENGINEERING, MATERIAL SCIENCE AND ENGINEERING, AND THE CALIFORNIA NANOSYSTEMS INSTITUTE, DIRECTOR, INSTITUTE FOR CARBON MANAGEMENT AT UNIVERSITY OF CALIFORNIA, LOS ANGELES; ROSS EISENBERG, VICE PRESIDENT, ENERGY AND RESOURCES POLICY, NATIONAL ASSOCIATION OF MANUFACTURERS; JULIO FRIEDMANN, SENIOR RESEARCH SCHOLAR, CENTER ON GLOBAL ENERGY POLICY, COLUMBIA UNIVERSITY SCHOOL OF INTERNATIONAL AND PUBLIC AFFAIRS; AND JASON WALSH, EXECUTIVE DIRECTOR, BLUEGREEN ALLIANCE

STATEMENTS OF BOB PERCIASEPE

Mr. Perciasepe. Thank you, Mr. Chairman and all the members, for being here and also for inviting me to speak to you today.

My name is Bob Perciasepe. I am president of the Center for Climate and Energy Solutions. We are a nonprofit nonpartisan organization that works with businesses to achieve climate goals.

I think there are three themes in my quick opening statement and in my written statement that you all have and I think it is already been mentioned by a number of the opening comments from

the members.

The challenge in the industrial sector is complex and difficult. Right now in the United States is close to -- including the indirect emissions from electricity used, it is close to 30 percent of the U.S. emissions of greenhouse gases.

Engaging businesses and the diversity of businesses in developing the solution mix is a pretty important part of what we will need to do and what we have been doing at the Center for Climate and Energy Solutions. So engaging businesses is another important point.

And the third key point I think is that businesses are not going to be able to do this alone. They need policy that will help them achieve the goals that they are setting themselves.

And so given the tremendous diversity, and I think we heard this already from particularly the chair of the full committee, that there are three big components in the industrial sector that are causing the emissions. One is the thermal energy they need -- the heat. The second is the different chemical processes like making steel and concrete. And there is also electricity that is used. And so thinking about all of those together gives you a sense of the complexity but it can also set you on a path on how you can start dissecting what the solutions would be.

And I have a lot more of this in my written statement but I want to go through very high-level examples here. So if you

look at those processes and then you look across all the different sectors, there are some that are in every sector. They are sort of like across the board. So thermal energy is used in a lot of different, from steelmaking to chemicals, and mostly, as has been pointed out, fossil fuels are used. So this is where the technology of fuel switching, in some cases, but also carbon capture and how important carbon capture would be for some of those processes. That is across the board.

Combined heat and power to be more efficient, the onsite power generation using different kinds of fuels and greater use of efficiency strategies are all things that cut across the different sectors. But then you have to get down to the different processes in the sectors and I want to say that on carbon capture we often think that this is still an evolving technology. And it is, of course, and we need a lot more work on infrastructure but today, while we are sitting here, there are two industrial applications of carbon capture currently in use, one at air products in Texas, where they are making hydrogen from reforming methane, and they are capturing that carbon. The other one is from Archer Daniels Midland in southern Illinois, who is making ethanol and that refinery produces carbon dioxide. And they are capturing that carbon dioxide and injecting into a saline geologic formation.

Other examples that are out there in the more specific areas,

manufacturing practices for steel, for instance, Lanza Tech, a company that is working with the steel industry looking at how to capture the carbon using biological methods.

I am going to do this very quickly because it is getting low here.

Apple has been working with Alcoa and Rio Tinto, a mining company, to look at different ways to produce aluminum from using ceramic anodes, instead of carbon anodes that create carbon dioxide.

DowDuPont and BASF are looking at pathways to make propylene oxide, which is a basic building chemical for many products that we know of from deicers, to food additives, to personal care items and they are looking at new approaches there.

And Lafarge Holcim and Solidia are looking at the very things that several of you have already brought up, the cement manufacturing process and how to use different approaches to both the cement itself and how it could absorb carbon but also how to use carbon in the curing -- use different approaches in the curing processes which can reduce emissions by up to 70 percent.

The last thing I want to mention very quickly is I think several people brought up the issue of competitiveness. And I think whenever looking at the policies that could help support this, including a price on carbon, looking at the trade-exposed companies in the United States and their international markets,

it is important to include provisions that will deal with that. We believe there are many approaches to dealing with that and would love to work with the committee when that time comes.

I am going to stop there.

[The prepared statement of Mr. Perciasepe follows:]

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Mr. Tonko. Thank you very much, Mr. Perciasepe.

And now we will go to Dr. Gregory, please, for 5 minutes.

You are recognized for your opening statement.

STATEMENT OF JEREMY GREGORY

Mr. Gregory. Good morning, Chairman Tonko, Ranking Member Shimkus, and esteemed members of the subcommittee. I am pleased to be here on behalf of the Massachusetts Institute of Technology's Concrete Sustainability Hub and the Portland Cement Association to talk about concrete's role in a sustainable low-carbon economy and how Congress and the cement and concrete industries can work together to achieve this goal.

I am the Executive Director of the MIT CSHub, a dedicated interdisciplinary team of researchers working on science, engineering, and economics for the built environment since 2009. PCA is a premiere organization serving America's cement manufacturers. Since the CSHub is jointly funded by the cement and concrete industries, our research teams regularly interact with companies in this area and also stakeholders who are involved in decisions related to concrete, such as architects, engineers, and contractors.

In my testimony today, I would like to provide the committee with some key actions related to the cement and concrete industries that will accelerate us on the path to sustainability in the industrial manufacturing sector.

For background, cement is the powdery substance that is mixed with water and aggregates to make concrete. If you didn't realize

there was a difference between cement and concrete, you can join my beloved mother in that esteemed club. Although cement and concrete have different manufacturer processes and emission profiles, they are inherently linked as an end use material whose impacts other emissions, such as building energy consumption or vehicle fuel consumption on pavements. Thus, it is important to consider the embodied emissions for these materials in the context of their full life cycle.

Furthermore, concrete is the most-used building material in the world for a reason. It is a relatively low-cost and low-environmental footprint material that provides critical functionality for buildings and infrastructure. It is necessary to meet societal goals for sustainable development.

There are four primary levers for reducing cement production CO2 emissions. One, improving the energy efficiency of the cement plant; two, switching to alternative fuels that are less carbon-intensive than conventional fuels, such as biomass and waste materials; three, increasing the use of low-carbon materials in the production of blended cements; and four, using emerging carbon capture on utilization and storage technologies, including in the production of new building materials.

A technology roadmap for the global cement industry estimated that meeting targets from maximum two degrees C. global temperature increase would require a 24 percent reduction in

cement industry CO2 emissions by 2050, with CCUS accounting for 48 percent of emission reductions followed by use of blended cements at 37 percent. There are fewer CO2 reduction opportunities associated with thermal energy efficiency or switching to alternative fuels and, thus, they only accounted for 15 percent of cumulative CO2 reductions.

Nevertheless, there are several opportunities to improve energy efficiency and increase use of alternative fuels and the cement industry in the U.S. has made significant strides towards these goals. However, regulatory programs are often barriers to making additional improvements. And there are some specific programs and suggested modifications that are detailed in my written testimony.

Cement production is unique from most other industrial processes, in that it has emissions associated with energy generation and the production process. Thus, even if zero- or low-carbon fuels can be used, emissions will still be a fundamental part of the process. As a consequence, CCUS is necessary to meet deep decarbonization goals and pilot programs in the cement industry are underway across the world.

Fortunately, there are several companies that are demonstrating how captured carbon may be used to produce binders and aggregates, thereby enabling circularity for these emissions. However, cost is a significant barrier to the implementation

of carbon capture technologies at cement plants, in terms of capital costs, and the adoption of carbon-utilizing materials in terms of higher product costs in the building material marketplace. Thus, there are significant opportunities for Congress to provide targeted CCUS research development and deployment funding that is specific to the cement sector and incentives for adoption of innovative technologies and materials.

Increasing the adoption of blended or alternative binders will require overcoming the risk aversion of engineer's specifying concrete. Engineers typically rely on prescriptive-based specifications that detail the types and limits of materials that can be used in concrete mixture. In addition, there is a significant burden of proof to demonstrate that new low-carbon materials will meet long-term structural and durability requirements. Supporting a shift to performance-based specification for concrete would spur innovation in the design of low-carbon concrete mixtures.

Sponsoring research on the long-term structural and durability performance of concretes using blended or alternative cements will help to mitigate perceived risk by engineers.

As you can see, there are steps Congress, industry, and academia can take together that would ensure the continued role of cement and concrete in sustainable development.

Mr. Chairman and members of the committee, we are ready to

work with you to pursue the paths toward the goal of a clean and sustainable economy together.

Thank you.

[The prepared statement of Mr. Gregory follows:]

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637 Mr. Tonko. Thank you very much, Dr. Gregory.

638 We now move to Dr. Sant, please, for 5 minutes.

STATEMENT OF GAURAV SANT

Mr. Sant. Thank you, Chairman Tonko, Ranking Member Shimkus, and members of the subcommittee for having us here today.

I am going to try and build a case or try and talk about the idea of how you really achieve net zero emissions with six talking points.

The first one is, I think, and as has been said quite a few times before, heavy industry operations are the foundation of the world that we live in. So you can look at the screen in your iPhone. You can look at the building that we are in. All of this came out of heavy industry operations. So an important part of what heavy industry does is actually provide us with the way of life that we actually have and the way of life that we live.

Of course, this comes at a price. It comes at the price of carbon emissions, which are very substantial, a third, as we heard others say. But we should also keep in mind that this is really what provides us with the standard of living that we have today and it is about a century and a half of deployment of these technologies which really leads us to where we are.

The second part, with regards to decarbonization, is we really need to keep in mind potentially the most critical need to mitigate the accumulation and release of carbon dioxide into the atmosphere is a regulatory certainty. And that being say,

regulatory certainty is the minimum pathway that we need to undertake to determine what happens next.

Of course engineering solutions are a big part of this but engineering solutions really need to focus on simplicity. We need pathways which are simple, which can bolt onto existing facilities because, as you can imagine, building a cement plant, or building a refinery, or building a steam plant, these are all really expensive undertakings. What that means is we cannot do this at substantial cost burden. So we need to think about simple ways how you do process integrations and optimizations to make sure that we integrate with existing processes simply enough without disrupting our way of life while we think about carbon management.

When we think about mitigation solutions beyond carbon capture and storage, we need to create other pathways. And I think utilization, carbon dioxide utilization is an important part of this because it can result in the production of salable products. As an example, think about CO2 concrete that we are working on, which involves the absorption of carbon dioxide into concrete.

However, I will caution by saying while these pathways are very attractive and especially so in the short-term, they are fractional solutions. So they are by no means a comprehensive pathway to carbon management but they are an important short-

to medium-term pathway to being able to think about beneficial ways by which we can reutilize CO2.

When we think about economic incentives, systematic and substantial Federal support is needed to innovate mature de-risk and bring down the cost of technologies. This is something which has happened and which continues to happen, which we will need to expand substantially so in time to come, across technology readiness levels and across both basic and applied research.

But beyond R&D support, we need to have support of policy, strategic actions and consistency messaging. This includes direct financial support, for example, grants to innovate those incorporations, targeted procurement actions, incentives, for example, tax credits, but also disincentives, penalties which actually incentivize a mechanism of change.

We need to focus on the consumer. As consumers, we are actually all each individually responsible for what heavy industry does because we are the consumers of these products. That being this case, we need to build consumer awareness and conscientiousness to achieve carbon efficiency individually and societally. This is extremely important. And, as an example, you can think about our programs in energy efficiency that we have in place for decades now. They have been an extremely important part of how we have achieved energy efficiency by imposing standards, by having products which are energy

efficient, by pointing out to the consumer that there is benefits in this. And so there is a pathway that you can follow that is based on what we will call a carbon efficiency standard.

We want to keep in mind that the U.S. provides effectively the knowledge reservoir to the world. This has come about the last 70 years or so by consistent systematic and deep spending in R&D dollars that go to U.S. universities and national laboratories. A lot of the innovations that we take granted around us going from the iPhone to the internet actually came out of these places. And that being the case, we want to make sure that we continue to provide this nature of support because we want to also establish a basis of carbon leadership industrially.

A couple of other things to keep in mind. When we think about heavy industry, these are what you classically call commodity sectors, which means that they are comparatively low profit and very high volume. And so you have got to think carefully about what are really the nature of pathways that need to be undertaken when sectors of the sort think about change. It is not easy to build a new cement plant. It is not easy to build a new steel plant.

So when we think about strategic actions, we need to think about a way that you both integrate regulatory certainty and a market pull that both demand a change in how we function.

Finally I think the closing comment to be made is really one of competitiveness. The rest of the world is looking very aggressively at standards around carbon efficiency and carbon management. You don't want to have U.S. corporations which are at a competitive disadvantage because they have got to have two standards to functions with one in the U.S., one elsewhere, and I think that particularly demands that we establish a basis of consistency, where U.S. corporations continue to lead the world in carbon efficiency.

With that, I would like to conclude.

[The prepared statement of Mr. Sant follows:]

**********INSERT 3**********

Mr. Tonko. We thank you very much, Dr. Sant.

And we now move to Mr. Eisenberg for an opening statement for 5 minutes, please.

STATEMENT OF ROSS MR. EISENBERG

Good morning, Chairman Tonko, Ranking Member Shimkus, Ranking Member Walden, for today, members of the subcommittee.

My name is Ross Eisenberg. I am delighted to be here representing the National Association of Manufacturers and talk about our commitment to climate change.

In the eyes of America's manufacturers, it is time to act on climate now. And the real question for policymakers should not be whether to act but, frankly, how to do so effectively. Manufacturers are doing our part. We have been and we will continue to do that.

Over the past decade, manufacturers in the United States have reduced the carbon footprint of our products by 21 percent, while we have increased our value of the economy by 18 percent over that same time frame. Overall, the U.S. manufacturing sector has one the world's lowest carbon intensities per dollar of GPD because we are so efficient, a fraction of the carbon intensities other major manufacturing economies like China and India.

For example, just to put a finer point on this, aluminum produced in the United States is less carbon-intensive than just about any other aluminum produced somewhere else and imported

into the United States. It is three times cleaner in that respect than aluminum produced in the Middle East and imported into the United States. It is four times cleaner than aluminum produced in China and imported into the United States. So, our efficiency is a win here for us and we should really be encouraging manufacturing to come back and really operate here because that is where it is going to be done the cleanest.

The type of deep decarbonization called for by this committee would require a dramatic set of technology and lifestyle changes across the economy. It is going to be extremely difficult. That is pretty much without question. It is going to require us all to work together here and around the world and it will, almost certainly, carry a cost. It is not, however, impossible. I want to make that clear. It is no, however, impossible and we are at the table for this discussion for that reason.

Manufacturers do appreciate the careful, considerate, deliberate approach that this committee has taken to listen to us, frankly, and to have the conversation that you are all having. In the course of those deliberations, two prevailing views have really emerged. The first is should we really be focusing on enabling innovation and the other is should we be empowering the Government to take action.

In the eyes of manufacturers, we believe we need to do both and here is why. We need innovation because the manufacturing

sector is different from other sectors and the technologies that may work in other sectors just may not work so well in ours. The process used to make a brick is substantially different than the process used to make steel, or paper, rubber, plastic, fertilizer, aluminum, not to mention finished goods like trucks, and cars, and airplanes, and food and beverage, and electronics. Innovation is and always will be the key to reducing the carbon intensity of those sectors and it is encouraging to hear everybody on this panel really say the same thing.

Innovation by itself, however, is just not going to be enough and so, for that reason, the Federal Government does have a clear role in setting climate policy. This begins by reengaging on the international stage to achieve binding fair global climate treaty. And with that backdrop, we hope that the Congress will enact a single unified climate policy that meets specific targets, ensures a level playing field and avoids carbon leakage, in other words, not simply outsourcing our carbon to another country that has lower standards than we do, and it will preserve consumer choice and manufacturing competitiveness.

My written testimony provides more details on both of these proposals but, together, we believe they should be the foundation of the U.S. response to climate change.

Now as we embark down this road, we need to have a serious discussion about cost. For manufacturers the math really does

matter. The average manufacturer pays about $20,000 per employee per year to comply with regulations. The small manufacturers pay even more, about $35,000 per employee because they can't scale it up. Any new cost imposed by a climate policy will be added to that already hefty base of costs and regulatory expenditures. So the extent that manufacturers have to bear those extra costs, Congress should consider reducing regulatory tax or other economic burdens to basically make manufacturers whole, and keep us whole, and keep us competitive.

The math also matters for the internal decision-making and I think that is something that I really want to stress today. A great deal of potential reductions are going to come from installation of new equipment, new processes -- innovation, essentially. Manufacturers budget for discretionary investments like this. They are always looking to make these investments but, at the end of the day, the decision on whether to spend that money involves consideration of a wide range of factors, including payback time, the risk of stranded investments, operating risks, reliability, environmental permitting, and external factors like the future of the plant itself in a competitive environment. Focusing on this math should be a top priority of anyone seeking to reduce the carbon intensity of the manufacturing sector.

The NAM believes we can be a part of this solution and we

look forward to working with this committee to pass and implement some of our preferred policy solutions. There are many near-term actions that we believe Congress and the administration could take to accelerate our progress towards deep emission cuts. My written statement includes a number of these and I hope we can talk about them during the Q and A section. We think these would make a real difference and ensure that emissions continue to decline in the manufacturing sector, while Congress and the administration work out some of these bigger policy issues as well.

I appreciate the time to testify today and thank you.

[The prepared statement of Mr. Eisenberg follows:]

**********INSERT 4**********

Mr. Tonko. Thank you very much, Mr. Eisenberg.

Next, we will go to Dr. Friedmann for an opening statement.

You are recognized for 5 minutes, please.

STATEMENT OF JULIO FRIEDMANN

Mr. Friedmann. There we go. Chairman Tonko, Representative -- Chairman Pallone, Ranking Member Walden, all of the members here -- I am so delighted to see so many people here for so long -- thank you, thank you, thank you for calling this hearing and for inviting me to testify.

My name is Dr. Julio Friedmann. I am the only one you will ever meet. This is the 5-minute version of the 5-hour testimony. I ask that if you have any questions or follow-ups, please invite me back. I am a resource and you know where I live.

This is an intensely difficult and complicated topic. This is not something that is easy or digestible in soundbites. You already have my testimony. I am happy to explain it in great depth but I want to take this time to hit a couple of key points.

First of all, I work at the Center for Global Energy Policy at Columbia University and we exist to provide information of this kind to people like you to help make good decisions. I lead an effort on carbon management. We have two reports coming out in the next month, all of them associated with heavy industry decarbonization specifically for heat. Fun fact: Heat for heavy industry is ten percent of global emissions -- just heat. It is more than all the cars and planes in the world together. If you have to melt a rock to do something, you need heat. Most

of our industrial processes start by melting a rock. That is properly hard. There aren't easy ways to replace that service and there aren't really reliable or straightforward substitutes for things like concrete, or steel, or plastics, or petrochemicals. We all have plenty to do. That is what the work looks like. So, to cut to the chase, a couple of facts, three findings, five ideas.

A couple of facts: The good news is that most of industrial production in the United States is concentrated in a couple of geographies -- New Jersey, Texas, California, Oklahoma, Chicago, along the Great Lakes. These things are all in one place. That actually means that there are ways to think about managing them in a straightforward way.

Another thing that is helpful to understand in this is that, as many people have mentioned, these are internationally traded commodities, for the most part. As such, the margins are small and small increases in cost and price have dramatic increases in market share. And of course, these sit in communities which have a great deal of stake in them, both positive and negative. In some cases, these are real sources of pride. They are essential sources of wealth for these communities. At the same time, many of these facilities are also sources for pollution. This question is about environmental justice associated with that. So these are fraught complex issues and that is exactly

why we need deliberation, discussion, and thought.

So a couple of other quick facts, then three findings, five ideas.

Quick facts, like I said to begin, we don't really have substitutes for this stuff. Second, the assets are long-lived. A steel plant or a petrochemical plant that exists today is going to run for a long time. That means that the idea that we will just replace it with some other thing is unlikely in the near-term. We are on the clock on climate change. So we have to make rapid emission reductions. So you have to work within the existing asset base.

And the options we have, as many people have said, are not great. We have chronic underinvestment in this sector, perhaps because we don't have a Department of Industry. I am not recommending we create one but it means that this jurisdiction is spread across the entire government in a strange way.

You may not know this but ammonia is tracked by the United States Geological Survey. That is because it is considered a mineral resource. So they are the ones who gather the data on this.

So there is plenty of stuff to do. In that context, three findings: First, as many have said here already, CCUS is essential. It is not optional in this space. Ten percent of global emissions are from steel and cement. Half of those

emissions are the byproduct chemistry emissions and we don't have processes today that are substitutes for that. So if you want to get five percent of global emissions, you have got to do that. That is it.

And you can refer to my last round of testimony. I talk on that subject in great depth. That was back in May 2019.

Second finding: Hydrogen is pretty promising. If you look at the things that can burn at that temperature or that can be good feedstocks, hydrogen is one of the good ones. Today, the way we make hydrogen that we call hydrogen, which is steam methane reforming and we vent the CO2 into the air.

At the Air Products facility that was mentioned earlier, we have what we call blue hydrogen, where we make hydrogen but we capture the CO2 and keep it underground. There is also green hydrogen, where you use green, renewable, or nuclear electrons to make hydrogen through electrolysis and you use that.

Today, green hydrogen costs five to twenty times more than blue hydrogen. So today, blue hydrogen is the best looking option. That costs about 20 to 50 percent more than gray hydrogen but it is pretty cheap, by comparison to a lot of the things we can do. It is also a gaseous fuel, which means you can swap it in with other stuff.

Last, as others have said, innovation is essential. We simply can't get from where we are to where we need to be if we

don't have a deep, large, committed program for innovation.

I have to stop there but I thank you all for your testimony and look forward to answering your questions.

[The prepared statement of Mr. Friedmann follows:]

**********INSERT 5**********

Mr. Tonko. Thank you, Dr. Friedmann.

And finally, Mr. Walsh, thank you for joining us, and you are recognized for an opening statement of 5 minutes, please.

STATEMENT OF JASON WALSH

Mr. Walsh. Thank you, Chairman Tonko, Ranking Member Walden, and distinguished members of the subcommittee. Thank you for convening this really important hearing today.

The BlueGreen Alliance unites America's largest and most influential labor unions and environmental organizations. Our partnership is firm in the belief that Americans don't have to choose between a good job and a safe environment. We can and must have both.

Reducing emissions from the U.S. industrial sector is a clear example of this principle. If done right, a robust Federal commitment to rebuild American manufacturing and reduce greenhouse gas emissions from this sector will grow American competitiveness and secure and create a new generation of good middle-class jobs across America.

The industrial sector is the largest source of emissions in the United States when electricity is distributed to its end use. And importantly, emissions are projected to increase significantly between now and mid-century by roughly 17 percent. That compares to other sectors, at least under a business as usual scenario, are projected to see flat or declining emissions. So any gains that we see in other sectors would be more than outweighed by increases in industrial sector emissions, unless

we act.

Tackling industrial sector emissions must, therefore, be central to any climate strategy moving forward. This is a significant challenge, as has been pointed out by a number of my fellow witnesses. Reducing emissions to the level required by climate math, which is pretty brutal, will require smart policies, tremendous technological ingenuity, and significant investment but we have barely gotten started.

Policymakers and philanthropy have focused, to date, on emission reductions in other sectors -- buildings, power, transportation, all for very good reasons, but the industrial sector has received relatively little attention by comparison and it will be the single hardest sector to net out zero emissions.

Tackling emissions is also an issue of global economic competitiveness. Prioritizing investments in U.S. manufacturing will not only reduce emissions but will create and retain good jobs in the United States for two primary reasons: One, a significant proportion of emission reductions can be realized by reducing energy waste, saving money manufacturers can invest in capital and in their workforces, supporting jobs through the installation of energy efficiency technologies as well; and two, U.S. manufacturers' ability to produce clean technologies and use cleaner processes will make them more competitive in an increasingly carbon-constrained global

economy.

Let me take the steel industry as an example, which also speaks to Ranking Member Shimkus' very good question which, in turn, echoed Mr. Gates' very good question. The steel industry currently generates about seven percent of the world's CO2 emissions, contributing over three gigatons of CO2 annually. Global steel demand is forecast to increase from 1.7 billion tons in 2018 to 2.6 billion tons in 2050.

There are several ways to reduce emissions from iron and steel production, including industrial energy efficiency, material efficiency and reuse, fuel and feedstock switching, and of course, carbon capture utilization and sequestration. Investments are happening today to drive these innovations and to develop cutting edge technologies and practices.

But where are these investments happening? They are not happening here. They are happening in Germany, in Sweden, in the United Arab Emirates. These types of cutting edge projects are not being built in the United States because we don't have the policies and programs in place that incent and support the kind of investments needed to make them a reality. If we don't start playing catch up, the future of innovative, low, and zero emission steelmaking will be commercialized by our global competitors in their own countries. We can't let that happen.

We need to move forward an aggressive American agenda to

regain our leadership in clean technology innovation and deployment and we need to do it now. We need a holistic approach to retaining and growing clean energy manufacturing in the U.S., while also investing in these industries to make them the cleanest and most competitive in the world. These investments must result in good paying jobs and go hand in hand with common sense tax procurement and trade enforcement policies to stop the offshoring and leakage of jobs and pollution, as have been noted by a number of witnesses and members of this committee.

My written testimony outlines a number of specific policy recommendations to achieve these goals.

In closing, we look forward to working with this committee as you move forward your agenda for the 116th Congress. Thank you again for the opportunity to testify today.

[The prepared statement of Mr. Walsh follows:]

**********INSERT 6**********

Mr. Tonko. Thank you, Mr. Walsh.

So that concludes the opening statements provided by our witnesses. We now will move to member questions. Each member will have 5 minutes to ask questions of our witnesses.

I will start by recognizing myself for 5 minutes.

We know that there are challenges but we should not underestimate what can be accomplished over the course of a few decades. If we start right now putting in place the right incentives, the research investments, and standards, how much progress can we make by mid-century to decarbonize industry? And what is your recommendation for the very first thing we should do to get started?

Let's start with you, Mr. Perciasepe. How much progress can we make and what is the first thing we should do?

Mr. Perciasepe. Well I think what you heard from a lot of the witnesses is that there is a lot of progress already underway, including some of the very difficult pieces that have been mentioned by members in their opening statements, in steel and in cement. Those industries we have to look at how to improve the actual processes.

But one other thing, there is also companion activities here because all of industry uses electricity. And so to the extent that we are decarbonizing electricity with other approaches, with renewable energy, nuclear, and carbon capture, the electricity

that the industry will be getting is going to be cleaner and there is also transportation moving the products around.

So I think that probably the first thing to do is, at a minimum, is to put more incentives in place to stimulate the innovation of the new technologies, ones that cut across industrial sectors like carbon capture, and we have some of that already as has been mentioned under the Tax Code, 45Q, but also the innovation needed in these new processes for making steel, making steel or iron, pure iron from a reduction with hydrogen as opposed to the current methods. It uses a lot less -- creates a lot less carbon dioxide just to make the iron. That is, obviously, the main ingredient in steel.

So these processes that companies are working on could really be accelerated with public incentives.

Mr. Tonko. Thank you.

Dr. Gregory, what progress can we make and what is the first thing we can do?

Mr. Gregory. I think that actually one of the simplest things that can be done that are specific to the cement and concrete sector are related to this use of performance-based specifications that I mentioned because you know we heard a lot of discussion about CCUS, which should definitely be done but, if we develop new materials that have a lower carbon footprint but we can't create a market demand for them, then they won't

be used. And we have already seen failures of companies that produced these things in this country, who couldn't do it in a cost-competitive way and also couldn't get adoption of this from engineers who use it. And so encouraging, essentially, engineers rather than to say this is the mixture that we have already used that is something safe and we know, get them to say what are the performance metrics that you are interested in and then tell me what the measurement is of the carbon footprint as well.

And believe it or not, that seems like a simple and obvious thing but it is sort of like instead of using a specific recipe to make cookies, tell me what are the kind of cookies that you are interested in. What are the attributes of them? That is what we need for materials as well, to create demand for these low-carbon materials.

Mr. Tonko. Okay. We have about 2 minutes remaining for my time. If we could just get quick answers from the remaining four witnesses, please.

Mr. Sant. Sure. Very quickly, I think the two things that we should really try and focus on is really, number one, carbon efficiency standards, which we can apply across the nation, across a series of products.

The second part, technologically, we have done a lot of work to develop new technologies. The issue with most of them is we have not demonstrated them suitably at scale. So I think we

really need support to be able to demonstrate things at relevant scales so that manufacturers can start to see whether these are cost-effective enough for them to actually integrate into their operations.

Mr. Tonko. Thank you.

Mr. Eisenberg.

Mr. Eisenberg. We all agree that innovation is the key here. Please give us the tools to do it. We need the incentives. We need the access to the labs, the partnerships with the Federal Government and within the private sector, and we need to make sure that the math works at the plant level.

Mr. Tonko. And how much progress can we make?

Mr. Eisenberg. We can make a lot of progress, especially in the near-term, especially since you are going to have a lot of hard decisions to make on the federal policy side. But getting that in now, funding those things up and giving us access to them, will make an appreciable difference and a real difference for manufacturers.

Mr. Tonko. Thank you.

Dr. Friedmann.

Mr. Friedmann. A comprehensive approach could get us 65 to 75 percent. We could get a lot.

The number one thing: procurement. You said it yourself, Chairman. The number one thing is procurement.

The Government buys 60 -- sorry -- 90 percent of cement and concrete, 50 percent of the steel that is made in this country. You guys have an outsized role. And by driving that procurement process, you can create new customer base and new options for the manufacturers themselves, so that they can sell a better product into a better market.

Mr. Tonko. Thank you very much.

And finally, Mr. Walsh.

Mr. Walsh. We need to deploy the technologies that we already have commercialized more fully -- industrial energy efficiency, co-generation. We can carve about 15 to 20 percent emissions out of the industrial sector as a whole.

Industrial sector decarbonization is really hard but one of the ways in which it is easier is that we know where those facilities are. We also know from DOE's Barriers to Industrial Efficiency Report, which was issued in 2015, that one of the primary barriers for manufacturers is lack of information. They don't know the technologies are out there. They don't know the payback times. They don't know different pathways. We have got a whole set of resources that DOE, the Advanced Manufacturing Office, international labs, that could be put -- could be brought to bear. It is nothing but benefit for U.S. manufacturers.

Mr. Tonko. Thank you very much to each of our witnesses.

I then will now recognize Representative Walden for, as the

ranker for the full committee, for 5 minutes to ask questions.

Mr. Walden. Thank you, Mr. Chairman. I want to thank all of you. This has been a really good panel and we really appreciate your input and your counsel on these issues and they are not easy. It is far beyond just a slogan. We have got a lot of important work to do.

Dr. Gregory, we are glad to have you here. I understand you grew up in Bend, Oregon. So there are two of us from the Second District here, at least. We appreciate that.

Mr. Eisenberg, our view is the path to cleaner technology comes from the ground up from innovators, from investors. We know you have got to have the right incentives.

Can you speak to the importance of the 45Q tax credit, which we extended as part of the tax bill? It has two different variants to it. Is that having a positive impact and incentive in the market that we want to see a result from? Is it working?

Mr. Eisenberg. So it is working to the -- and I am hearing it from my members. We actually recently this year brought in a group called the Energy Advance Center into the NAM. It is a project of the NAM. It is manufacturers that came together around the 45Q tax credit and are looking to try to find ways to turn that into innovation on the ground, principally, in the oil and gas sector but definitely other manufacturing sectors as well. We are going to need it all.

There is a lot more we can do beyond that but it was a heck of a start. And it is one of those things where you can use incentives and they work. I mean we saw it on a number of issues in the energy space, and this is no exception, where incentivizing the technology has brought manufacturers out of the woodwork ready to actually test some of this and put it into place.

There is plenty more that we can do in this space, including starting with enacting the USE IT Act and passing the USE IT Act.

Mr. Walden. Right.

Mr. Eisenberg. But also, things like port space, ownership, and plenty of other issues to get this off the ground but it is good to hear that we all agree that this is important.

Mr. Walden. Yes, I think so. And I guess I approach it from how do we give the carrot as opposed to the stick. I mean that is where I tend to come down and not over-regulate, or overtax, or whatever on the Government side of this but, rather, how do we put in the incentives in place for our great innovators to respond and act?

And Dr. Gregory, and Mr. Eisenberg, Oregon's only cement manufacturing plant, as it turns out, would be in the district I have the great privilege to represent in Durkee, Oregon. It employs about 100 people, directly effects around 600 jobs in the area, which is enormous in this very rural county, as you know. It is a very trade-exposed plant. And I have been out

there. I have toured it. They have invested tens of millions of dollars to reduce all kinds of emissions, mercury, everything else. They really do care about the environment.

It costs roughly the same amount to ship the cement they manufacture to Portland, Oregon, not Portland cement but Portland, Oregon, as it does for China to ship their cement from China to Portland, okay, which is pretty hard to believe but that is what they tell me.

And our concern is if Oregon replicates some of the other climate proposals and policies, we could end up losing that plant and those jobs, and cleaner emission cement. And as a result, they estimate we would import the cement and it would be 400,000 tons more per year of emissions globally. So as I sort through these policies, we don't want to do that.

And in fact a lot of the mercury pollution we get on the West Coast I am told originates from Chinese manufacturing.

And so do you see -- how do we work through these trade-exposed policies, especially on cement? Dr. Gregory, can you comment on that?

Mr. Gregory. Yes, sure. I mean China makes more cement than the rest of the world combined. Right? And so the U.S. manufacturers two percent of the world's amount of cement.

Mr. Walden. And do they -- what standards? Is there a graph of standards here for cement emissions?

Mr. Gregory. There very much is a range. And as many of the other panelists here have mentioned, you know trade leakage is a really significant concern if we shift the standards that we are using to produce cement here today.

I think, just like we also heard, the power of -- the purchasing power that Government has, whether that is at the federal, or the State level --

Mr. Walden. Right.

Mr. Gregory. -- or even municipal levels --

Mr. Walden. Right.

Mr. Gregory. -- Oregon is one of the states that is really looking at the concrete that it produces. What is the quality of it? And I think whether it is efforts going on in the City of Portland or in the State of Oregon to look at that, that is a great place to start to ask producers, local producers, where did you get this. What was the quality of it?

Mr. Walden. Right.

Mr. Gregory. What was the environmental footprint of it? And ask for that. And have that start out. Producers will --

Mr. Walden. But do we have data on the amount of emissions from Chinese manufacturing or some other country -- I am not just picking on China here -- versus U.S. manufacturing for the same products? Is there a place where consumers can go and see that?

Mr. Gregory. Yes, we do have some high-level numbers on

overall Chinese emissions. What is a little bit different is getting data from individual plants, where there can be significant variation. The types of cement that they make are a little bit different than what we make in the U.S.

Mr. Walden. Right.

Mr. Gregory. So it is not quite an apples to apples comparison.

Mr. Walden. Right. Right.

Mr. Gregory. And so that ends up being a little bit --

Mr. Walden. Because any consumer power is really powerful.

Mr. Gregory. Absolutely.

Mr. Walden. And disclosure, and information, and we were just talking about your comment, Dr. Friedmann, maybe Mr. Walsh, this information is not even available for some.

I know my time has expired, Mr. Chairman. Thank you.

And again, thank you all for your participation in this.

Mr. Tonko. The gentleman yields back.

The chair now recognizes Mr. Pallone, full committee chair, for 5 minutes to ask questions, please.

The Chairman. Thank you Chairman Tonko. And let me thank all the witnesses for your testimony and assistance in developing policy solutions to achieve 100 percent clean economy, while keeping and increasing good jobs here at home.

But I want to -- I don't have a question for Mr. Eisenberg

but I did want to particularly thank him and the National Association of Manufacturers for your very constructive testimony. Thanks so much.

Mr. Eisenberg. Thank you. It is my pleasure.

The Chairman. It wanted to start on the topic of jobs. And Mr. Walsh, you testified, and I quote, that if done right, federal climate policy can help not just maintain but grow American competitiveness in the global economy.

So let me ask you what would be the number one thing you think we should do now to position American manufacturing to lead and produce low-carbon products, if you will?

Mr. Walsh. Well, I think we need to start by recognizing where we have already done that, right, where we have increased U.S. manufacturing competitiveness, while also reducing emissions. One of those sectors, of course, is the automotive sector, right, through a combination of very careful fuel economy standards, coupled with manufacturing policy. We have a whole generation of autoworkers that are making a high-efficiency, in some cases, zero-emission vehicles not only for markets in the United States but for markets abroad.

The challenge is more -- I think the bigger challenge in front of us is the energy-intensive commodities manufacturers that I talked about in my testimony and that several other witnesses have spoken to. We are going to need to do a whole

lot of things at the same time.

I have already talked about industrial energy efficiency. I want to emphasize high-temperature heat and the importance of finding low- and zero-emission alternatives. I mentioned some of the exciting innovations going on in Europe and a few other parts of the world. We need the same thing here. In order to get it, we are going to need a whole set of policies that range from making sure that manufacturers have access to affordable capital, to technical assistance, to consistent and smart regulatory and tax policy.

The Chairman. Thank you, Mr. Walsh.

I wanted to move to carbon capture. When we talk about the U in CCUS, people often think of enhanced oil recovery as the default way to utilize captured CO2 but, as we know, there are many other potential uses for captured CO2, including in the type of product that Dr. Sant is developing at UCLA.

So I just wanted to pose this question to three of you, to Dr. Sant, Dr. Friedmann, and Mr. Perciasepe: What are some of the more novel uses for captured CO2 and how can those uses be developed, both economically and at scale?

And let's begin with Dr. Sant and then we will go to the other two, if you would.

Mr. Sant. Thank you. That is a very important question. So you know when we started to work on this, and I think I will

speak to the context more generally, is we really wanted to look at markets where you can use a substantial quantity of CO2, which is why we started to look at concrete as an example because it is a large market globally. It is also a carbon-intensive commodity. So being able to rationalize its carbon footprint is important.

There are other things that you can produce, some of them which are competitively large, some of which are smaller. So you could produce liquid fuels as an example. You could also produce things like formic acid.

I think the question around utilization is extremely significant because first, to point out, it is highly unlikely we will ever use anything more than 10 to 15 percent of global emissions to be able to produce product. So it is not a pathway for carbon management, relatively speaking. However, it is an important revenue generation pathway to undertake in the short- to medium-term to be able to create utilization solutions. However, I think we need to be very pragmatic and analytical about utilization solutions to make sure that the life cycle analysis does actually demonstrate that you are using more CO2 in the utilization step than you make. And I think this is something that we often lose sight of but I think this is something we need to be critically focused on.

So as an example, speaking for ourselves, it is something

that we have taken into great account as we have looked at developing cementation solutions based around CO2. But I think this is a sentiment that really requires standards and bases of analysis to be able to actually effect utilization properly.

The Chairman. I think I am going to run out of time but I said Dr. Friedmann next. So, we will go to him.

Mr. Friedmann. I will be brief.

Along the lines of what Dr. Sant just said, you can't balance the climate books on utilization. There is just not enough tons to put places but you can get a couple of gigatons. And the markets where you can get a couple of gigatons start with cement and aggregates. The next big market is fuels and chemicals. I have written three reports on this. I am happy to send them to you all.

The Chairman. Doctor -- I mean Mr. Perciasepe.

Mr. Perciasepe. Some people do call me doctor every once in a while.

The Chairman. That is all right. Maybe you are. I don't know.

Mr. Perciasepe. I would concur with Julio that building materials and fuels are the most likely to be at scale but you asked for some of the interesting things.

Well you know there is complex materials like carbon fibers and nanotubes. There are agricultural products, including

fertilizers. There is a number of things that people are working on all across the board but those two are the most likely for at-scale that we need in the near-term.

The Chairman. Thank you.

Thank you, Mr. Chairman.

Mr. Tonko. The gentleman yields back.

The chair now recognizes the representative from Washington State, Representative Rodgers, for 5 minutes, please.

Mrs. Rodgers. Thank you, Mr. Chairman. And I, too, want to thank all of the panel for being here today. I appreciate your leadership, your commitment to making our economy more efficient, more sustainable. It is essential.

As others have highlighted, the U.S. already leads the world in reducing emissions, in developing new and innovative technologies to increase efficiencies and reduce waste. As plan for the best way forward for a clean energy future, we must ensure that we do not harm our competitiveness in an increasingly global economy. It is really free market innovations that have made the U.S. a leader in both emissions reduction and technological solutions, such as carbon capture.

Unnecessary burdensome regulations will only succeed in hamstringing our manufacturing economy. And we are celebrating right now 500,000 jobs, new manufacturing jobs in America. We do not want to be forcing these jobs overseas to countries like

China and India, who account for a disproportionate share of global emissions. From my perspective, we should be encouraging new innovations and technologies that can increase efficiencies and decrease emissions.

You know in my home State of Washington, emissions have increased six percent since 2012 and this is despite Governor Inslee's increased mandates and regulations on our energy and industrials. By developing and exporting new processes and new technologies to the developing world, we can continue to lead the world in emissions reductions and remain competitive in the global economy.

Innovation is the key to combatting climate change, growing the economy, and raising the standard of living in our communities.

Mr. Eisenberg, I would like to discuss the central role of global competitiveness when we develop these industrial emissions policies, from past experience as a parent, that there is a tremendous risk to our ability to make and do things in America, if policymakers impose unnecessary cost on industrial processes and the energy used in those processes.

Would you just share with us from your perspective what we can be doing as policymakers to make it less expensive and more efficient for manufacturers and industry to innovate, rapidly deploy, and eventually export new products?

Mr. Eisenberg. Thank you for the question. And I really appreciate, frankly, everybody's commitment to manufacturing here. I mean it is so encouraging to hear everybody talk about how important manufacturing is in your districts into the future. We obviously feel that very, very strongly. That is why I took this job.

There is a number of things in the climate space and in the emissions space that I think would really work here, especially in the near-term. It starts with -- and a lot of them are in my testimony. I will quickly run through a bunch of them.

First things first. There is a bill called the Clean Industrial Technology Act that came out of the Science Committee and I believe has dual jurisdiction here. It would create, basically, a program at DOE that would have sort of long-term advanced focus on decarbonization of the industrial manufacturing sector. That is one way to really get us out there doing this kind of work with the Government and with the labs in making it happen. Ratify the Kigali Amendment or enact legislation that will get you there, that will reduce serious tonnage and keep us competitive on the greenhouse gas side.

Scale up energy efficiency. Scale up energy efficiency. This is something that I think we are all saying. My counterpart Jason said it best. This is where we really need to focus on the math and give us the tools to install that stuff with the

right payback period. Full and complete expensing in the Tax Reform Bill made a big difference to a couple of my manufacturing companies. It gave them the opportunity to change the math and allowed them to put in things like CHP and some of those newer technologies to let them be more efficient, the permitting process, the work you are doing on NSR, reauthorizing Title 41 of the Fast Act. There is plenty more I can get into but these are all kinds of things that we think would be bipartisan strong measures that we can do right now that would help keep manufacturing competitive while reducing our emissions.

Mrs. Rodgers. Great. In the time I have left, Dr. Gregory, I wanted to ask if you would just elaborate more on the promise of carbon capture and just what is your understanding as far as what other countries are doing related to carbon capture.

Mr. Gregory. Sure. Yes, carbon capture for cement plants is a little bit different than it is for other types of industrial sectors because we have these two sources of emissions; one set associated with generating energy for the kilns that operate at over 2500 degrees Fahrenheit and another set that comes from the process of making the cement itself.

So there are pilot plants that exist, that I know of at least, in Canada, and in Germany, and I believe one in China, as well, where they are testing these out but they only occur when there is a significant decision to be able to invest in those things.

And basically, a lot of them are very small scale in order to pilot them but in order -- it is a fixed cost on top of the production of cement. So in order to really accelerate that there needs to be additional incentives or investment in order for that happen.

Mrs. Rodgers. Okay. Thank you for that. I have run out of time.

But I think we also should be promoting those policies that are going to encourage carbon capture. I yield back.

Mr. Tonko. Thank you. The gentlelady yields back.

The chair now recognizes the chair -- vice chair of the full committee, Representative from New York, Representative Clarke, for 5 minutes.

Ms. Clarke. I thank our chairman, Mr. Tonko, and our Ranking Member Shimkus for convening this important hearing on how we can protect our environment from industrial emissions and increase American competitiveness in the global economy.

Now we have heard already today greenhouse gas emissions from the industrial sector holds a major challenge to tackling the climate crisis. When you include the energy that industrial facilities purchase from the electricity grid, the industrial sector as a whole is actually the single largest source of greenhouse gas emissions in the United States, larger than each of the buildings and transportation sectors and these emissions

are growing. While the emissions from the other sectors of our economy are projected to decrease or stay relatively flat, industrial sector emissions are actually projected to continue increasing over the next 30 years.

But there is good news, too. Many solutions already exist to reduce emissions from certain industrial sources today. And where the solutions don't yet exist, there is still significant room for innovation. Therefore, as we strive towards a 100 percent clean economy by the year 2050, it is important that we continue to think openly and critically about the challenges, so that we in Congress can create the right policies and programs to foster innovation, reduce pollution, and help the U.S. industrial sector lead the world towards a low-carbon future.

My first question is to Mr. Walsh. There are some who would continue to put forward a false narrative that we must choose between the environment and our economy. However, those of us who have studied this know that the opposite is true. By cleaning our economy, we can also increase the competitiveness of our manufacturers on the global stage.

Could you please talk a little bit more about the global marketplace for industrial goods and about the demand for products that are made under cleaner industrial -- excuse me -- environmental standards. Just how far behind is the U.S. in this regard and what will happen if we do not catch up?

Mr. Walsh. Thank you for that important questions, Congresswoman. Yes, let's talk a little bit about global competitiveness.

I think what we need to recognize is that the rest of the world is already moving in terms of their industrial processes and the policies and investments that support it in a low- and zero-carbon direction.

We are actually lagging behind. There are various ways in which we are doing that. Certainly, the fact that we have withdrawn from the Paris Agreement, or in the process of doing that, the only nation in the world that is, is a significant signal. But as you pointed out, this is not just an issue of equity. It is also an issue of competitiveness.

So we want workers in the United States to be building the products that we know are going to be demanded around the rest of the world, whether that is low-carbon steel or high-efficiency light weight vehicles, or even appliances that have gasses in them with low global warming potential. We have talked mostly about industrial sector emissions. We have talked less about the way in which the industrial sector, if we decarbonize it, can lower embedded emissions in the products that we sell to the rest of the world as well and that includes a range of things from automobiles to appliances, to you name it.

So you know when we talk about global competitiveness, I

think your question is really on point because we need to be talking about where this world is going, where markets are going, and where we are falling behind.

Ms. Clarke. Dr. Friedmann, I saw you somewhat nodding and pointing. Did you want to add to that?

Mr. Friedmann. Yes, absolutely. This is a key question that always comes up is well, how do we think about China and what makes sense because they are a huge source of industrial emissions.

We have to have a better product to sell. We have to have a better technology to sell. We have to have better manufacturing to deliver those. So we actually have to invest in the innovation. We have to build plants and we have to do things like protect the workers in those sites for things like a procurement standard, or a border tariff, or some international partnership. And that is actually how we can drive down emissions in the rest of the world, as well as in the United States.

Ms. Clarke. As we clean our economy and make our companies more competitive stage, it is extremely important that we create good-paying jobs, especially in low-income, black, and Latinx communities, who continue to suffer most greatly from environmental pollution and economic inequality.

Mr. Walsh, can you ensure, as we work towards a clean economy, that investments are also made into good-paying domestic jobs

and that new pathways are created to bring more young people of color into our future of industrial and manufacturing workforce?

Mr. Walsh. Yes, let's start by acknowledging that generations of economic and racial injustice have disproportionately exposed communities of color and low-income communities to pollution, and as well to climate threat.

So they need to be at the front of the line for new opportunities as we build new products and reconfigure our manufacturing sector. I think there are some very intentional ways in which we can do that. In the construction industry, we have seen models that involve community workforce agreements, community benefit agreements, which include local hiring pathways for folks in those communities into the jobs that are being created. We are beginning to see some of that in the industrial sector in automobiles, in particular. I think we need to see more of it.

We also need to be constantly paying attention to the issue of environmental justice. Right? So let's also talk about the importance of regulation. Right? Let's talk about the importance of making sure industrial plants don't blow up which, of course, not only kills or injures workers, it also kills and injures people who live on fenceline communities.

So we need to be weighing both of those.

Ms. Clarke. Thank you very much.

Mr. Chairman, I yield back.

Mr. Tonko. The gentlelady yields back.

The chair now recognizes the representative from West Virginia, Representative McKinley for 5 minutes, please.

Mr. McKinley. Thank you, Mr. Chairman.

Dr. Gregory, I am probably the only one on this panel who has ever written a specification for concrete. I have been writing concrete specs or been involved in it since 1965. And one of the things that pointed out was the fight we had, the contradiction where people wanted to use fly ash as a hazardous material, would not allow it to be used in concrete. Without a doubt, I think you would say we want to continue to use fly ash in concrete.

Mr. Gregory. Yes. Yes, absolutely.

Mr. McKinley. So we were able to prevail on that. There was quite a fight on that.

But I want to learn from the rest of the panel here on this. I think this concept of being able to get down to zero emissions, it can be achieved. It is going to be very expensive to do that but we can achieve that. But the concern I have is we are addressing America. We are not addressing our competitors.

And we know that Gina McCarthy would come before this panel in years past and she would say, yes, we can do these things. We can lower emissions in America but it won't really make any

difference. She said she recognized that what it was going to do to the whole greenhouse gas problem of the globe but she said we are trying to get people to -- we are going to lead and the other nations are going to follow.

But it was John Maxwell that said a leader has no followers is merely a man taking a walk. And I am afraid what has happened here in America is we are just taking a walk. We are not getting other nations to follow.

Look at greenhouse emissions over the last 16 years. In America, those emissions, and several of you testified, that America is already voluntarily reducing its emissions by 16 and I think, Eisenberg, you might have even said 21 percent.

We are already making those reductions. But in the meantime, India has increased its emissions by 235 percent and China by 290 percent. They are not following what we are doing. We are putting ourselves at disadvantage.

So what I would like to hear from you is why should we expect any other nation to follow our lead? Why are they going to put themselves at a competitive disadvantage by us making that reduction? Why are they going to adopt that?

Can any of you -- Eisenberg, do you want to share on that?

Mr. Eisenberg. So we agree with that sentiment wholeheartedly and that is specifically why we have called for us to reengage on the international scale and get a real good

agreement in place that is fair and equitable. And we will make sure that we are not putting ourselves at a disadvantage. It has got to be the backbone of our climate policy.

Mr. McKinley. But how? Don't go 30,000 feet with me. How do we get it? Is it in a trade policy or what are we going to do to get other nations to adopt so we are on a level playing field? Because I am afraid what is going to happen is more and more of our companies, the industrial companies are going to locate or essentially go offshore and outsource their CO2 emissions because it is going to be cheaper to operate someplace else.

Mr. Eisenberg. I mean I think there is a very real concern here and that is why -- I mean it is 30,000-foot because we haven't really gone there but we made a lot of progress last time when we engaged internationally. There is more to be made.

We really need to get this right and there is a lot of different ways to go about it.

Mr. McKinley. Give us a policy. How do we adopt -- what is a policy that would allow us to be competitive -- excuse me -- that would force other nations to adopt a standard that we all are producing it under those little missions?

I see your hand up. I just wanted Eisenberg to finish his thought because I wanted something more specific, not 30,000 feet.

Mr. Eisenberg. No, I appreciate that. I won't take too

long.

So all countries have to, including all of the major emitters have to agree to reductions. Right? And there can't be this inequity of some countries basically getting a free pass until 2030, 2040, 2050, while we impose stuff on ourselves. It has got to be enforceable. It has got to be transparent. It has to be pro-trade. It has to be innovative. It has to be enforceable by the WTO. I mean these are all things that we are going to need to make sure that that leakage doesn't happen and that we stay competitive.

Aluminum is a good example, right? So --

Mr. McKinley. Go ahead. You seem to have drifted up to 30,000 feet again. I want to hear specifics.

Mr. Friedmann. I have got three discrete policies that can do the job.

Mr. McKinley. Okay.

Mr. Friedmann. So those are in my testimony. One of them is a border tariff. This is a topic which is extremely difficult, extremely dangerous, and extremely fraught. I don't say that lightly. But it is an option.

If we had a border carbon adjustment, that would protect U.S. workers in U.S. industries, as long as we decarbonized, and it would advantage us compared to some of those other countries. If they wanted to sell to us, they would have to hit that standard.

Second option, something basic like the Montreal Protocol, where you have a sectoral group working together. We have multiple countries coming together and they all set a standard for emissions for steel. You do that with the EU. You do that with Canada. You do that with Mexico, the United States, you get a bunch of countries together. At that point, they create a market that those other countries can't sell into. Japan, Korea, China, India, they can't enter those markets if they don't hit that standard. So you can either go alone or you can go together.

The third thing is you can just be better. You can just have a better product and that is a combination of procurement and innovation.

Mr. McKinley. Okay, thank you. And Dr. Friedmann, I do hope you come back. You seem to be colorful in your presentation. I like your passion.

Mr. Friedmann. I told Chairman Tonko that when I was in government, I hated testifying. Now that I am out of government, I love testifying.

Mr. McKinley. It is a sickness.

I yield back.

Mr. Tonko. We are just so happy you are having fun.

The gentleman yields back.

The chair now recognizes the gentleman from California,

Representative Peters for 5 minutes, please.

Mr. Peters. Thank you, Mr. Chairman. It has been a fascinating hearing. Emissions from industrial sectors account for over a third of global carbon emissions and just steel, cement, and basic chemicals account for a little more than over half that total.

To me, it sounds like we have got sort of three general challenges. One is an infrastructure challenge. What is the infrastructure that needs to be built out to accommodate these changes? Second, what would a standard look like, a carbon standard that we would measure against? And third, what are the incentives we could get for industry to adopt these things, given that we have very low margin businesses and we have international competition?

Dr. Friedmann, I am going to go you first, at the risk -- the one thing we have noticed is, as happy as you are, you are bad at the clock. So I want you to briefly explain to me kind of -- you talked a little bit about how there is an advantage that some of these things were located together. There is an implication about infrastructure in that. I would like you to follow-up on what pipeline and transport infrastructure might look like and why that is important to carbon capture and utilization.

Mr. Friedmann. Thank you. I am guilty as charged.

As my testimony says, a massive important option to exercise is building CCUS infrastructure.

Mr. Peters. What does that mean?

Mr. Friedmann. That is mostly pipelines. Just as one example, though, 28 percent of the U.S. emissions come from Texas and Louisiana in the Gulf Coast, all around those petrochemical facilities. You could get about a third of those emissions, maybe half of them, if you had a pipeline that connected them together and good dedicated storage sites.

Mr. Peters. So carbon dioxide pipelines -- CO2 pipelines.

Mr. Friedmann. CO2 pipelines.

There are other things you can do. Hydrogen pipelines are inevitable. We are going to build those someday. We should think about it. If we want to electrify these things, we are going to have to add high-voltage transmission lines into these facilities, which don't exist today, necessarily, or may not have the capacity. But the big lever is CCUS and that means the big lever is CO2 pipelines.

Mr. Peters. Okay, good.

Let me ask about incentives, what a carbon standard would look like. Dr. Sant, you talked a little bit about that. What would be the metric you are talking about? How would we measure success in this area?

Mr. Sant. So I think there are a couple of ways to do it

but I think we really want to look at what is the amount of carbon that is emitted over the course of production of any given material or product that we want to consider. You could consider it for something like cement. You could do it for something like steel.

Mr. Peters. Would it be per unit? Would it be carbon per unit of cement?

Mr. Sant. Per unit mass, as an example, per pound, per ton, per kilograms, choose as you may.

And the reason that a ranking system of this sort becomes useful is then you can start to take lots of different which are produced, for example, in different places, in different locations, not only in the U.S. but internationally. And then set criteria on what your minimum for, as an example, purchasing might be.

So if you are a private buyer versus the Government that decides to implement a procurement standard, you can actually start to say we will only buy a product if it is at or below a particular carbon efficiency standard. And that turns into a really powerful way of forcing both the public and the private sector to act.

Mr. Peters. Okay, good. Thanks.

And then finally I did -- you know I would like 15 minutes to talk about all these things but I just wanted to touch on what incentives would look like. We talked about incentives for

business to adopt this.

Why is Germany doing this, Mr. Eisenberg? Is there a profit in this at some level? What would it be that we would have to do to get businesses to want to invest in this?

Mr. Eisenberg. So it is tough to compare the U.S. and Germany for a couple reasons. One is, obviously, the fuel sources available to us. I mean we have tremendous energy from all kinds of different sources. And so it needs to be a technology discussion first and foremost, rather than you know I mean they don't have all of the natural gas that we have and things of that nature.

But certainly, they have a very top-down approach. They passed a --

Mr. Peters. Well, forget about them because we don't want them but what is it about? What should we be doing, as Congress, to incentivize American business to make these investments?

Mr. Eisenberg. So we absolutely believe incentives to work. You know they are not the only way to get there but --

Mr. Peters. What do you mean by incentives?

Mr. Eisenberg. So --

Mr. Peters. Because they can be carrots or sticks.

Mr. Eisenberg. So carrots, obviously, would be preferential. Right? There is -- you look over time at the different carrots that have kind of worked in the energy space,

in terms of electric vehicles, in terms of carbon capture, in terms of you know different types of energy sources. They do make a difference and they help bridge that gap towards commercialization. They are not the only way to do it. They are a big deal.

Certainly in the energy efficiency space, I think that is really one that, especially in the industrial sector, that we need to focus on. Because at the end of the day, so much of that, as much as and everybody is saying like 50 percent could come from industrial energy efficiency deployment.

Mr. Peters. I get that.

Mr. Eisenberg. And so changing that math so that --

Mr. Peters. I have got to write language that says this is an incentive to get your business to invest.

Dr. Friedmann, do you have any ideas on what we might do, as Congress, to incentivize these investments?

Mr. Friedmann. First, create a procurement standard. Second, exercise it. Period.

If the Army Corps of Engineers could buy low-carbon concrete and were directed by Congress to do it, and the standard was written by NIST and other experts like Dr. Gregory and Dr. Sant, then it could just be done. Ninety percent of cement and concrete is bought by governments.

In addition to that, just super quick, the cost for the

finished product goes up one percent. If you doubled the cost of concrete in the United States, the cost of a bridge goes up one percent.

Mr. Peters. Okay.

Mr. Friedmann. So the actual cost to the taxpayer is relatively light in terms of this but it gets U.S. companies doing stuff. It incents them to have a better product. That is, I think, where we want to go.

Mr. Peters. Okay, thank you.

My time has expired. Thank you, Mr. Chairman.

Mr. Tonko. The gentleman yields back.

The chair now recognizes the ranking member of the subcommittee, Representative Shimkus, for 5 minutes.

Mr. Shimkus. Thank you, Mr. Chairman. I apologize for being absent. I was in another meeting that I had to attend.

But let me go to Mr. Walsh first. As he knows, U.S. Steel Granite City Works was idled in December 2015 due, in part, to pressure from Chinese steel dumping. In January 2017, part of the facility reopened, bringing back about 730 United Steel Workers to the plant. My grandfather worked in this steel mill years ago.

In March 2018, President Trump announced he would impose tariffs after the U.S. Department of Commerce Section 232 investigation and U.S. Steel announced it would reopen the blast

furnaces at Granite City and ramp up production soon after.

Over Labor Day this year, workers at the facility were even talking about mandatory overtime. That is good. Regardless of whether one approves of the President's approach to trade or not, nobody can deny that cheap Chinese steel produced under lower environmental standards is a threat to our workers and the climate.

If we impose additional cost on domestic steel production, what do you think would happen to the workers at Granite City?

Mr. Walsh. If it is done well and smartly, which we have been talking about, so in a context where we might be looking at different policies doing something around border adjustments, it could be a win-win.

If it is done badly, of course, we offshore jobs.

Mr. Shimkus. Thank you.

Mr. Walsh. There is I think on this full panel absolutely no support for the idea of offshoring U.S. manufacturing jobs.

Mr. Shimkus. Right. No and I think that is a major point. We have got to be careful in this debate that we don't offshore these jobs or lower environmental conditions and for workers. So I appreciate that.

And we would -- I mean based upon your answer, you also kind of alluded to this. If we offshore these steel worker jobs and the plants, what would be the net environmental impact?

Mr. Walsh. Bad. Bad because it would be offshored to countries that have lower labor standards and environmental standards.

Mr. Shimkus. Thank you. Exactly.

Mr. Eisenberg, thanks for being here. For 20 years I have been talking about new source review. You had mentioned it in your testimony. That is low-hanging fruit. I would say, why don't we go there?

Mr. Eisenberg. I have been asking the same question. In fact, I testified on it a couple of years ago and asked the same question. This seems like an easy one, right?

You know this has been a barrier, both real and perceived, to the installation of equipment that would be more efficient and would reduce pollution at the manufacturing shop floor. Fixing this program, to cure both the real and the perceived impacts of this would do a lot. And it is just one of the many things that will help us get those things into the line. We think it is so important.

Mr. Shimkus. Yes, and for my colleagues, the basic premise is, correct me if I am wrong, you have clean air standards. You maintain those clean air standards so the boilers and emissions are already under the Clean Air Act. You replace a generator with a more efficient generator. No effect. The emissions are still the same but because of the rules and regs, we have to totally

re-permit that facility. So there is an example of something I believe I wish we would have done years ago.

Mr. Eisenberg. And it opens the door to a much broader look at the facilities, and the processes, and everything else. And so it is just -- it is operated as a barrier. When you are kind of working it out and you have to meet deadlines and things like that, more often than not, you are just not going to do it. And that is unfortunate. We need to make sure that they will do those things.

Mr. Shimkus. And would you agree I think the 45Q, what we passed last Congress, that is helpful. I mean the last Congress did. So that is a tax incentive. So that is a positive thing that we have done.

Mr. Eisenberg. Yes.

Mr. Shimkus. And then we have not totally finalized it yet but we are working through the process, it is in the NDA Conference Report -- Dr. Friedmann, you are shaking your head -- the USE IT Act. Would that be good, and helpful, and low-hanging fruit?

Mr. Friedmann. 45Q immensely important. Passing the USE IT Act would definitely be helpful. Will it actually capture the CO2 from the steel plant? No. The incentives are not large enough. You actually need more on top of that if you really want to go after the emissions. Those are necessary and useful but not sufficient.

Mr. Shimkus. Right. Anyone else?

Mr. Perciasepe. I just want to add on the 45Q that any encouragement the committee could provide to the Internal Revenue Service to get the rules done so that we can actually implement it, that would be great.

Mr. Shimkus. Good. Great.

Mr. Sant. So maybe the one comment to add, you know one of the things that we want to think about is incentives and approaches that really help with ground-up innovation with entrepreneurship. So there is lots that we are doing. We were talking about large manufacturing facilities that are owned by large corporations but, fundamentally, U.S. success started with entrepreneurship that went ground-up.

And I think what is not really incentivized sufficiently at this point is this ground-up innovation and I think there would be tremendous, tremendous value to trying to do that. And it is something that we don't hear spoken about a lot. And in many ways, we count on the venture capital community to do it but, as you can imagine, these are not sectors in which the venture capital community, as an example, substantially invest because long time horizons, lower return on investment, hard problems, regulations. You know you want to think about the problem a little bit more holistically than sort of thinking about really what can only large corporations do but what can small innovators

do.

Mr. Shimkus. Thank you. My time has expired. I need to plagiarize Bill Gates a little bit more every now and then. I sound smarter that way.

I yield back.

Mr. Tonko. The gentleman yields back.

The chair now recognizes the gentlelady from Delaware, Representative Lisa Blunt Rochester, for 5 minutes.

Ms. Blunt Rochester. Thank you, Mr. Chairman and thank you to Ranking Member Tomkus [sic] -- Shimkus for holding today's hearing.

This is actually a phenomenal -- sorry I called you Tomkus. I see. I see. It is a combination. You are one and I think it is representative of today's hearing.

I have heard some real consistency, which is phenomenal. I also have heard some very consequential things that we can do for our country. So this is a very important hearing and I want to thank our witnesses.

As you all acknowledged, decarbonizing the industrial sector is a challenge but that is exactly why we are here today, to confront those challenges to climate action head-on and to find innovative solutions to overcome them. And in my home State of Delaware, companies are looking for ways to do just that, as was mentioned earlier.

Several of the country's largest chemical companies are based in my State and these companies recognize the need to do the hard work of reducing our carbon footprint. I want to make sure that these companies have the tools they need to reverse that trend and to lead the world in reducing emissions from chemical production.

I am going to start my first question with Dr. Sant. I know that you also recognized how climate action can create economic opportunities, especially the early stage innovators. And I was really glad that you focused on that ground-up innovation. In your testimony, you described the importance of supporting entrepreneurs and researchers who are developing creative solutions for industrial decarbonization.

As Congress considers legislative options to reduce emissions from industry, how can we ensure that policy helps early stage innovators like you and are there certain tools that we at the federal level can provide that would help overcome some of the primary barriers to research development and deployment?

Mr. Sant. So a couple of comments. I think the first high-level comment is really regulative certainty. I think having guidance regarding where the Government is going to go is super helpful.

The second part, procurement standards. Again, super helpful because they give you targets of what you really want

to fulfill.

The third thing to point out is, in some ways, this is a space in which there is a little bit of a gap between very early stage research and sort of commercial full maturity application. And so I think we need quite a bit more funding to sort of flesh out the gaps.

As I say, in one role as a university professor, you know there are programs that you can go to. Of course, they need to be quickly expanded, potentially by an order of magnitudes and by substantial amounts of money. But that kind of support exists and we have a mechanism for putting it into place.

I think where we don't have as much support is being able to translate technologies from that very early stage. There is something that industry can actually start to look at, take on, and do something useful with. And I think that is something that we really need to work on fleshing out.

Ms. Blunt Rochester. One of the solutions that I am looking at that would include a revolving loan fund that would provide capital for energy efficiency upgrades. Would that be helpful to early stage innovators?

Mr. Sant. My first guess is probably not because early stage innovators don't have a need for funds of that sort. It is also the same reason why you can't really explore a tax credit.

Ms. Blunt Rochester. Right.

Mr. Sant. I think what you need for this very early stage innovation is actually direct grants, direct support that actually helps to get things off the ground.

Ms. Blunt Rochester. Great. Thank you.

And Mr. Perciasepe, in your testimony you discuss some of the ways that chemical manufacturers are developing more environmentally friendly chemical production -- chemicals production. Can you please elaborate on the opportunities for low-carbon chemicals production in the United States?

Mr. Perciasepe. There are a lot of chemicals that are made and, in many cases, there are no greenhouse gas emissions from those chemical reactions but sometimes there are.

And so almost every chemical company, DowDuPont, for instance, are looking at those. What kind of catalysts they use in the reaction where you have this chemical and this chemical and you put it through some catalytic reaction or some heated reaction to create the third chemical. I am being very simplistic here. My organic chemistry is failing me.

And I mentioned one in particular, polypropylene, that was being looked at for reducing the emissions that are coming from it by using different kinds of reactors. And this is all kind of green chemistry and innovation. And it is the area of, I think, the greatest challenge but also the greatest opportunity in the industrial sector.

I mean we look at the carbon capture. We know we get these emissions. Let's capture it. We need to do that. We need to innovate on that. And we know that the electricity and the heat, we have to find ways to do that in a different way or capture that. But the chemical processes, whether it is making -- taking --

Ms. Blunt Rochester. I only have 5 seconds left.

Mr. Perciasepe. I am sorry.

Ms. Blunt Rochester. Friedmann, you have got 3 seconds.

Mr. Friedmann. University of Delaware has a world-leading program on turning CO2 into chemicals and plastics. For them to get funding the way that Dr. Sant needs it, there is two bills in front of Congress now, the CITA Act and the EFFECT Act. Both of those would create authorities within the Department of Energy, hundreds of millions of dollars to fund that kind of work.

Ms. Blunt Rochester. Fantastic. Thank you so much.

And I yield back.

Mr. Tonko. The gentlelady yields back.

The chair now recognizes the very patient Representative Long for 5 minutes.

Mr. Long. Thank you, Mr. Chairman.

And my friend, Ranking Member Shimkus, has been quoting Bill Gates all morning and I am sitting here thinking about Jed Clampett and his cement pond. That is the difference between Missouri

and Illinois.

Dr. Gregory, in your testimony, you referenced the use of alternative fuels as an easy way to reduce emissions in the cement production process. In the United States, only 15 percent of fuel comes from these alternative sources, compared to the more than double that in the European Union.

Can you explain why these alternative fuel sources would reduce emissions?

Mr. Gregory. Yes. Basically, the use of alternative fuels goes back to that heating the kiln that I mentioned, over 2500 degrees Fahrenheit. Usually, we use fossil fuels, coal, and in some cases, natural gas because we need it to get that hot. The alternative fuels are often biomass or waste materials, like scrapped tires, and essentially those are the types of alternative fuels. The limitations usually are about concerns about clean air but, as you mentioned, in other countries they use significantly more because the type of incineration that is done in those can still generate that energy from the waste materials, while maintaining clean air.

Mr. Long. Thank you, kindly.

Then to my next question: How does federal policy discourage the use of these fuels and how could environmental laws be reformed to promote their use?

Mr. Gregory. It is exactly that, trying to amend acts like

the Clean Air Act and also RCRA to basically better allow for increased use of these alternative fuels in cement plants.

Mr. Long. And in your opinion, is this the easiest way to reduce carbon emissions in the cement industry? And how much of a reduction of carbon emissions would we see if the amount of alternative fuels we use rises to the level of the EU?

Mr. Gregory. This is one of the low-hanging fruits. We can definitely get increased emissions reductions associated with these alternative fuels. Like I said, at a global level, there has been some estimates that we can increase reductions by about ten percent, and so which is definitely significant and something that we should go after.

Mr. Long. There would be a ten percent reduction in carbon emissions?

Mr. Gregory. Yes. Yes. Yes, carbon emissions.

Mr. Long. Mr. Eisenberg, your testimony references the need to modernize the electric grid and make use of smart grid technologies. More broadly speaking, how do the new digital technologies drive innovation and lower greenhouse gas emissions and can this be achieved without new government regulation?

Mr. Eisenberg. So there is a lot of new technologies out there. The grid, which was traditionally a one-way thing, a one-way highway, right, from the power plant to the end user, it is now becoming much more of a two-way street, where we have

things like demand response and a lot of these new technologies that allow the user and -- the user to become a producer, and you can have things like microgrids, and things like that that really change it.

You know there is a lot of ideas, some that involve government involvement, some that involve the private sector. I don't know whether there is one perfect approach here but it has unquestionable greenhouse gas emissions reductions benefits.

DOE found that you could eliminate 277 million at 359 million tons of CO2 per year by upgrading this grid and allowing those new technologies the access that they need.

Mr. Long. Okay. Unless anyone else needs my time, I will yield back.

Mr. Tonko. The gentleman yields back.

The chair now recognizes the gentleman from Florida, Representative Soto for 5 minutes, please.

Mr. Soto. Thank you, Mr. Chairman.

You know I want to talk about sorting out fact from fiction here. You know we have heard a lot of comments today. First, the facts that climate change is, in part at least, human-caused and it is an existential threat to humanity. Another fact is that our chairman has set out a goal of getting to net zero-carbon dioxide emissions by 2050.

In addition, another fact is that we are going to have

hearings from the fall through early winter to develop a plan by the end of 2019. I thank all of you here, as our panelists, to help us with that.

And another fact, we are open to all of the above strategy on this ambitious net zero-carbon dioxide goal by 2050.

Some fictions: That this committee is not prepared to work to develop bipartisan solutions. Another fiction is that we have already ruled out nuclear or carbon capture. These are things that we are prepared to work together on.

Many of you have said that innovation is key. So I would like to know, by a show of hands: How many of you believe the Trump administration's elimination of California's fuel emission standards hurts innovation by a show of hands?

So there is many ways we could do that. I know that is not exactly manufacturing, although obviously auto manufacturing is a big part of our manufacturing base.

I would like to start with Mr. Eisenberg. You know we have had some staff information point out that in 2015 the Department of Energy estimated that adopting high-efficiency technologies could reduce energy consumption in the industrial sector by as much as 32 percent by 2025. They gave some ideas: One, installing advanced motor systems, high-efficiency boilers, and smart manufacturing; and two, using combined heat and power systems.

Could these technologies, and others, assist in getting us to a 32 percent reduction?

Mr. Eisenberg. They absolutely could. They can be effective. We have just got to get the math right, and make sure that manufacturers have the incentives and really the opportunities to put them in place, and have the payback be good.

Mr. Soto. Thank you.

And for Dr. Sant and Dr. Gregory, it would be great to hear. Our staff has mentioned that by switching to low-carbon fuel stocks and feedstocks, such as the electrifying industrial process could reduce both direct and indirect emissions by switching to hydrogen or biomasses of fuel or feedstock, for the industries that you all are studying -- oh, and as well -- yes, excuse me. For the industries you all are studying, is that feasible going forward as part of a plan for 2050?

Mr. Sant. So a couple of comments to point out. In general, switching to alternative fuels is beneficial but it is not trivial because, in many ways, it requires changes around how we actually handle solid waste and how we actually categorize solid waste prior to combustion. That is comment number one.

The second comment that goes with it is a lot of the process that we look at, which withstand, as Julio put it some time ago, trying to burn and melt rock, it is not terribly trivial to switch processes from a fossil fuel source to a renewable source. It

is not out of the question but we are not close to doing it.

That being the case, running a cement kiln electrically is not trivial because you are trying to produce 10,000 tons of cement a day.

Mr. Soto. Mr. Friedmann --

Mr. Sant. Oh.

Mr. Soto. Last sentence, then, I have got to switch.

Mr. Sant. I think when we think about these things, we want to take an economy-wide perspective to how we actually manage carbon. It is not sufficient to just look at heat, or power, or a single process.

I will close with that, sir.

Mr. Soto. Thank you.

Dr. Gregory.

Mr. Gregory. Yes. Yes, I wholeheartedly concur. To get to that 2500 degrees Fahrenheit, you really right now have to do it with fossil fuels. There is our people looking at how you can do that through electrification but it is not employed anywhere in the world because it is so difficult.

So alternative fuels are sort of a short-term step that can be used until that type of technology or the hydrogen technology can be employed.

Mr. Soto. And Dr. Friedmann, I know there was a discussion here among our staff about that carbon capture utilization storage

may be a more cost-effective way in some subsectors for, they reference, ammonium production to get the biggest reduction as quickly as possible for CO2 emissions. Would you agree with that?

Mr. Friedmann. A hundred percent.

Mr. Soto. And lastly, for Mr. Walsh, you know we saw a decline in jobs in steel in the '70s and '80s because we didn't embrace new technologies. Is this a juncture where embracing new technologies will actually make us more competitive over the next 10 to 20 years?

Mr. Walsh. Yes, in addition to avoiding bad trade policy.

Mr. Soto. Thanks so much.

I yield my time back.

Ms. Barragan. [Presiding.] The gentleman yields back.

The chair recognizes Mr. Mullin for 5 minutes to ask questions.

Mr. Mullin. Thank you, Madam Chair, and thank you to our witnesses for being here.

I want to circle real quick to the follow-up with trying to generate 2500 degrees with electricity. Have we even ran the numbers of how much that would take, what kind of power we are talking about here, Mr. Gregory -- or Dr. Gregory, if you want to answer that?

Mr. Gregory. Yes. There are people who have done sort of theoretical studies on how this could be done.

Mr. Mullin. So they have measured like how many kilowatts this is going to take?

Mr. Gregory. Yes and I don't know it off the top of my head and I can definitely get you those numbers on those studies but it is --

Mr. Mullin. Well, I kind of figured we would have to start with that because we would have to figure out is it feasible when we start talking about how many furnaces we are going to be heating.

Mr. Gregory. It is a question of economics.

Mr. Mullin. Is it even -- I mean when you start talking about wind power and solar power, how are you going to generate that? How much is that going to take off the electrical grid to be able to do that? I don't -- I am just a country boy from Oklahoma but I have sure worked with a lot of boilers. I have my boilers license and I have installed a ton of them. I just don't think it is feasible. I just don't know how you get there.

Mr. Gregory. In the short-term, it isn't and that is why it is not being adopted.

Mr. Mullin. Well, already to take all the fossil fuels off our grid, according to the studies that we have already seen, it would take a wind farm the size Texas to replace it. Is that correct?

Mr. Gregory. I haven't seen that specific one but it is

-- it is a lot of electricity.

Mr. Mullin. It is a lot. And now you are going to be adding everything else on to it. I just -- and we are not even factoring in heating our boilers up to 2500 degrees with electricity.

I mean we all want clean air and clean water but we have got to do it in an economic-responsible way, too.

With that being said, we are talking about a lot, Dr. Gregory, talking about cement plants. And we know that we have moved to roughly 15 percent of our plants now are using natural gas instead of coal because coal has been the main source for a long time. I am not against coal. I am truly all of the above energy, as long as we do it in a clean way.

What is prohibiting the rest of them to move to natural gas? Is it the accessibility? Is it the price? I mean natural gas is pretty cheap right now. What is it that is prohibiting the other plants from moving?

Mr. Gregory. Both of those; having access to natural gas and then also just the investments associated with it.

Mr. Mullin. Access, meaning just to the pipelines?

Mr. Gregory. Like getting natural gas to the plant.

Mr. Mullin. And so it is the pipelines.

Mr. Gregory. Yes, absolutely.

Mr. Mullin. The permitting process.

Mr. Gregory. Yes.

Mr. Mullin. Because there is a lot of areas around the country right now they would love to be able to sell their gas.

Mr. Gregory. Yes.

Mr. Mullin. But without the infrastructure to do so, this would be very difficult.

And I think you mentioned a while ago that we, just by switching from coal to natural gas, you are going to affect roughly ten percent of our -- I mean a reduction of ten percent of the CO2 emissions. Is that what I remember you saying or am I --

Mr. Gregory. I was talking about different alternative fuels that can be used --

Mr. Mullin. Okay.

Mr. Gregory. -- like the scrapped tires and things like that. I would expect that it would be a similar order of magnitude in terms of --

Mr. Mullin. So how does that work? I heard you mention scrapped tires. So how does that work? I mean I have seen a few tires burn, and maybe on brush piles, or something like that once or twice in my life, and they are pretty black when they are burning. So how do you make that clean if you can't make coal clean?

Mr. Gregory. It helps that you burn at 2500 degrees. Basically, that takes care of a lot of bad stuff when you are burning it that high.

Mr. Mullin. But you have got to get it to 2500 degrees first, right?

Mr. Gregory. You do and that is why you don't see any cement plant that is doing 100 percent scrapped tires. Right?

Mr. Mullin. It is kind of tough.

Mr. Gregory. And in the U.S. there is a maximum of about 15 percent. In Europe, it is about 35 percent maximum.

Mr. Mullin. So you have got to get it to 2500 degrees before you throw the first tire on it, right?

Mr. Gregory. Absolutely, yes.

Mr. Mullin. So that would take a fossil fuel of some sort.

Mr. Gregory. Yes. Yes. Yes.

Mr. Mullin. And once again, I am not opposed to clean energy at all. I am just saying it is feasible. It is fun that we put out these goals of 2050 and we want to knock the President for saying guys, we are not listening to California; they don't set the standard for the rest of the world. And we can say yes, it is going to cut innovation. That is an easy question because it does, when you have California go out there and make these emissions, it does force people to start getting there. But if it is not feasible, if the technology is not there, the regulation can't outrun the technology. It is not there yet.

And I know we want to incentivize them to do it but we do. We incentivize by creating an environment for them to do that.

We don't do that by regulating businesses out of business along the way.

Mr. Gregory. Absolutely.

Mr. Mullin. With that, I will yield back.

Thank you guys so much.

Ms. Barragan. The gentleman yields back.

The chair now recognizes Ms. Schakowsky for 5 minutes to ask questions.

Ms. Schakowsky. So I have to tell you my heart is pounding over this very high-level conversation because I am not hearing the sense of urgency about this.

You know the United States of America has known about climate change since the Johnson administration. And I am hearing about incentives and I am hearing about making progress but we are really and truly running out of time.

There is a 16-year-old that is over at the Supreme Court right now, Greta Thunberg, who some know from Sweden, who made an important address to the United Nations and is now leading young people. She is 16 years old. A lawsuit, the Juliana suit, that says that young -- this is 21 young people who are suing the Government of the United States of America for knowing about climate change and doing nothing about it.

Now I just heard from my colleague saying well, if we don't provide these incentives -- look, carbon emissions went up

worldwide. They went up in the United States of America. We are not making progress. We are actually going backwards. And it is shameful that we are not sensing what young people are feeling, which is the sense of urgency.

So I do have some questions. So we have been hearing for decades this issue, Mr. Walsh, this false claim that somehow tackling climate change will be a job-killer. We are hearing it today.

As someone who has worked closely with unions all your life, how would you respond to that argument?

Mr. Walsh. Well, I think it is a strawman. I think we can both create quality jobs and preserve a livable planet at the same time.

And what we have been talking about today -- and by the way, we share your sense of urgency, which is why it is so important to be focused on the industrial sector now because the lifespan of a lot of this capital equipment is so long.

But we can do both. This is not a false choice but we need smart policy. We need to support strong innovation. And we need to deploy. We have talked a lot about innovation but, at the end of the day, we are going to have commercialize these technologies.

Ms. Schakowsky. Okay but you know what? My sense of innovation is when there is regulation, industry responds and

finds a way to do it.

And I would like to ask you, Mr. Friedmann -- Dr. Friedmann, is it? Have you not talked about a carbon tax?

Mr. Friedmann. I have not talked about a carbon tax. Part of the reason why is because there aren't actually carbon tax. Our analysis shows that it is helpful. It is in my testimony it is helpful but, actually, this sector is insensitive to a lot of carbon tax regulation.

If you actually had a $50 a ton carbon tax, it wouldn't be enough to actually decrease the emissions from these facilities.

Ms. Schakowsky. So it would be helpful?

Mr. Friedmann. Probably with some stuff, like the efficiency bits, you probably get. But even a substantial, a high carbon tax is only one part of the solution set that you need.

Ms. Schakowsky. So what are some of the other parts?

Mr. Friedmann. Well, if you want urgency, I have spent the last 20 years of my career trying to keep CO2 emissions out of the air and oceans. We have this technology said today that works. It is called carbon capture storage. The best place in the country to do it is Texas. The second best place in the country to do it is Illinois. In fact, you can capture the CO2 for those facilities and put them underground.

We already have a beginning with the tax incentives but we

actually need things like pipelines to take the CO2 from the Great Lakes District and move them down to Central Illinois, where you can store the CO2.

We actually know everything we need to know about this, except for how to get financed.

Ms. Schakowsky. So --

Mr. Friedmann. And that is actually where we think policy will be most important.

Ms. Schakowsky. I mean it just seems to me that this idea of we somehow have to woo industry, at long last, to do what they need to do to come up with innovation is a too late strategy. The time has come for us to take incredibly strong action.

Does anyone else want to comment on that?

Mr. Perciasepe. Well first of all, you are correct. But one thing I do want to point out to the committee is many of us on this panel have been to many hearings about what do with electricity, what to do with automobiles and transportation. This is the first time I have ever come before the United States Congress to talk about this very complicated issue of this remaining amount of emissions in the industrial sector that are very complicated.

Now we get those other two going with different kinds of electric vehicles. We know how to decarbonize electricity with nuclear, and carbon capture, and renewable energy but this sector

is something that hasn't been talked about enough and I appreciate the fact that we are doing it.

It is not urgent enough to just talk about it but it, to me, it is a move in the right direction for the United States Congress to even have a hearing on this particular issue.

Ms. Schakowsky. Well it is a pathetically small effort and I am for it. And I appreciate all of you being here today but the talk is not going to solve the problem. And any of the ideas that you have that we have heard today could be very useful.

Thank you and I yield back.

Ms. Barragan. The gentlewoman yields back.

And now the chair recognizes Mr. Flores for 5 minutes of questions.

Mr. Flores. Thank you, Madam Chair. And I want to thank the leaders of this subcommittee for hosting this hearing today.

As I mentioned during our last hearing in July, we haven't always celebrated how the U.S. is leading in terms of emission reductions. And to correct the record from the last person who was asking person, the EI has recently put out their forecast that carbon emissions in the U.S. are going to decline again in 2019. So we are making progress in this regard but it has been through innovation and market forces that have gotten this done, not government mandates or taxes. Innovation is the greatest contributor to our emissions reductions, which have been

significant.

As we continue to dramatically reduce our emissions, the U.S. has been able to retain the world's largest, and fastest growing economy, and a significant creator of jobs and economic opportunity. So instead of new taxes or mandates to decarbonize in some sort of a chaotic fashion, our climate policy should adapt on things that work, like innovation, conservation, adaptation, and resiliency. Unleashing these innovations at home will continue to ensure that not only do we maintain economic growth balanced with a healthy environment, but more importantly, we can export these technologies, and as we are leading the can-do spirit to contribute to growing energy demand in developing countries abroad.

And today, I am glad we are talking about the industrial sector. This is a sector which is responsible for numerous modern conveniences, from the roads we drive on, to the buildings we live and work in, down to fertilizers that farmers use to feed families around the world. This sector, however, faces unique challenges, as almost all of you laid out in your testimony and I want to thank you for sharing those with us today.

Now for our questions. Dr. Gregory, are there any technologies currently under development, which would greatly reduce or eliminate emissions from Portland Cement -- the Portland cement manufacturing process?

Mr. Gregory. Yes, there is basically four different ways that you can lower emissions from cement production. One is through CCUS that we have discussed. Another is through the use of blended cements, which are kind of a lower carbon alternative of cement. A third is the use of alternative fuels. And the last is increasing the energy efficiency within the cement plants.

Mr. Flores. What would the -- this is a little bit of an abstract question but what would the Green New Deal do to U.S. cement manufacturing and jobs?

Mr. Gregory. You know, at least for me, that is a little bit of a hard question to ask because I think there is a lot of large or high-level ideas but it is hard to know exactly how that is implemented. There is kind of different ways in which it could go.

It is certainly, like Mr. Walsh mentioned, that it certainly is possible, I think, to create more jobs associated with green materials but it has to be done in a way such that we ensure that the standards associated with those materials really can be done in this country, right, and it doesn't lead to leakage that happens in other countries where they don't have those same standards.

Mr. Flores. Well, I think it is safe to assume that a dramatic increase in energy prices or a curtailment of energy availability would dramatically cause the export of our cement manufacturing to overseas locations.

Mr. Gregory. It is certainly one potential option but it, as we have heard, you know a lot of concrete is actually purchased by governments. And so that is certainly one way to start out is to make sure those governments make decisions that are consistent with our values.

Mr. Flores. And continuing with you, Dr. Gregory, you mentioned the fact that concrete and other industrial processes have the need for high-temperature heats sustained over long periods of time. There have been -- we have talked conceptually here about electrifying that process, which I think is a good direction to go. The challenge is where does the electricity come from. What produces the electrons?

And so Mr. McNerney from California and I introduced a bill that passed the House last week to create new fuels for next-generation reactors because, at the end of the day, nuclear energy is the only zero-carbon, zero emissions source of baseload power that we have. You can't get it from wind. You can't get it from solar.

So would this be promising technology to pursue to accelerate the decarbonization of the industrial sector?

Mr. Gregory. Yes, I actually happen to work very closely with colleagues at MIT in the Nuclear Science and Engineering Department, who just published a Future of Nuclear Report that speaks exactly to this potential.

One of the things we have talked about is basically how today's nuclear energy is not your parents' --

Mr. Flores. Exactly.

Mr. Gregory. -- or grandparents' nuclear energy. There are a lot of opportunities to do it in a much more innovative fashion using small modular reactors where, basically, the price is a primary focus, making sure that price of nuclear is competitive with other energy sources.

Mr. Flores. Right.

Mr. Gregory. So it is a significant opportunity.

Mr. Flores. I would like to supplementarily ask you or to ask you to supplementarily respond with a question about what are the challenges to get wind and solar to do the same thing that we could do with next-generation nuclear.

And so that gives me a second to ask one final question. Are there other ways to sequester carbon, to sink carbon, other than CCUS. And that is open for the panel.

So Mister -- I can't pronounce your name.

Mr. Perciasepe. That is all right. If they could just put bob up there, you would be okay.

Mr. Flores. Bob. Okay.

Mr. Perciasepe. Well I think there are a lot of different ways to capture the carbon. Sometimes you can change the process -- the carbon dioxide. Sometimes you can change the actual

process of like running a turbine so that the exhaust that comes out is actually relatively pure carbon dioxide, so you don't need to have some chemical process to capture it. And then what you do with it can be sequestration in the geology. We have been using it for enhanced oil recovery to reuse old oil wells.

Mr. Flores. Right. Right.

Mr. Perciasepe. And there are many -- you know we talked earlier about building materials and actually using it to make fuels.

Mr. Flores. Dr. Gregory, and try to keep your answer short, if you can.

Mr. Gregory. Sure. Sure.

Mr. Flores. I am at the forbearance of the chair here.

Mr. Gregory. Absolutely. We have heard several options for taking carbon and putting it back into building materials. Binders are actually only like ten percent of concrete. Aggregates are much heavier and present, actually, a larger source of opportunity to store carbon that can be used in asphalt, and concrete, and all kinds of things.

Mr. Flores. Okay.

Ms. Barragan. The gentleman's time has expired. The gentleman yields back.

Mr. Flores. Thank you.

Ms. Barragan. And now the chair recognizes the gentleman

from California, Mr. McNerney for 5 minutes of questions.

Mr. McNerney. I thank the chair. I am going to thank the panel. Your testimony has been very informative and I appreciate that. There is an effort that goes into this.

And we hear a lot about innovation but, Dr. Friedmann, would you say that innovation and regulation go hand-in-hand?

Mr. Friedmann. Before I answer that question, as a proud citizen of Livermore, California, I have been a long-time fan of yours, Congressman.

Mr. McNerney. Well, thank you.

[Laughter.]

Mr. McNerney. I want my time back. Go ahead.

Mr. Friedmann. That is between me and my spin doctor.

It is often helpful to have a combination of carrots and sticks. Part of the reason that I am enthusiastic about procurement is that it provides a market signal that drives the innovation. Part of the reason that I am enthusiastic about things like the EFFECT Act, and CITA, and increased appropriations for national labs, and for universities is because that stimulates that kind of innovation.

I think if you try to make it just regulatory, it is harder to get that innovation out but, sometimes when well-crafted and well-exercised regulation can provide the appropriate focus to drive new innovators to new ideas.

Mr. McNerney. Thank you. Well, in a highly competitive global marketplace, it is essential that we view any policies from a global perspective. The last thing we want to do is see American jobs ship overseas and increase in carbon emissions. Some of the countries seem to be able to manage that balance.

Mr. Walsh and Dr. Sant, can you have recommendations on stuff to craft American policy to make that balance between emissions and jobs?

Mr. Sant. Sure. So I think two comments. The first one, I think, really going after the carbon efficiency standards is an important thing to go after. In effect, it lets you do more with less. It is exactly what we do with energy efficiency, as an example, and I think that is something that we have to follow.

I think that the second comment is something which Julio touched on not very long ago is really border data adjustments. I think the moment you signal globally that it doesn't matter where you produce but if you bring a product into the U.S. and sell it in the U.S. market, there is a natural adjustment that happens that is based upon a U.S. standard. This is the easiest way to get rid of any sort of complexity that comes from where a product is purchased.

Because I think it is clear that in the world of today, material flaws are interlinked and that means that where you sell should determine the rules you play with.

Mr. McNerney. Thank you.

Mr. Walsh. I want to echo what Dr. Sant said about border adjustments. We talked about procurement and the purchasing power of the Federal Government. I just want to be specific that we have an example from your State of California, Julio's State of California, it is called Buy Clean. It is using the purchasing power of the State government on infrastructure projects to identify the global warming potential of structural steel and some other basic building blocks of infrastructure projects in the State. That is a model that we can build on and use in other States but, most importantly for the purposes of this conversation, at the federal level as well.

Mr. McNerney. Thank you. Doctor, you said something that intrigued me, that we need more performance-based specifications than prescriptive specifications. Could you talk about that a little bit?

Mr. Gregory. Sure, yes. Usually, when concrete is specified by engineers, including perhaps Mr. McKinley who is no longer here, but basically they are very specific about like the amount of cement that needs to be used. We are actually usually putting limits on what we call supplementary cementitious materials, like fly ash from coal-fired power plants or slag from seal. And they limit those because of concerns that exist, maybe at one point, about durability or the performance of the concrete.

It turns out a lot of those prescriptive specifications that are very specific, a lot of people don't remember why they were put in place, so they don't have justification for them. So instead of saying here is exactly how you make the concrete, say this is what we are looking for in terms of strength, durability, stiffness, et cetera, and then require a test to basically demonstrate that you can meet those.

And that is exactly the type of thing that I think if you implement like a Buy Clean Act, you need those types of things to go hand-in-hand with it because not all concrete is the same. Different mixtures are different.

Mr. McNerney. Very good. Thank you.

Mr. Perciasepe, I appreciate your comments about trade exposure. I think that has sort of been fleshed out a little bit here, the trade adjustments but we need to have standards in the United States before we can start imposing trade adjustments, border adjustments. Wouldn't that be the case?

Mr. Perciasepe. Yes. Obviously, you would be trying to protect you know some exposed part of the industrial sector and this is where most of it comes. When you do climate policy, it is going to be in the industrial sector. It has to actually have a requirement that may, and I want to point out that it is always possible some of these process we are talking about could reduce the cost of making some of these things.

But if it is a trade exposed, then it does have unique increased costs and there is an importation of products that are not meeting those standards. That is where you put the border adjustment on so that you -- I am being very simplistic here. It can get very complicated very quickly.

Mr. McNerney. In a 5-minute thing, you don't have time to be more than simplistic. Thank you.

I yield back.

Ms. Barragan. The gentleman yields back.

I see nobody on this side.

The chair recognizes the gentlewoman from California, Ms. Matsui for 5 minutes to ask questions.

Ms. Matsui. Thank you very much, Madam Chair, and I thank the witnesses for being here with us today so we can discuss options in what is considered to be one of the most difficult sectors of our country to decarbonize.

While decarbonizing the industrial sector may seem daunting, I look at policies and initiatives championed in my State of California and take hope in that the State has paved the way and we all know that proposing and testing out solutions that are already making a difference in emissions and how industries are designing their operations.

As you may know, the State of California has, for the past 9 years, under the Low Carbon Fuel Standard, which sets an average

carbon content for fuels to decline annually. One of the leading contributors of emissions in the industrial sector, petroleum refineries, is a regulated party under the LCFS. The LCFS has been successful in incentivizing refiners to switch operations to produce biofuels and other alternative fuels and has introduced and expanded the use of cleaner alternatives for fuel consumption.

Mr. Perciasepe or Dr. Sant, can you describe the benefits in terms of emissions reduction we see in expanded use of low-carbon or zero-carbon fuels in the industrial sector?

Mr. Perciasepe. Well, in the industrial sector, unlike some of the transportation fuels --

Ms. Matsui. Right.

Mr. Perciasepe. -- in California, there is a lot of opportunity. I mean we were talking about the extremes earlier of 2500 degrees --

Ms. Matsui. Right.

Mr. Perciasepe. -- which is very hot, warm even. But there are lots of thermal needs in industry that are a lot less temperatures that can be converted to electricity, as an alternative to using a fossil fuel.

Ms. Matsui. Sure.

Mr. Perciasepe. And if the electricity is coming from a decarbonized electric system, then you have got the impact.

So it is like many things we deal with in these complicated

issues. It is never binary. It is neither this or that.

Ms. Matsui. Right.

Mr. Perciasepe. But the extremely high temperatures, we have to find alternative ways to do it --

Ms. Matsui. Sure.

Mr. Perciasepe. -- that we are not quite sure yet. But the lower temperature -- the lower heat temperature --

Ms. Matsui. We have already got options.

Mr. Perciasepe. -- we got ideas.

Ms. Matsui. Okay, great.

How important do you think nationwide price on carbon, such as cap and trade, is to reduce the emissions from the industrial sector, Dr. Sant or --

Mr. Sant. I think it is fundamentally important. I think it is something that we have to be able to do, to have a nationally-agreed upon price.

The reason I say this is you know a couple of comments. Of course, California has been tremendously progressive. We have done some remarkable things and we continue to do so.

I think looking nationwide, you want to have consistency. And so you don't want to again have, like I say, two sets of standards --

Ms. Matsui. Right.

Mr. Sant. -- one for California and ones for elsewhere.

And so having consistency in pricing helps industry plan for what they are going to do across the nation.

Ms. Matsui. So you think it is economically feasible for the industrial sector across the country to do this more broadly, is what you would like to see.

Mr. Sant. In principle, it is, absolutely. No question. It is also where the world is headed. So I think it behooves us to do it.

That being the case, I think we need to be thoughtful about how we approach it.

Ms. Matsui. Okay. Cleaning up our industrial sector means adopting, as we said, all of the above approach, including considerations to how our Federal Government sources materials for buildings, infrastructure, and government equipment. This is all the more timely, as conversations around a robust infrastructure package continue.

California has passed and begun implementing the Buy Clean California Act, which requires the State to take into account the supplier's emissions performance when contracting byproducts, such as steel, flat glass, and mineral wool for infrastructure products.

Dr. Friedmann, you mentioned in your testimony the importance of procurement standards in decarbonizing our industrial sector. What percent of cement, concrete, and steel

is bought by our Federal Government?

Mr. Friedmann. If you look at all governments, Federal, State, and local governments, they buy 90 percent of cement and concrete.

Ms. Matsui. Wow. Okay.

You allude to a well-designed zero-emissions buy clean standard. Can you expand on what well-designed means? What considerations should be taken when developing such a standard?

Mr. Friedmann. First, as others have testified, we actually need to create a performance-based standard for the stuff. If, in California, Caltrans can't buy clean concrete and cement because they are required by law to buy Portland Cement.

Ms. Matsui. Right.

Mr. Friedmann. So until they exercise their performance-based standard, they can't do it. Caltrans has been working it for a while but that is like step one. It can't enter the market until that is done.

Step 2, life cycle analysis. This is something both Dr. Gregory and Dr. Sant have also mentioned. You have to really make sure that you are doing the job and that you are tall enough to go on that ride.

Ms. Matsui. Okay.

Mr. Friedmann. And then third, you actually have to buy it. And I have advocated for a while sort of a ratchet which

grows. So you start with a fairly small volume -- one percent, two percent.

Ms. Matsui. Uh-huh.

Mr. Friedmann. You have groups like the National Academy or NIST work to try to figure out what that is but then you increase ambition over time. By 2025, it may be two percent but by 2030, it may be twenty percent. And you do that based on how the manufacturers can deliver the stuff. You don't ask for more than they can make but you set a market signal and you drive it up.

Ms. Matsui. Okay, fine. Thank you very much.

And I have already run out of time. So thank you very much. I yield back.

Ms. Barragan. The gentlewoman yields back. The chair recognizes Mr. Ruiz from California for 5 minutes to ask questions.

Mr. Ruiz. Thank you for holding this hearing on this important topic and thank you to our panel for being here today.

Our world is sick, showing symptoms of climate change that can lead to disastrous consequences for human food, security, water consumption, and safety from extreme natural disasters. I care deeply about climate change because I have seen the human toll, the suffering that will only get worse as people who lose their homes and their loved ones from wildfires. And the people who are most vulnerable are those who are not rich enough to move

or build another more secure home elsewhere.

This week, climate activists around the world will be making their mark to raise the alarm and demand climate justice for everyone. And I agree with that sentiment and their efforts.

Sixteen-year-old Greta Thunberg has picked the consciousness of an entire planet and pushed a call to action. And this committee must answer that call to action with real policies that lead to real changes to reduce our dependency on fossil fuels through a clean economy for a clean environment. We must do it for my twin daughters, for our children, our grandchildren, and their children, for our public's health, and our nation's security.

And we are already witnessing and living the negative effects of climate change in increasingly more dramatic ways. For example, in my district, in California's 36th District, drought has crippled our water supply for years. Increased heat and dryer environments have led to more intense and frequent wild fires in our mountain forests. Extreme rains have led to expensive infrastructure damage requiring federal disaster aid, even Joshua Trees. At our beloved Joshua Tree National Park, the iconic symbol of desert life may go extinct due to rising temperatures.

America, California especially has been a leader in replacing harmful fossil fuels by pioneering new technologies

that harness natural resources, including wind, solar, and hydrogen for everything from homes to transportation. For example, some SunLine Transit in my district uses buses that run on clean hydrogen. Homes and schools are powered by wind farms and solar panels that use nature's awesome power without threatening our ozone.

Clean energy is the future, the antidote to climate change that we must work towards as a country. A clean energy future is attainable and essential and the time for talking is over. The time for action is now.

One sector that plays a key role in reducing carbon emissions is heavy industry. Steel, concrete, and other materials are literally the foundation of buildings and roads, and they essential to our economic success. So how can we reduce the carbon output of the manufacturing sector, while protecting good-paying jobs? Well, we must develop and deploy new technologies that help the manufacturing sector further reduce their carbon footprint.

This is where the value of international agreements comes in. We must hold other countries accountable through international climate agreements. This is why withdrawing from the Paris Agreement hurts our efforts to reduce climate change. This is why the U.N. Summit on Climate is such an important opportunity. Without a global agreement, other countries will

continue to burn fossil fuels without any obligation to invest in new technologies. In fact, we have heard from several of you today on how other countries, like those in the Southeast Asia, are increasing their coal and fossil fuel emissions. We have also discussed how we can ensure that American companies don't lose out while making an effort to reduce emissions.

With that in mind, I would like to dig further into how we establish that advantage for U.S. companies.

Mr. Friedmann, given that our goal is to help the industrial sector achieve a competitive advantage, what is the best way for Government, academic research institutions, and industry to work together?

Mr. Friedmann. As I said in my testimony, procurements, innovation, infrastructure investments. We need to actually have a government analytical function so that we can make sense out all this stuff. But if you want to even just find facts on these topics, it is hard to do.

And then last, we actually do need to have international agreements and partnerships on this exact topic because this is all bound into international trade.

Mr. Ruiz. Dr. Gregory, as an expert, you have watched these technologies evolved. What is the best way to make sure that newly developed technologies are deployed in a timely and efficient manner?

Mr. Gregory. It has to -- there has to be market demand for them. And one of the best ways to do that is through procurement policies because there is so much government purchasing of concrete.

Having said that, we need to make sure that the engineers are also interested in specifying these low-carbon materials. So we need to ask for their performance and also for their carbon footprint as well.

Mr. Ruiz. Thank you.

Ms. Barragan. The gentleman yields back.

The chair now recognizes myself for 5 minutes to ask questions.

First of all, I thank the witnesses for being here today. I want to thank you, Mr. Walsh, for your testimony about bringing up the issue of frontline communities, and communities of color who are disproportionately impacted by the pollution that is happening and by what we are seeing happening on climate.

I happen to represent one of those districts. It is a district that includes the Port of Los Angeles in South L.A. It is about almost 90 percent Latino-African American. It is a district where it is low income. It is minority. There is industry there. There is manufacturing and, of course, the port. And on top of all that, we are surrounded by three freeways.

And so when you talk about air pollution and you talk about

negative health impacts, my communities are often seen with inhalers around their necks, and doctors' offices pack these inhalers for the children. It is heartbreaking to see.

And so we are seeing across the country a call, a demand for action climate. In my own community, I see it day in and day out because of the health impacts and because of what is happening with the planet.

And so one of the things that we have talked about today has been very helpful talking about procurement and the different ideas here. You touched a little bit about a just transition. And I would like for you maybe to expand a little bit on that.

When drafting policy and legislation, what can we put in that to make sure that we are not leaving communities behind, like my district? And I think the second part of that is, and I think you mentioned this as well, is that they should be first in line, and they should get priorities, and if they don't, they won't be able to participate in a clean economy.

Mr. Walsh?

Mr. Walsh. Thank you for that very important question and for putting a really fine point on the fact that we are not just talking about climate here. We are talking about health and health as it affects particular communities.

I think with respect to just transition, we also need to acknowledge that neither the impacts, in terms of environmental

pollution and climate change, are felt disproportionately by particular communities and particular people.

There are also, as we transition away from certain fossil fuels, like coal impacts, in that transition away in coal communities, for example, that are not spread evenly across the country. They are hitting eastern Kentucky or southern West Virginia.

So I think a first order of business is just being very clear about where impacts are being felt and who is being impacted, and targeting Federal investment, particularly in this respect, economic and workforce investment, both to make sure that we are taking care of workers and providing opportunities to workers to get into new jobs created.

It is also about community revitalization and economic diversification. You have to be very targeted about that as well. We don't always have the ability to target with broad scale federal programs. There are regionally-focused programs we used quite a bit, like the Appalachian Regional Commission, to target investments. I think we need to do a better job to get those investments to districts like yours.

Ms. Barragan. So one of the things I hear back, I get pushback on, is well, that is great, we are going to train people for cleaner jobs but then the jobs won't be there.

Is that accurate? Is that the choice?

Mr. Walsh. I think we have to be careful about not over-promising anything. I certainly have been guilty in the past of probably doing a little bit too much green jobs evangelism, even though I think these are an important opportunity.

But we are more interested now in making sure we develop very concrete pathways into those jobs. There are specific ways we know work. We know registered apprenticeship programs work. We know pre-apprenticeship programs that get folks from low-income communities, and communities and workers who have been underrepresented, in the construction trades, as an example, into those registered apprenticeship programs, so that we are not just creating jobs; we are creating career pathways and careers for those folks.

Ms. Barragan. Thank you.

You know one of my colleagues earlier said that he was unclear why we set goals and that you know when California sets goals and standards that are different than the rest of the country, it is not feasible for business.

I happen to disagree with that. I happen to think that when you set goals, when you set bold and aggressive action and milestones, it does force people to come up with innovation quicker. It forces Congress to come up with incentives quicker.

In California, in particular, and especially today with what is going on with the administration and the rollback on the fuel

standards in California, I think that we actually have the industry, the car industry saying don't do this. And so to hear that it is not feasible for industry, you actually have industry saying no, wait a second; don't roll these back.

And so I just wanted to take a moment to disagree on the record and say that there are benefits. When you set goals, when you set milestones, sometimes it gets Congress to act quicker. Sometimes it gets companies and industry to act quicker.

In this instance, I think that seeing the positive benefit of what is happening to the clean air and the cleanup of pollution in California is happening.

Mr. Walsh, I can give you 3 seconds.

Mr. Walsh. I just wanted -- you make an important point. I also want to add a jobs point.

By the Federal agencies' own analysis, not only when the current administration proposes to roll back fuel economy standards, not only are we having a pollution impact, we are actually losing jobs. They estimate that 60,000 fewer jobs will result from their rollback of fuel efficiency standards because we are investing in a whole set of new technologies that create those jobs.

Ms. Barragan. Thank you, Mr. Walsh.

And with that, I yield back.

The chair recognizes the gentlelady from Michigan, Mrs.

Dingell, for 5 minutes of questions.

Mrs. Dingell. Thank you, Madam Chair.

A hundred percent clean economy by 2050 may be ambitious but we have to get there. And since you both closed on the subject of California, I think I will start there.

I am probably as angry as anybody at the announcement that was made today by the President when every single car company asked him not to do it. And he has rolled back. He has created uncertainty. He is putting this in the courts for years to come. It is taking capital away from investment needs to be done to get the newer technologies.

I want to ask Mr. Perciasepe and Mr. Walsh: What is the ultimate impact of the President's decision today to revoke California's fuel emissions waiver as it relates to our efforts to reduce emissions? I will start with Mr. Perciasepe and let Mr. Walsh go next. Yes.

Mr. Perciasepe. So I think what you pointed out, Congresswoman, that the automobile industry, by and large, wants to continue making the fuel-efficient cars that it has been making, my expectation, at least in the near-term, is that they will continue to do that, regardless of what the Federal Government does in the current situation. And then while they continue to do that, on top of that, there will be a lot of litigation.

But I think in the near-term, the long-term may be different but, in the near-term, the automobile industry, as you well know, is 4 years ahead of what we are doing. Right? What it is doing now, it was working on 4 years ago. And what it is going to be doing 4 years from now, it is working on now and it is not going to stop.

Mrs. Dingell. The industry is not going to stop but it could --

Mr. Perciasepe. The industry is not.

Mrs. Dingell. I don't want to answer my own question. I want the experts to give us the answer.

Mr. Perciasepe. That is what I would guess.

Mrs. Dingell. Mr. Walsh?

Mr. Walsh. BGA issues a report which found that clean car standards and the consistency of those standards helped drive investment of over $63 billion in facilities across the country in 100 factories.

So to my earlier point, this is a jobs issue. When you see that level in investment, you are also creating and sustaining automotive jobs. When we take away that standard, when we create regulatory uncertainty, we freeze investment and we lose jobs.

Mrs. Dingell. So let me ask you this again, both of you: How will instituting strong fuel economy standards, or what President Obama was trying to do, help with year-to-year

increases, help us achieve that net zero that we are trying to get to by 2050? And is permanent damage being done to that goal in the transportation sector?

Mr. Perciasepe. Well, the concept behind the performance standards over a period of time, and these standards only went to 2025 --

Mrs. Dingell. That is correct.

Mr. Perciasepe. -- so we need to be -- we are into 2050. But to 2025, they kept reducing the average of emissions. It is actually a performance standard, grams per mile of greenhouse gases, even though we say CAFE. And so that declines over time to a point where the translation was to somewhere near 50 miles per gallon on average.

Now that has a significant reduction in those vehicles that are sold in 2025 in the amount of greenhouse gases they produce on an annual basis. But of course, this is all related to how many miles somebody drives, and all this other stuff, but you are looking at the average.

I think, as I just mentioned, and I believe, in the near-term, in the next couple of years, the automobile industry will continue to sell the kinds of cars that they were programmed to make.

Mrs. Dingell. At least some of them are.

Mr. Perciasepe. Yes.

Mrs. Dingell. Let me ask you -- I am not going to have you

answer that question because I am down to a minute. What does this do to the electric vehicle? Which I frequently get asked by some young people why are you so focused on the electric vehicle.

Mr. Walsh, anybody who wants to answer this: Are we correct the electric vehicle is key to getting to a carbonless, or a non-gasoline, or engines, other forms, there are other forms that are being done? And are we doing enough in the transportation sector to get to where we need to go, instead of -- or do you think we are going backwards instead of forward?

Mr. Walsh. Well, today we are going backwards.

Mrs. Dingell. Yes, I agree.

Mr. Walsh. But electric vehicles are absolutely essential to decarbonizing the transportation sector, as long as we also continue progress in decarbonizing the power sector as well.

Mrs. Dingell. And are we doing -- well, we all have to work together to do that, which you have all talked about.

Now, I am down to 4 seconds, so I can't --

I guess I yield back my 0 seconds.

Ms. Barragan. The gentlewoman yields back.

The chair now recognizes Ms. DeGette from Colorado for 5 minutes for questions.

Ms. DeGette. Thank you so much, Madam Chair.

As we have heard, some industrial processes release carbon

dioxide, not only as a result of the energy they use but also because it is a byproduct of the chemical processes involved and, as we heard today, cement manufacturers are a good example of this.

So even if we completely decarbonize our energy production and use, we would still need to have carbon capture utilization and storage to keep the emissions from these industries from getting into the atmosphere. And we also know that we are going to have remove existing carbon dioxide from the atmosphere if we are going to keep global warming at the goal of below 1.5 degrees Celsius.

So I think that the U.S. is in the best position to develop these technologies. And I want to ask you guys some questions about these issues. I guess we can just go down the line.

The first question is: Do you agree that the United States needs to make a major investment in the development and deployment of technologies that capture, utilize, and store carbon dioxide from a wide variety of energy and industrial sources, as well as from the atmosphere?

We will start down here.

Mr. Perciasepe. Yes, it is an essential tool that needs to be in the climate change battle toolkit.

Ms. DeGette. You bet.

Mr. Gregory. Yes. And, as you mentioned, cement and

concrete has this unique opportunity where the carbon can be captured and then used again to make new cement and concrete.

Ms. DeGette. Right. Right.

Dr. Sant?

Mr. Sant. Unquestionably, yes, but I think we need to really focus on cost reductions in these technologies --

Ms. DeGette. Right, as part of the development because it has to be marketable worldwide.

What about you?

Mr. Eisenberg. Yes and we may not be able to do without them, as well.

Ms. DeGette. Okay.

Mr. Friedmann. My Twitter handle is CarbonWrangler.

Ms. DeGette. So your answer is yes?

Mr. Friedmann. The answer is hell, yes.

Ms. DeGette. Okay, thanks.

Mr. Walsh?

Mr. Walsh. Yes.

Ms. DeGette. So are we on track, do you think -- and we already have a sense of the answer to this but are we on track to deploy and develop these technologies at scale right now? I think we probably can get agreement on this, too.

Mr. Perciasepe. We are not on track. We need more to go.

We talked about 45Q, which, obviously, many members have

been involved with. We need to get the IRS to get the regulations and the rules done so we can actually implement it. And we need some thoughtfulness from the Congress on infrastructure to help move carbon after it has been wrangled.

Ms. DeGette. Thank you.

Mr. Gregory. 45Q actually, it doesn't specifically apply to cement plants. So actually having programs specifically for cement plants would be more beneficial.

Ms. DeGette. Great.

Mr. Sant. Yes, what we are doing would be but we need to do a lot more. And I will go so far as to say we need to step up our investments in these areas by an order of magnitude, at least.

Ms. DeGette. Okay.

Mr. Eisenberg. Agreed, we need to do more.

Ms. DeGette. Yes, Dr. Eisenberg -- Mr. Eisenberg.

Mr. Eisenberg. Agreed. We need to do more.

Mr. Friedmann. We need more investment. We need more incentives. We need more innovation on all of it, especially on CO2 removal.

Ms. DeGette. And Mr. Walsh?

Mr. Walsh. We need to do more, particularly in industries where the CO2 is more low-purity. We have a lot of opportunity for high-purity. CO2 ammonia has been mentioned but in steel

and cement, these are low-purity sources. We have got to reduce the cost of carbon capture.

Ms. DeGette. Right.

Mr. Walsh. We do that through R&D, and innovation, et cetera.

Ms. DeGette. Aside from some of the things that this panel has said we need to do, the infrastructure, the R&D, and so on, are there other things that Congress and the Federal Government could be doing to develop and deploy these technologies at scale? Anyone.

Mr. Perciasepe. I will start very quickly.

Ms. DeGette. Okay.

Mr. Perciasepe. Think of a layer cake and you have layer after layer of incentives for different technologies and then you have got to put an icing on the cake. The icing on the cake would be a price on carbon.

Ms. DeGette. Okay.

Mr. Gregory. Just practice what you preach, in terms of the Government's construction that it does. You know make the choices to low-carbon materials for those practices.

Ms. DeGette. That is a good point.

Mr. Sant. I think public-private partnerships, which start form the innovation stage and work towards commercialization would be really attractive.

Mr. Eisenberg. We need a single unified response here. I mean we have a really good opportunity here today to actually kick that off and move towards some federal unified response that captures all of these things. It really is important.

Mr. Friedmann. I will gladly send you my last four congressional testimonies on exactly these subjects with the policy recommendations.

The most important number one thing to get going today, the infrastructure.

Ms. DeGette. Yes.

Mr. Friedmann. If we had the pipelines in place, we would have more projects today because 45Q would help. It already helps but it is not enough without the pipelines.

Ms. DeGette. Right.

Mr. Walsh. As we make investments on infrastructure on other deployment pathways, it is absolutely essential that we have prevailing wage standards, other kinds of labor standards, and buy American provisions, and make sure that the jobs we are creating are U.S. jobs and high quality jobs.

Ms. DeGette. And that they are good jobs. Great.

Well, wonderful job, everybody.

I am now happy to yield back and I appreciate your unity on these answers.

Ms. Barragan. And the gentlewoman yields back.

As the chair, I request unanimous consent to enter the following documents into the record: A letter from Rebecca Dell, Industry Strategist at the ClimateWorks Foundation; a Climate Action Report from ArcelorMittal, the largest steel producer in the world; a report entitled Mission Possible: Reaching Net-Zero Carbon Emissions from Harder-to-Abate Sectors by Mid-Century; two reports from C2ES entitled Decarbonizing U.S. Industry and Carbon Utilization: A Vital and Effective Pathway for Decarbonization; a statement from the American Iron and Steel Institute; a fact sheet from the Fertilizer Institute.

Without objection, so ordered.

[The information follows:]

**********COMMITTEE INSERT **********

Ms. Barragan. And I would like to thank all of our witnesses for joining us at today's hearing. Very informative. I am a firm believer this should be a bipartisan issue, where we come together. And this committee has been able to do that on issues. I am hoping we can do that here.

I remind members that pursuant to committee rules, they have 10 business days to submit additional questions for the record to be answered by our witnesses. I ask each witness to respond promptly to any such questions that you may receive.

At this time, the subcommittee is adjourned.

[Whereupon, at 12:48 p.m., the subcommittee was adjourned.]