NEAL R. GROSS & CO., INC.

RPTS BRANDON PATERSON

HIF037180

TIME FOR ACTION: ADDRESSING THE ENVIRONMENTAL AND ECONOMIC EFFECTS OF CLIMATE CHANGE

WEDNESDAY, FEBRUARY 6, 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 10:10 a.m., in Room 2123 Rayburn House Office Building, Hon. Paul Tonko [chairman of the subcommittee] presiding.

Members present: Representatives Tonko, DeGette, Schakowsky, Matsui, Castor, Sarbanes, McNerney, Clarke, Ruiz, Peters, Barragan, McEachin, Blunt Rochester, Soto, Pallone [ex officio], Shimkus, Rodgers, McKinley, Johnson, Long, Flores, Carter, Duncan and Walden [ex officio].

Staff present: Jeff Carroll, Staff Director; Adam Fischer, Policy Analyst; Jean Fruci, Energy and Environment Policy Advisor; Tiffany Guarascio, Deputy Staff Director; Caitlin Haberman, Professional Staff Member; Rick Kessler, Senior Advisor and Staff Director, Energy and Environment; Brendan Larkin, Policy Coordinator; Dustin Maghamfar, Air and Climate Counsel; Tim Robinson, Chief Counsel; Mike Bloomquist, Minority Staff Director; Adam Buckalew, Minority Director of Coalitions and Deputy Chief Counsel, Health; Jerry Couri, Minority Deputy Chief Counsel, Environment & Climate Change; Jordan Davis, Minority Senior Advisor; Caleb Graff, Minority Professional Staff Member, Health; Peter Kielty, Minority General Counsel; Bijan Koohmaraie, Minority Counsel, CPAC; 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; Zack Roday, Minority Communications Director; Peter Spencer; Minority Senior Professional Staff Member, Environment & Climate Change.

Mr. Tonko. Good morning, everyone, and welcome to the Subcommittee on Environment and Climate Change's first hearing of the year. Now that the gavel has been found we can move forward.

Let me before I make my comments thank Chairman, former Chairman, always Chairman perhaps, John Shimkus for his great work in leading this subcommittee. I think we had an outstanding track record. And I enjoyed the years that he served as chair and I as ranking member. It is a pleasure to have served with you and now to continue to serve with you.

I welcome all the colleagues of this subcommittee to this first hearing and to service through this subcommittee. And in general I think we have a lot of business ahead of us but I look forward to a great, spirited debate on all of these issues and bipartisan response to the solutions that we will develop.

The subcommittee now comes to order. I recognize myself for five minutes for an opening statement.

In 1957, when I was the impressionable age of 8, Earth entered the Space Age with the launch of the Sputnik satellite by the Soviet Union. People around the world stopped what they were doing and looked the heavens. Nothing after that would ever be the same. Americans leapt into action, training to become scientists and engineers in droves. I was one of them.

And I see that same motivation, wonder, and drive in many

of the people today who are working and advocating to transform our economy to one that is cleaner, safer, and more just. They are advancing clean energy technologies, designing the infrastructure of the future that will help communities endure, and rethinking every industry we have ever known.

It goes by many different names: Sandy, Harvey, Maria, Katrina, Campfire, but there is no question we have reached a new generation's Sputnik moment. How we respond to this threat and the opportunities it offers will indeed shape American lives for generations. In the 1960s our government and our nation's best rose to the Sputnik challenge by sending a person to the moon. Today our course remains unclear.

How our committee responds at this inflection point will define our nation for the next half century and beyond. Will we rise to this challenge and tackle our most complex problems? Will we continue to be the world leader in science, engineering, and technology innovation? Will we make our country and our planet better for future generations?

These questions are at the heart of our work here today. In 1961, when President Kennedy promised to put a person on the moon by the end of the decade, what would have been the consequences of failure? Loss of scientific discovery? Damage to America's reputation? Ultimately it would have been remembered as another missed deadline, or failed call to action, or broken promise from

a politician.

With climate change the cost of failure is existential. Failure to launch this next moonshot will result in deaths, devastation, and irreversible damage to our communities, our economy, and our environment. This is not an exaggeration. It is the assured outcome we should fail -- if we should fail. But America is a nation of pioneers and problem solvers.

This climate challenge is not beyond us. Time is running out but it is not gone. Some of our colleagues may protest the cost of climate protection. And our constituents are already paying a heavy price after each and every hurricane, wildfire, and flood. Investing in solutions and resilience today will help manage and limit those risks and serve as a foundation for job creation, healthier communities, and economic opportunity. But let's be clear, there is no path forward more costly than for us to do nothing.

Today we will hear from an expert panel to help us better understand those costs, along with possible solutions that Congress is considering. Dr. Brenda Ekwurzel co-authored the Fourth National Climate Assessment and can explain climate threats our nation is facing.

Mike Williams can discuss job opportunities that will come from a clean energy transition, including from building more resilient infrastructure to adapt to new climate realities.

Reverend Leo Woodberry can tell us the importance of a transition that is equitable. We must address historic environmental injustices and ensure that benefits of a green transition are shared across every community.

Rick Duke can discuss a range of potential policy and technology solutions for climate mitigation, many of which are cost competitive and proven to work.

In the decade since Congress last considered comprehensive climate legislation, green technologies have become more affordable and more effective. Today there are viable decarbonization pathways for many sectors of our economy that will enable our nation and the world to achieve emissions reduction targets. Congress can give the certainty, price signals, and resources needed to achieve these goals.

In 1961, we chose to go to the moon. Today we must make another choice: will we have the clarity of mind and conscience to choose to address climate change with the urgency that scientists say is necessary? I say yes. Chairman Pallone says yes. Every member on this side of the aisle says yes. And we are willing to work with the legions of Americans, countless businesses, local state and foreign governments, our U.S. Department of Defense, and our colleagues here on the other side of the aisle, and anyone else with ideas that can solve this crisis.

To my friends across the aisle, I implore you, now is the time to join us. We want to work together. But inaction is no longer an option. We must act on climate.

These issues were not always partisan. Our parties came together to pass the Clean Air Act and its amendments. And as a credit to Mr. Shimkus' leadership, this subcommittee found ways to work together to solve other seemingly intractable, multi-decade stalemates. We have proven we can find common ground and we can get things done. We want to find solutions that work for all communities and all Americans, and we will not be deterred.

We have science-based targets that we cannot afford to miss. The very real and urgent threat of climate change is not just the issue of the day, it is the issue of our time, the challenge of our time, the opportunity of our time. And I hope the hearings held by this subcommittee will help us find a path, a path forward where we can seize this opportunity.

With that, I yield back. And the Chair now recognizes Mr. Shimkus, ranking -- excuse me, Republican leader of the subcommittee of the Subcommittee on Environment and Climate Change, for five minutes for his opening statement. Mr. Shimkus. First of all let me congratulate you, Mr. Chairman. And thank you for the kind words. I am truly touched by those.

We have had some policy differences over the past six years.

We also enjoyed, as you identified, some significant bipartisan policy achievements during my chairmanship, in no small part due because of the thoughtful work that you brought to the panel as a Democrat leader, and your very competent staff. I believe this subcommittee will be served by your leadership.

Today's hearing ticks off a topic that will be challenging but not impossible to work through in a bipartisan manner. We all agree that extreme weather events and climate change presents risks to our communities and communities around the world. While we agree these risks should be addressed, we may disagree about what to do. If we are to reach an agreement on this issue, I believe we must look openly and broadly at potential solutions.

Many climate policy advocates have been suggesting for years that if you agree climate change is real, then command and control policy prescriptions are the only way to address this problem. If you question these expensive solutions, you must not accept the problem.

That is a false choice. And the amped-up partisan rhetoric it generates severely inhibits a full look at potential, practical policies that not only help reduce carbon dioxide emissions, but also ensure our nation and its communities can grow and prosper.

Recent projections by the International Energy Agency show that fossil energy, even with all existing and announced policies implemented, will likely be the dominant form of energy in our

world system through 2040, and likely beyond. Wind and solar energy will serve a larger portion of electricity generation across the world and in the United States according to this data, but fossil energy and nuclear energy, a technology regrettably frowned upon by many climate policy advocates, will remain dominant.

While future innovation could substantially change these projections, the stubborn route is that U.S. and global energy systems necessary for societies to develop, grow, trade, and prosper depend upon affordable and abundant energy and mobility. Policies that artificially raise the costs or availability of energy threaten to undermine this fundamental fact, which helps explain the 30-year failure of international climate agreements to significantly reduce global emissions, although the United States seems to be doing better than most of the countries that are in agreement.

No nation seeking to improve the lives of its citizens will accept energy or transportation constraints, and neither should the United States if we want to maintain a robust economy, economic growth, and remain globally competitive for future generations.

We could have a fuller conversation about accelerating the transformation to cleaner technologies if we accept that proposing top-down government requirements to rapidly decarbonize the U.S. and global economies may not be the most

realistic way to address the climate change problem.

We should be open to the fact that wealth transfer schemes suggested in the radical policies like the Green New Deal may not be the best path to community prosperity and preparedness.

And we should be willing to accept that affordable and abundant energy is a key ingredient for economic development and growth. After all, economic growth and economic resources, coupled with sound planning, infrastructure, and governance, increase local capabilities to minimize impacts of future extreme events.

These are realities we should explore today and in future hearings if we want to develop sound environmental and energy policies to address climate risk. We should also focus on the ingredients behind the exceptional achievements of American know-how in energy, in technology and innovation that has led to world-leading prosperity, and making sure we can continue to foster these advances in other technology.

The American shale revolution transformed our nation's economic competitiveness and is driving cleaner electricity generation because of old fashioned innovation, entrepreneurship, regulatory certain private capital, not bigger government mandates. And let me also mention private property rights on these areas. Let's apply these lessons more broadly.

Mr. Chairman, there are different approaches to dealing with

climate change. Let's focus on solutions that work for the American public.

And with that, Mr. Chairman, I yield back my time.

Mr. Tonko. The gentleman yields back. And thank you, Mr. Shimkus.

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

Mr. Pallone.

The Chairman. Thank you, Mr. Tonko, Chairman Tonko.

Today's hearing on climate change is long overdue. We are feeling its effects now, and the influence of unchecked climate change is becoming more obvious every year. Experts have warned us for a long time that climate change would lead to more intense storms, extended droughts, longer wildfire seasons that burn hotter and cover larger areas, greater seasonal temperature extremes, melting of glaciers and ice sheets, and rising sea level.

The predictions have proven true. And these scientific experts warn us that as greenhouse gas pollution continues to grow, climate change effects will intensify as the planet warms to levels that people have not experienced any time in human history.

Unfortunately, we are currently going in the wrong direction with respect to greenhouse gas pollution. The Fourth National

Climate Assessment of the International Panel on Climate Change's recent report made clear that if we do not aggressively cut emissions now, we will jeopardize public health and safety, as well as our economic and national security.

The science on climate change is indisputable. And I do want to thank -- I listened to Mr. Shimkus' opening remarks and I noticed that he basically said that he agrees that there is a major impact from climate change, suggested that innovation was certainly one of the ways that we deal with it. So, again, I want to say that I know that in the past we were never able to have a hearing on climate change when the Republicans were in the majority, but I am glad to see that our ranking member is saying that it's something that has to be dealt with and is real.

I don't think that we need to debate the scientific facts. Instead, we must focus on solutions to the problems and must act now to avoid the most catastrophic consequences associated with climate change. The good news is that we already know the solutions. There are untapped opportunities to expand the use of renewable energy and to become more efficient with all the resources and energy we use. With focused investment and innovation we can help transform industries and economic sectors that will find meaningful emission reductions more challenging.

Meanwhile, states, local government, and individual businesses are moving forward to reduce emissions to meet our

obligations under the Paris Agreement. And it is now time for the Federal Government to step up and help them in these efforts and spur further action in communities across the country.

I know there are those who believe we can't address this problem because the costs are too high. But the costs of not acting are far higher and a lot more painful. In 2017, the U.S. experienced 16 natural disasters with costs totaling $360 billion. This past year, disasters again cost over $100 billion. The dollar figures are concerning but the real tragedy is the loss of life and destruction of homes, businesses, and communities when these events occur.

And tremendous sustained efforts are required for communities to recover and rebuild. And I saw this firsthand in the aftermath of Superstorm Sandy in my district. Events disappear from the headlines in a matter of weeks but the work to rebuild and recover takes years. And it is still going on in my district. Many people have not been able to return to their homes. Many businesses have not.

We simply cannot afford to delay any longer. And we must discuss ways to help communities better adapt to the changes that we are already seeing. We need to modernize and upgrade our infrastructure to ensure vital services like water, sewer, electricity, telecommunications, and transportation are more resilient. And here, Mr. Shimkus, in particular I think that we

can work together with the Republicans. And this important work would not only make our communities safer and better prepared for extreme weather events, but it will also provide good-paying jobs and the modern, flexible infrastructure that will better support a robust economy in the future.

We want to find innovative solutions that will help strengthen our economy by creating jobs in industries that will begin to repair the disparities found in so many vulnerable communities. And it is precisely those front line communities that experience the worst effects of climate change and natural disasters and that are the least able to recover from them. Again, I saw it in my own district where some of the most vulnerable communities economically are the ones that still have not recovered.

I think we can do better. We must do better. And these communities need to be engaged in the process of designing adaptation and mitigation measures to reduce pollution.

So as we move forward, we hope to have our Republican colleagues as partners in these efforts. Certainly what has been said by Mr. Shimkus today gives me hope. The devastating effects of unchecked climate change do not know partisan or political boundaries. They effect us all. And I hope we will be able to find common ground and work together on solutions.

And the U.S. has always been a global leader in science,

technology, and industry. And our leadership on climate action and global transformation to a low-carbon economy is leading now. This hearing is the start of our efforts to maintain U.S. leadership and to put us on the path to a low-carbon and more prosperous future.

And if I can say something, Chairman Tonko, I know that this has always been something that you cared so much about and worked on even when you were in the state legislature. So, we are glad that you are the chairman. Thank you. Mr. Tonko. Thank you, Mr. Chair. The gentleman yields back. And, Chairman Pallone, I appreciate your comments.

The Chair now recognizes Mr. Walden, the Republican leader of the full committee, for five minutes for his opening statement.

Mr. Walden. Well, thank you, Mr. Chairman. Again, congratulations on finding the gavel and using the gavel. We are delighted to work with you. And thanks for holding this hearing on climate change.

It is no secret the Energy and Commerce Committee has the jurisdiction, the ability to find a bipartisan path forward to tackle this important issue that confronts not only our nation but also the world. As you know, I spoke out early and forcefully, Mr. Chairman, about the unnecessary effort by Speaker Pelosi to create yet a separate select committee which lacks any legislative authority. Our able members will certainly serve on that panel.

It is as redundant as the last one she created more than a decade ago.

With all this activity, it is important to highlight a few fundamentals at the onset. Climate change is real. The need to protect the environment is real. The need to foster a strong U.S. economy and grow American jobs is also real. And the need to prepare our communities for the future is real. Republicans on this committee are ready, willing, and able to have serious solutions-oriented discussions about how to address and balance these considerations.

For instance, we believe that a longer conversation about the Democrats' Green New Deal is necessary. We have heard about general tenets of the plan for the U.S., such as all renewable electricity generation by 2030, all zero emission passenger vehicles in just 11 years, a federal job guarantee, a living wage guarantee, but we obviously have some concerns about the potential adverse economic employment impacts of these measures.

At least one analysis has estimated that going to a 100 percent renewable energy in the U.S. could cost a minimum of $5.7 trillion, trillion dollars. It sounds like a huge sum for consumers and taxpayers to foot.

The Republicans are focused on solutions that prioritize adaptation, innovation, and conservation. Just as America led the world in energy development which reduced carbon emissions,

we want America's innovators to develop the next technologies that will improve the environment and create jobs here at home. We want to help the environment for our children, and grandchildren, and their children. We also want the people who live in our districts in this country today, right now, to have jobs and to be able to provide for their families.

These are not mutually exclusive principles. And I believe, Mr. Chairman, working together we can develop the public policies to achieve these goals.

As the Republican leader of the committee, I will work to promote a better policy vision for the environment, one which supports and accelerates continued technological advances in energy and environmental practices to improve our quality of life. It ensures a sound regulatory environment where people have the confidence to invest their money to innovate and to create American jobs, one that improves information needed to understand future impacts and provide resources to communities to adapt and to prepare for these impacts, one that promotes America workforce development and training in energy -- related industries, and one that recognizes the importance of open and competitive markets in the role the United States plays as the world's leading energy producer, innovator, and exporter of advanced technologies.

Indeed, Republicans have a track record of supporting policies that protect the environment and ensure energy access.

For example, in the last Congress we supported legislation to promote zero emissions nuclear energy, and renewable energy including hydropower. Hydropower has great success as a clean energy source across the country, and especially in my district and my state where 40 percent of our energy comes from hydropower.

Legislation we passed into law in the last Congress will streamline the permitting process for closed loop pump hydropower projects. We have such a project in the permitting process in my district that would power up to 600,000 Oregon homes in a closed loop hydropower process.

We also advanced legislation to promote energy efficiency, grid modernization, energy storage, natural gas, a more resilient electric grid, carbon capture and utilization, and better forest management to address wildfires and limit their air quality impacts. This is what happens after a fire. This is called post-fire wildlife habitat right here. It is nothing but ash and destruction of the habitat.

Oregonians choke on smoke every summer from wildfires that burn across our poorly managed federal forests, filling our skies with ash and polluting our airsheds with carbon dioxide, among other pollutants. Managing our forests not only reduces the risk of these catastrophic fires, but the Intergovernmental Panel on Climate Change say that sustainably managing our forests would create the longest sustained carbon mitigation benefit. So,

there is work we could do there.

And the numbers show that our policies are working. In 2017, U.S. carbon emissions were the lowest they have been since 1992, and are projected to remain steady in upcoming years, more than 10 percent below 2005 levels. Unfortunately, the Green New Deal ignores many of these important elements of our energy strategy that makes it more difficult to reach our shared environmental goals.

We look forward to hearing from our witnesses today on these topics, especially Mr. Powell from ClearPath which has promoted clean energy advanced nuclear and carbon capture; and Mr. Worthington of the U.S. Energy Association, which advocated for a diverse energy mix within the United States and the importance of energy access and affordability around the globe.

So, when it comes to climate change, Mr. Chairman, Republicans are focused on solutions. That is why we back sensible, realistic, effective policies to tackle climate change. What we are deeply concerned about are plans we believe will harm consumers and cost American jobs and drive up our costs and not result in the kinds of goals we want to achieve mutually.

So, thank you for having the hearing. I yield back the balance of my time. Mr. Tonko. Thank you, Representative Walden. And the gentleman yields back.

As Chair, I remind members that pursuant to committee rules

all members' written opening statements shall be made part of the record.

I now introduce our witnesses for today's hearing. And let me thank each and every one of you for sharing your time and offering input on this very important topic. We do appreciate your participation.

So, we have from my left to right, Dr. Brenda Ekwurzel, Director of Climate Science, Union of Concerned Scientists.

Next to her is Mr. Rich Powell, Executive Director of ClearPath.

Then we have Mr. Rick Duke, Principal of Gigaton Strategies.

Then Reverend Leo Woodberry, Justice First Tour, Kingdom Living Temple Church.

Then we have Mr. Barry K. Worthington, Executive Director of United States Energy Association.

And then finally, Mr. Michael Williams, Deputy Director of BlueGreen Alliance.

We as a committee want to thank our witnesses for joining us today. We look forward to your testimony. At this time the Chair will now recognize each witness for five minutes to provide his or her opening statement.

Before we begin I would like to explain the lighting system. In front of our witnesses is a series of lights. The lights will initially be green at the start of your opening statement. The

light will turn yellow when you have one minute left. Please begin to wrap up your testimony at that point. The light will turn red when your time expires.

So, with that, Dr. Brenda Ekwurzel, again welcome. You are recognized for five minutes.

STATEMENT OF BRENDA EKWURZEL, DIRECTOR OF CLIMATE SCIENCE, UNION OF CONCERNED SCIENTISTS; RICH POWELL, EXECUTIVE DIRECTOR, CLEARPATH; RICK DUKE, PRINCIPAL, GIGATON STRATEGIES; REV. LEO WOODBERRY, JUSTICE FIRST TOUR, KINGDOM LIVING TEMPLE CHURCH; BARRY K. WORTHINGTON, EXECUTIVE DIRECTOR, U.S. ENERGY ASSOCIATION, AND; MICHAEL WILLIAMS, DEPUTY DIRECTOR, BLUEGREEN ALLIANCE

STATEMENT OF BRENDA EKWURZEL

Ms. Ekwurzel. Thank you, Chairman Tonko, Ranking Member Shimkus, and for the opening statements by Chairman Pallone and Ranking Member Walden, and the committee for providing me the opportunity to testify here before you today.

I am Director of Climate Science at the Union of Concerned Scientists, and I also had the privilege of serving as one of the co-authors of the Fourth National Climate Assessment released in November. Before I share with you the advances in our understanding from these latest assessments, I want to turn to a recent example of the high cost of climate change.

During the recent outbreak of extreme cold weather that gripped large parts of the nation, a University of Iowa student and a University of Virginia student were counted among at least 21 people who perished from consequences likely from the dangerous wind chill. Although it may seem counterintuitive, recent

studies indicate that climate can cause unusually cold temperatures at mid latitudes by disrupting the normal winter season polar vortex in the stratosphere.

A good analogy to this disruption is a weak seal on a freezer door that periodically allows frigid air to flood into the room while warmer air rushes into the freezer. At the end of January, similarly, a cold blast spilled out of the Polar Regions and into the Midwest and expanded through to the eastern U.S., breaking wind chill records across. Yet Alaska experienced above-freezing temperatures and rain falling on snow, forcing the cancellation of mid-distance dog sled races that contestants use to compete for the long-distance races, the Iditarod.

Evidence is growing that warmer-than-normal periods in the Arctic are associated with a greater chance for extreme winter weather in the eastern United States. This deadly cold snap is just a recent example of the changing nature of extreme events that scientists are studying. One goal is to provide earlier warning so local officials have more time to take precautionary measures and improve safety.

Climate assessment provide the public and policy makers the most advanced warnings through summary and evaluation of the latest science. I will briefly share with you some findings with you today from the Intergovernmental Panel on Climate Change Special Report on Global Warming of 1.5 degrees Celsius above

pre-industrial levels, and the Fourth National Climate Assessment.

So, human-induced warming reached approximately 1 degree Celsius, or 1.8 degrees Fahrenheit, a warmer world. And what has that brought us? Research indicates that this warming has changed the behavior and severity of extreme events.

For example, scientists found that global warming made the precipitation around 15 percent more intense for Hurricane Harvey that brought devastating flooding to Houston, and made it around three times more likely.

So, at the present rate, global warming would reach 1.5 degrees around 2040, and around 2 degrees around 2065. And every half a degree of global temperature increase has major consequences. For example, coral reefs have an immense variety of species and support fisheries that help feed many around the world. The Intergovernmental Panel on Climate Change Special Report assessed that coral reefs are projected to decline a further 70 to 90 percent at 1.5 degrees Celsius above pre-industrial, and losses of nearly all coral reefs at 2 degrees Celsius above pre-industrial levels.

To avoid surpassing 1.5 degrees Celsius, global carbon emissions would have to drop around 45 percent below 2010 levels by around 2030, and reach net zero emissions by the mid-century. The special report asserts that to hold temperatures to 1.5

degrees would require "rapid and far reaching transitions in energy, land, urban, and infrastructure" at an "unprecedented scale" with "significant upscaling of investments in options." Given the scale of changes needed and the time to lay the framework, this is a make or break decade to make capital investments needed to reduce carbon dioxide levels, or the Paris Climate goals are unlikely to be achieved.

The Fourth National Climate Assessment was released in November in accordance with the legal mandate of the 1990 Global Change Research Act. And, increasingly, U.S. residents already recognize the consequences of climate change. Midwest forest products industry has experienced over the past 70 years 2 to 3 week shorter frozen ground season suitable for winter harvests. The Great Lakes ice cover decreased on average 71 percent from 1973 to 2010, with a recent rebound in the ice years of 2014 and 2015.

Meanwhile, during the 2012 and 2017 winters, Lake Ontario and southern Lake Michigan the temperatures never dropped below 39 degrees Fahrenheit. And that's a critical threshold for seasonal mixing of the waters. Without winter or spring seasonal mixing, the chance is for increases for low oxygen conditions, which are toxic to aquatic species.

In another case, an extreme flooding event in Thailand caused a U.S.-based company to lose around half of its hard drive

shipments during the last quarter of 2011. Consumers may not have realized this, but this temporarily doubled global hard drive prices and drove up the costs for Apple, HP, and Dell.

Climate Change can exacerbate historical inequities. And I want to say that the projected costs in the labor and the -- is around $155 billion per year. And under a low emissions scenario we could take a bite of nearly a half out of those damages. Extreme heat mortality could have damages towards the end of the century of over $140 billion per year. We could take a 48 percent bite.

Mr. Tonko. If I can ask you to wrap up, please.

Ms. Ekwurzel. And just want to say overall coastal property losses, the losses are real, climate change is real. We need to step up solutions at the root cause, which states and cities are doing today.

Thank you very much.

[The prepared statement of Ms. Ekwurzel follows:]

********** INSERT 1 **********

Mr. Tonko. Thank you. And we now move to Mr. Rich Powell. You are recognized for five minutes, Mr. Powell.

STATEMENT OF RICH POWELL

Mr. Powell. Good morning, Chairman Tonko and Pallone, Republican Leaders Shimkus and Walden, and other members of the committee. Thank you for the opportunity to appear today.

I am Rich Powell, Executive Director of ClearPath, a non-profit that develops conservative policies that accelerate clean energy innovation. ClearPath supports flexible low-carbon technologies, nuclear, hydropower, carbon capture for both coal and gas, and energy storage.

Climate change is an urgent challenge that merits action at every level of the government and private sector. It is too important to be a partisan punching bag. Climate change deserves a pragmatic and technology-inclusive agenda to make the global clean energy transition cheaper and faster. It is conservative to hedge for this risk.

Heavy industry is aggressively moving onto solutions to deal with climate issues. Southern Company is reducing their emissions in half by 2030, and will be low to no carbon by 2050. Shell also aims to cut emissions in half by 2050. Notably, senior executives from Southern, Shell, and just last week BP, are linking their pay to hitting emissions targets. These examples illustrate that the Federal Government should enable private sector solutions through market-oriented policies.

Crucially, we must also remember that climate change is a global problem. A molecule of CO2 emitted on the other side of the world has the same impact as one released here. Since 2000, coal power generation in China nearly quadrupled. Bloomberg reports that new Chinese coal capacity remains planned roughly equivalent to the entire U.S. coal fleet. Abroad, China is financing another 100 gigawatts of goal in at least 27 countries. The expected emissions growth from developing Asian countries by 2050 alone would offset a complete decarbonization of the U.S. economy.

More broadly, the share of global energy supplied by clean sources has not increased since 2005. Despite significant renewables growth, global emissions continue to rise. In other words, clean development is only just keeping up with economic development. Clean is not gaining ground. Clean tech available today is simply not up to the task of global decarbonization. It must represent a better, cheaper alternative so developing nations consistently choose it over higher-emitting options.

We have a choice. That that the Chinese and their partners shut down their coal-fired power plants at the expense of economic growth, or develop, demo, and export U.S.-based emissions control technologies.

This technologies challenge is evident in the most ambitious plan yet from a major U.S. utility. Xcel Energy recently

announced plans to reduce carbon emissions 80 percent by 2030 and 100 percent by 2050. Xcel noted they will require innovation to reach their 100 percent goal while remaining reliable and affordable for their customers. Growing their already-impressive portfolio of renewables won't be enough.

A serious debate on climate solutions must include a dose of political and technical realism. Let's not rush toward any impracticably hasty, exclusively renewable strategy in the U.S. that will be both costly and unlikely to reduce global emissions. If supporters of a Green New Deal truly believe climate change is an existential threat, they should focus on policies that reduce global emissions as quickly and cheaply as possible.

So how do we change our trajectory? Well, we have done it before. There is no reason that clean technology needs to be more expensive or worse performing than higher-emitting technology.

Take America's shale gas revolution, rooted in decades of public-private research partnerships. This R&D, coupled with a $10 billion alternative production tax credit, yielded combined cycle turbines, diamond drill bits, horizontal drilling, and 3D imaging. Markets took up the technology, increasing gas from 19 to 32 percent of our power between 2005 and 2017, lowering emissions 28 percent.

The same ingenuity that produced the shale boom can make that gas fully clean. Near Houston, NET Power is successfully

demonstrating a groundbreaking zero-emission natural gas power plant. More broadly, it is an immensely promising time for public-private partnerships in U.S. clean innovation. Some examples:

Form Energy is developing cheap, long-duration energy storage that may enable many more renewables. NuScale is licensing a small modular nuclear reactor, while Oklo and X-Energy partner with our national labs on micro-reactors.

The last Congress hasn't received the credit it is due for boosting low-carbon technologies. Your broadly bipartisan agenda enhanced critical incentives for carbon capture, renewables, and advanced nuclear; invested in clean R&D at record levels; and reformed regulations to accelerate the licensing of both advanced nuclear reactors and hydropower. One example, the 45Q tax incentive for carbon capture was supported by a vast bipartisan coalition from environmentalists to labor to utilities to coal companies. Notably, seven national unions just collectively restated the need to include carbon capture and nuclear in any national climate policy.

Going forward, given the scale of the climate challenge, we need to greatly increase the pace and ambition of our efforts. Let's not shy away from smart investments in technology moonshots to deliver lost-cost, high-performing clean technology. Let's create stronger incentives to commercialize cutting-edge

companies and deploy their technologies globally, and remove regulatory barriers to rapidly scaling clean technology.

Bipartisan cooperation on climate change is essential under divided government, and attainable. In fact, it is the only chance our nation will have to play a significant role in the global solution.

Thank you again for this opportunity, and I look forward to the discussion.

[The prepared statement of Mr. Powell follows:]

********** INSERT 2 **********

Mr. Tonko. Thank you, Mr. Powell.

And next we will move to Mr. Rick Duke. You are recognized, Mr. Duke, for five minutes.

STATEMENT OF RICK DUKE

Mr. Duke. Thank you, Chairman Tonko, Republic Leader Shimkus, and members of the committee for inviting me to testify on the prospects for reducing greenhouse pollution through American leadership on technology and diplomacy. It is an honor to share with this committee my confidence that we can still contain the most costly and destabilizing climate impacts, but only if we choose to act to put our nation on a path to net zero greenhouse gas pollution by mid-century.

In short, rapid climate action is strategic for both our economy and our national security. And we urgently need strong federal policy to make it all happen.

This is a momentum game -- the faster we act, the easier it gets. Early support for emerging green technologies gives American entrepreneurs the chance to cut costs as they scale up production and learn by doing. As these costs come down, bigger markets open up, including for exports to countries that raise their ambition in response. And this in turn allows further cost reductions in global-scale economies.

This virtuous cycle spurs the incredible progress we are seeing for climate solutions ranging from super-efficient lighting to renewables. And many of these originated in American labs and start-ups. To build on this momentum we need to double

down on cutting greenhouse gas pollution in the United States. And we know exactly what to do. It starts with quickly scaling up zero-carbon electricity; we have to broadly electrify vehicles, buildings, and much of industry; and we also have to cut non-CO2 greenhouse gases.

Over time, solutions that remove carbon dioxide from the atmosphere will play an increasingly important role. This includes restoring farmlands and forests through increased economic productivity, while also storing carbon in healthier soils and vegetation. At the same time, we need to kick start promising emerging technologies to directly extract CO2 from the atmosphere and safely sequester it.

These carbon dioxide removal solutions will allow us to achieve net zero by balancing out certain emissions that we don't know how to eliminate currently, such as methane and nitrous oxide from agriculture.

Despite the imperative to get moving though, some argue that other countries aren't doing much so we should hold off on cutting our emissions. But the facts are that our competitors are already moving. Every country other than the U.S. remains committed to the Paris Agreement. The EU and Canada both have carbon pricing in place that is strong.

Mexico is moving to 35 percent clean electricity by 2024. And China has over 80 strong technology deployment policies in

place that are propelling up to nearly $130 billion in renewables investment in 2017 alone. That is triple the level in the U.S.

At the same time, China already accounts for well over half the electric vehicle sales, and two of the top three electric vehicle manufacturers in the world. Tesla is still number one slot, and GM is in the top ten.

All this investment is driving down low-carbon technology costs globally, including batteries and solar electricity, both of which have come down about 80 percent since 2010. It has never been easier to cut greenhouse gas pollution. And all 50 states can act now. In fact, at least 45 states have already installed utility-scale solar and wind at increasingly prices that are below conventional power. And we are making progress with carbon capture and storage, including the zero carbon natural gas electricity pilot in Texas, and cleaner ethanol in the Midwest.

But, unfortunately, we are not moving fast enough. Last year our energy CO2 emissions were up over 3 percent after a decade of falling about 1.5 percent per year. And now federal policy is creating headwinds. The last two budget proposals sought to cut energy R&D by as much as 70 percent. Thankfully, Congress strategically increased funding on a bipartisan basis.

On deployment, the current administration is seeking to gut the clean power plan, weaken vehicle standards, thereby threatening to cost drivers billions at the pump in higher

gasoline consumption, and undermining measures to cut energy waste and methane leaks from our oil and gas systems. Instead of rolling, instead of rolling back standards we need stronger federal investment in policy, both new legislation and vigorous implementation of existing law, to propel all low-carbon solutions forward.

Many different policy packages could get the job done, but this ideally starts with at least doubling clean energy R&D, plus legislation that puts a price on pollution and equitably and productively uses resulting revenue. And we absolutely can and must do right by workers and others on the front lines of this transition, including those struggling with the decline of coal, and communities most impacted by pollution. Added all together, we could cut our emissions in half by 2035, on track to net zero by mid-century, while bolstering our technological and diplomatic leadership.

Thank you. Look forward to the discussion.

[The prepared statement of Mr. Duke follows:]

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

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

And now we will move to Reverend Leo Woodberry. Reverend, you are recognized for five minutes.

STATEMENT OF REV. LEO WOODBERRY

Rev. Woodberry. Thank you. Thank you, Chairman Tonko, and thank you distinguished members of the committee.

I have been doing this work now for over 25 years dealing with issues of climate and environmental justice. I could begin by talking about being too big to fail. But if we talk about that, then we can also talk about how we should not have moved away from kerosene to electric lights, or how we should have protected the carriage and buggy whip industry rather than developing the auto industry. Or we could have said let's keep the typewriter industry going and never develop a computer industry.

So, those are topics I can talk about. But what I would like to talk about is what we found last year when we conducted the Justice First Tour and went through 12 southeastern states and 25 cities and talked to people on the front line, people who have been suffering the impacts of carbon emissions, pollution, and the impacts of climate change.

So I am talking about people like the 90-year-old woman in Sellers, South Carolina, in Marion County who now has to elevate her home 7 feet in the air.

I am talking about people who labored in our fields, cleaned our homes, and worked for employers who never paid into their Social Security and have to live off SSI checks of $600 and $800

a month.

These are the people who are being impacted. We don't have to wait 12 years for a switch to be flipped. Americans are suffering the impacts of climate change right now. People being displaced, communities are being destroyed. And we come here issuing the clear clarion call of hope. We need policy change. We need to desperately put our people to work.

We can, like in the town of Sellers, South Caroline, they said that the flooding impacts were worse because of large-scale logging, losing our natural defenses against flooding. Because the ditches had not been cleaned out in 25 years in this rural community.

We can put our people to work elevating homes, cleaning out ditches, building bioswales to minimize flooding. We can pass legislation that will put in place community-based climate solutions. It is time to move beyond the false narrative that equates big utilities with renewable energy.

Let's look at the justification. Utilities said, we could not exist in a competitive environment because we have to build such large infrastructure that we might not get a return on our investment. Solar and wind can exist in a competitive environment. We don't have to look just towards macro solutions. If we can put timers and do energy efficiency in 10 million homes and reduce energy generation by as little as 200 kilowatt hours

a year, we will have made a significant difference. But in order to do this we have to be able to look towards people who desperately need work.

We have counties, like Marion County, like Dillon County, like Darlington County, like counties all across this country, rural communities where people have to drive 25, 30, 40 miles each way every day because there are no engines of economic development in their community.

I came here today to talk about the people along the Black Belt; the people of Flint, Michigan; the people along the I-95 corridor of shame; the least among us; those who were forgotten about, who we turned our gaze away from while the same polluting facilities were allowed to be sited in their communities that have led to climate change, and the possibility of humanity no longer having civilization as we know it. We can debate forever whether or not climate change is real. But the problem is here. The problem is now. And we need to build a wall of protection around the citizens of this country, a wall of mitigation, a wall of adaptation, and a wall of resilience.

Because the science is clear, whether we are looking at the Intergovernmental Panel on Climate Change or we are looking at our own national climate assessment, the storms are going to get worse. The hurricanes are going to become more intense. And we have to keep our forests standing in the ground because they are

the greatest carbon sinks on this planet. And we don't have enough time to see whether or not some technologies might work.

Mr. Tonko. Reverend, if you could wrap up.

Rev. Woodberry. And so, I just want to close by saying this. The time for action is now. And if we don't take action today then we do a great disservice for generations to come.

Thank you very much.

[The prepared statement of Rev. Woodberry follows:]

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

885 Mr. Tonko. Thank you, Reverend.

886 And now we will move to Mr. Barry K. Worthington. Mr.

887 Worthington, you are recognized for five minutes.

STATEMENT OF BARRY K. WORTHINGTON

Mr. Worthington. Thank you, Chairman Tonko, Ranking Member Shimkus, and members of the Subcommittee on Environment and Climate Change. My name is Barry Worthington. I am the Executive Director of the United States Energy Association. I have been in this role for 30 years, and have another dozen years in the energy business.

The U.S. Energy Association has worked in transitional economies in developing countries for 25 years, over 25 years, with the U.S. Agency for International Development, and also with the Department of Energy, to expand the use of clean energy technology. Our members include energy production companies, energy efficiency companies, but also engineering, finance, legal, research, and consulting organizations. Our purpose is to convey information about the realities of global energy issues in the 21st Century.

We are not a lobbying organization. We are not an advocacy organization. We are an educational association both by function and IRS tax status. My intent today is to offer information and observations to you and to convey an offer that the U.S. Energy Association is available to be a resource for you and your staff as you begin to tackle the priorities of the 116th Congress.

The risks of climate change are real, and industrial activity

around the globe is impacting the climate. Addressing climate change is a challenge for our country. It affects every world citizen. While the industry adjusts to climate change, it continues to ensure American citizens have access to increasingly safe, affordable, reliable, and clean energy, which we all do in this great country.

We are fortunate here. But, but we have between a billion and a billion-and-a-half global citizens with no access to commercial energy. Women in developing countries spend all day forging for sticks and animal dung to generate their cooking, lighting, and heating. This is dangerous. Burning firewood and animal dung indoors kills children. Indoor air pollution causes asthma and other health problems.

Access to energy, on the other hand, provides improved health, education, economic development, and allows mothers and fathers to spend more time with their family instead of scrounging around to find animal dung to burn in their inside.

Central to energy access is lighting, for example. In developing countries, simple lighting reduces thefts, rapes, personal assaults, and other crimes. Access to energy paves the way for economic development in businesses such as simple cell phone charging enterprises, refrigeration for vaccines. Energy access improves people's lives.

And our members are volunteering their time to work with

their counterparts in developing countries to share technology and management practices in the developing countries. And we are trying to do our part.

Our industry's challenge is to double the provision of energy services globally while reducing greenhouse gas emissions by 80 percent. Though there are 1 to 1.5 billion people with no access to energy, recognize there are also another 1.5 billion with inadequate access. And considering a global population growth of 2 billion leaves the energy industry to provide 5 billion more energy consumers access to energy services by mid-century.

Many of these consumers will utilize fossil fuels because they are domestic, abundant, and affordable. We should work harder towards helping them use high efficiency/low emissions technology. USEA has been doing this for 25 years.

And domestically we are expected to reduce greenhouse gas emissions by 80 percent. Our industry has undertaken a wide range of initiatives to reduce and avoid greenhouse gas emissions, and we are proud of our progress.

For example, electric power carbon dioxide emissions declined 28 percent from 2005 to 2017. Methane emissions declined 18.6 percent from 1990 to 2015, even though we increased domestic natural gas production by 50 percent.

We think the solution to the dual challenges of climate change and global access to safe, reliable, and affordable and

clean energy is technology. And an "all of the above" approach is essential. This means all of the renewables as well as all of the traditional fuels, including nuclear and fossil fuels. We need to work harder towards assuring that fossil fuel utilization uses high efficiency/low emissions technology, including carbon capture and storage.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Worthington follows:]

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

970 Mr. Tonko. Thank you very much, Mr. Worthington.

971 And finally, from the BlueGreen Alliance, Mr. Michael

972 Williams. You are recognized for five minutes.

STATEMENT OF MICHAEL WILLIAMS

Mr. Williams. Thank you, Chairman Tonko, Republican Leader Shimkus, distinguished members of the committee. I am honored to be here alongside my fellow panelists and with you all as we strive to find common comprehensive solutions.

As the Chairman noted, my name is Mike Williams. I am the Deputy Director of the BlueGreen Alliance, a national partnership of labor unions and environmental organizations. BlueGreen Alliance unites America's largest labor unions and its most influential environmental organizations to solve today's environmental challenges in ways that create and maintain quality jobs and build a stronger, fairer economy.

We believe that Americans don't have to choose between a good job and a clean environment or a safe climate. We can and we must have both.

The world's leading scientific organizations have been unambiguous that climate change is a dire and urgent threat. And we need comprehensive action and solutions to rapidly drive emissions down now. I am heartened by the common commitment to action I am hearing today.

Our communities bear the burden of climate change in wildfires, hurricanes, heat waves, droughts, and sea level rise it spawns. At the same time, our nation is struggling with deep

and crippling economic inequality. The majority of American families are less able to deal with these problems as their wages have fallen and their economic mobility and power in the workplace has declined.

For too long the debate on the economic impact of climate action has been framed as either disaster or miracle, yet neither aligns with the complicated realities in which American workers live. This flawed debate has prevented us from addressing climate change at a level commensurate with the size of the challenge. The driving forces behind the challenges of climate change and inequality are intertwined, and we must tackle them together as equal priorities and place good jobs and working families at the center of a massive economic transformation.

Thankfully, we are starting to see examples across the country of the kinds of solutions needed to achieve this outcome and justice for all Americans. Take "Buy Clean California," a landmark law that requires state agencies to consider the embedded carbon emissions of industrial products. This law will reduce emissions globally, while also leveling the playing field for domestic manufacturers who are investing in clean, efficient manufacturing technologies and processes.

Or in the state of Illinois where the Future Energy Jobs Act provides sweeping changes to boost renewable energy and energy efficiency while protecting the jobs of workers at current energy

generation facilities in the state, including existing nuclear power plants, and establishing standards for the solar industry to use a skilled and qualified workforce.

Finally, critical federal efforts, like America's landmark fuel economy and greenhouse gas standards for cars and trucks, drive investment, innovation, and job growth. Our research finds more than 1,200 U.S. factories and engineering facilities in 48 states, and 288,000 American workers, building technologies that reduce pollution and improve fuel economy for today's innovative vehicles.

As significant transformation is needed to truly address climate change and inequality at the speed and scale demanded by the scientific reality and the urgent needs of our communities, it will require bold ideas and a guarantee that no worker or community is left behind. And instead of leaking jobs and pollutions overseas, we invest in our industries and our people here.

This is a big task. But I cannot stress firmly enough that no solution to climate change or inequality will be complete if Congress does not move forward with an ambitious plan to rebuild and transform America's infrastructure so that it is ready for the significant transformation we need to tackle climate change. This plan must address all aspects of our infrastructure needs, from strengthening the electric grid and modernizing our water

systems, to reducing methane leaks in the natural gas distribution sector, improving surface transportation, investing in natural infrastructure, and making our schools, hospitals, and other buildings safer, healthier, and more energy efficient.

These investments can reduce air and water pollution and make our communities more resilient to the impacts of climate change. They will also create millions of good jobs. But we have to make sure we tackle this challenge the right way.

This means ensuring all products are subject to Buy America and Davis-Bacon;

Using project labor agreements and community benefit agreements, and local hire provisions;

Prioritizing the use of the most efficient, resilient, and cleanest materials and products;

Enhancing workforce training and development programs;

Increasing pathways to economic opportunities for communities and local workers, especially people of color and low-income communities;

And prioritizing public funding and financing.

Repairing America's infrastructure systems should be a bipartisan legislative priority for the 116th Congress.

In closing, I want to reiterate that tackling the crisis of climate change, if done right, is a significant opportunity to ensure a more equitable society, increase U.S. global

competitiveness, and create quality, family-sustaining jobs across the country.

We look forward to working with this committee as you move forward with your agenda for the 116th Congress. Thank you again for the opportunity to testify.

[The prepared statement of Mr. Williams follows:]

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

Mr. Tonko. I thank you, Mr. Williams, and your fellow panelists who have provided great information.

So that concludes our opening statements. We will now move to member questions. Each member will have five minutes to ask questions of our witnesses. I will start by recognizing myself for five minutes.

The United States emits around 6.5 billion metric tons of greenhouse gas each and every year. That pollution will outlast us by decades, and even centuries. As is clear from testimony, Americans are already feeling the effects of climate change, but most of the people in this room will be long gone when the worst consequences hit. The decisions we make today will determine the conditions for generations not yet born.

Dr. Ekwurzel, I would like you to expand upon why it is so important that we start drastically reducing emissions now.

Ms. Ekwurzel. Thank you, Chairman Tonko.

Essentially what you said is correct, that for 20 percent of the carbon dioxide emissions it could be trapping heat day in/day out for centuries. And also methane, nitrous oxide, these are the very important pollutants to get out of the atmosphere. In part, because you may have noticed that coastal properties is one of the big sectors for damage. And if you reduce emissions you can take over a 20 percent bite out of that. And it is because the legacy of sea level rise has already been baked in with the

historical emissions of heat -- trapping gases into our atmosphere.

So, think about what else we have baked in. It is very important to reduce emissions now so we have a chance at taking a 60 percent bite out of damages and extreme heat mortality in the labor sector, 50 to 60 percent. It is critical for saving lives to reduce emissions as soon as possible. Delay is super costly.

Mr. Tonko. And the difference between a high emissions or business-as-usual scenario compared to a low emissions one, what basically is that difference?

Ms. Ekwurzel. So, for example, in damage to the U.S. economy, the loss of labor cost would be, so, the range could be $20 to $200 billion per year by the year 2090.

If we went on the low emissions pathway we could take nearly a 60 percent bite out of that, or 50 to 60 percent. And that doesn't include adaptation. If we add adaptation in the mix, we can lower the costs immensely,.

What we see is, in general, a very tight relationship with each global average surface temperature increase, a bigger bite out of the U.S. percentage GDP.

Now, Ranking Member Walden mentioned some of the costs to transition to a clean energy economy. You compare that against some of these annual costs you start realizing that an investment

in reducing emissions is a very good investment.

Mr. Tonko. Thank you.

And, Mr. Duke, you have done a lot of work on decarbonization strategies. I, for one, believe we cannot take solutions off the table at this point. I hope today we can hear about the merits of any different options.

Given all the potential pathways to decarbonize our economy, at this stage in the process how would you recommend Congress approach this challenge?

Mr. Duke. Thank you, Chairman. I would start on two tracks to address this challenge, starting with the easiest part first. And that would include at least doubling clean energy and clean solution research and development investment. And I appreciate the bipartisan move in that direction over the last year or two.

And at the same time, in the near term it is possible to do quite a bit of harvesting of low hanging fruit. That includes things like measures to cut energy waste, to scale renewables even faster because they do need to go even faster than today's pace. We need to modernize the electricity grid, as has been noted. And do things that save consumers money, and cut energy waste, and build on what the states are already doing.

At the same time, we need to go the next step. And the next step on a second track would be putting in place comprehensive policies that start with a price on carbon sufficient to put us

on that path to net zero greenhouse gas emissions by mid-century. And we need to do this in a way that ensures that all communities benefit equitably and that we're investing the resulting revenue in a smart way. This will create broad-based economic incentives that help our entrepreneurs and innovators scale up and bring down costs yet further and create that global momentum that we need.

Mr. Tonko. Thank you very much.

I share the sentiment that we need to make progress now while we can, while developing our comprehensive economy-wide solution.

I mentioned before that it has been a decade since the House last seriously attempted to address climate change. What has changed over the past 10 years that indicates that this time it can be different, Mr. Duke?

Mr. Duke. Thank you for the question. There is quite a bit on the technology front that is worth just briefly summarizing.

We have got all kinds of cost, cost-effective solutions today, from wind and solar to energy efficiency. And electric vehicles are even cost-effective for some drivers in high mileage applications like taxi drivers. You see them even here in D.C.

And you have got demand flexibility solution as well that are helping with the intermittency of some renewables.

Down the line we see all kinds of things coming soon, like emerging technologies that electrify heating buildings through heat pumps, and electric vehicles that are cheap enough to compete

on first cost with internal combustion engines, and dominate in terms of life cycle costs, will be available by many estimates within five years.

And so this kind of technology solution set is a game changer and making it easier to act to cut pollution today.

On the policy side we have also learned a lot. And I think it is worth noting that pricing pollution clearly works. And what we have seen, in fact, is that countries that have done this, for example the European Union or our own states in the Northeast or California, have routinely seen that innovation means that the cost of the tradable permits under a cap in trade system is much lower than they initially anticipated.

And so we should think about that as a lesson to create investor certainty when we have these kinds of programs. We might want to add a, we might want to add a price floor on those kinds of mechanisms. And in general we need to ratchet up standards regularly for things like efficiency so we don't lose momentum on fuel economy or appliance efficiency. And we need to stretch incentives further with competitive mechanisms like clean electricity standards.

Mr. Tonko. Thank you. Thank you, Mr. Duke.

And I now recognize Representative Shimkus as the Republican leader of this subcommittee for five minutes to ask questions.

Mr. Shimkus. Thank you, Mr. Chairman. I'm going to turn

my questions to Mr. Worthington.

You state that the challenge for the energy industry is to double the provision of energy services globally while reducing greenhouse gas emissions by 80 percent. Can you break this down for me? What is driving the increase in global energy demand? And why are fossil fuels projected to remain the dominant source for energy globally?

Mr. Worthington. Thank you, sir, for that question.

Driving demand is multi-fold. It is a 2 billion population increase by the middle part of the century. It is providing access to energy for a billion to 1.5 billion people who don't have it now. This is captured in the United Nations Sustainability Goal Number 7. And it is an increasing the availability of energy to those citizens today who don't have reliable, affordable access to energy.

There are countries in, for example, in Africa and Asia where electricity might be available three to four hours a day. And that just renders an economy helpless. You can't operate industrial facilities with electricity only being available three or four hours a day.

So, so those are the drivers of demand.

On the production side, you know, we work in dozens and dozens of countries. We are in touch daily with the people who operate energy systems in other countries. And in China, India,

Indonesia, Vietnam, South Africa, Colombia, so on and so forth, they all tell us they have every intention of continuing to use their domestic fossil energy resources because they are domestic they don't have to be imported, they are abundant, and they are affordable.

And I have had business people tell me, don't pay attention to what our government leaders say about us, we are going to use fossil --

Mr. Shimkus. Okay, wind this up because I have got a couple more questions for you, so.

Mr. Worthington. Okay. We are going to continue to use fossil energy.

Mr. Shimkus. Thank you. What is the scale of transition that would have to take place to reduce energy system emissions by 80 percent?

Mr. Worthington. Well, we would have to deploy every type of low-carbon/no-carbon technology that is possible. This truly becomes an all-of-the-above, and recognizing that countries are going to continue using fossil fuels.

Mr. Shimkus. Well, let me ask this. Can the world do that with existing technology? Can they do it now?

Mr. Worthington. We can't do it today, no. We need technology advancement all across the board, advanced nuclear systems, better, better energy storage, better renewables, and

carbon capturing and the like.

Mr. Shimkus. Which I think it speaks to the research and development equation that a lot of you have supported. Because we can't do it now, but with R&D and continued dollars we may be able to get there eventually. Correct?

Mr. Worthington. If we can put a man on the moon, we can solve the climate problem.

Mr. Shimkus. My friend McNerney would say, It is an engineering problem; right? He is right there. He is a Californian, so.

That is right. You are going to be a long time before you get to ask questions.

Some climate change proponents want to move fully away from fossil energy. Is your experience in this reasonable?

Mr. Worthington. Impossible.

Mr. Shimkus. Is there another way at the problem where the benefits of affordable energy help us actually address climate risk?

Mr. Worthington. Yes. By deploying technologies that reduce the CO2 output from fossil energy: high efficiency, low-emissions technologies.

Mr. Shimkus. Yeah, I think you weaved a great story in your opening statement. I think we all know people who are in different aspects, maybe in the mission field in underdeveloped

countries. And I think understanding, and the reverend is here, and we are concerned about our brother, and we are supposed to be our brother's keeper, bringing electricity to underdeveloped countries helps their livelihood, helps them develop, helps them or their state.

So that is part of the whole discussion as we deal with this, not just as a United States solution but as a solution that will affect the entire world.

You are the current Chairman of the Committee on Cleaner Electricity Production for Fossil Fuels for the United Nations Economic Commission for Europe and a member of the Sustainable Energy Committee for the U.N. commission. How would you describe the role of fossil fuels in meeting U.N. sustainability goals?

Mr. Worthington. The U.N. Sustainability Goal Number 7 is energy access. And the use of traditional fuels all around the world are critical to achieving that goal.

Mr. Shimkus. Thank you.

Mr. Chairman, I will give you the two seconds left.

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

Now the Chair recognizes Representative Pallone, full committee chairman, for five minutes to ask questions.

The Chairman. Thank you. I just wanted to emphasize, Mr. Chairman, the priority for our committee in addressing climate

change. And to that end, I do believe we can work together, and it will strengthen the economy and create more good-paying jobs in addition to protecting the environment through investments in clean energy and resilient infrastructure.

So, I want to start with Dr. Ekwurzel. What does the Fourth National Climate Assessment say about the anticipated effects of climate change on our nation's infrastructure?

Ms. Ekwurzel. It is we do need to build a more resilient infrastructure in the United States to deal with the earlier snow melt in the western mountains, and providing water that is escaping out of water sheds that we could instead harness for water resources, fighting wildfires, and other aspects. We need to upgrade our 20th Century infrastructure to deal with the 21st Century climate impacts. And that is a wise investment.

The Chairman. Well, I believe very strongly that if we are going to do something on a bipartisan basis to address climate change that a major infrastructure bill and putting provisions in that bill will probably be the thing that we can most easily do on a -- maybe easy is not the word, but that we can most likely do on a bipartisan basis and get President Trump to sign.

But do we have the tools to address this? In other words, how do we make -- how can we build and repair infrastructure in ways that reduce pollution? Give us some ideas and how feasible that is?

Ms. Ekwurzel. Sure. When you take climate change risks into account you end up having solutions, such as on the coastal areas, of nature-based solutions that are more resilient to the different types of hazards that climate-induced extreme events throw your way, and they suck up more carbon. So that is important and helps reduce emissions.

However, if we do other types of infrastructure decisions that do not take into account the risks or the increased emissions that may result, we could have, make it, you know, have maladaptive options. We have to learn as we go and start as soon as possible.

The Chairman. You are saying that we have to be careful if we do a major infrastructure bill that we actually, you know, build in these provisions that will help address climate change, otherwise it might make it worse?

Ms. Ekwurzel. Yes. And we have a lot of folks that are stepping up with lots of interesting designs once these incentives are unrolled.

The Chairman. All right, let me ask Mr. Williams about job opportunities associated with expanding clean and renewable energy. How do we ensure that, you know, that what we do with clean and renewable actually creates jobs and supports and strengthens the middle class?

Mr. Williams. Sure. I appreciate the question, Mr. Chairman.

The Chairman. And, again, by reference to infrastructure if you could.

Mr. Williams. Yeah, absolutely. Infrastructure is a phenomenal way to do that. So, direct investment in infrastructure across systems, especially in the electricity, in the energy grid, so, both the deployment of energy for heating and transportation, as well as electricity. So, directly investing in that area of infrastructure is incredibly important. But doing so in a way that advances strong labor standards or incorporates strong labor standards.

So, basic, what we think of as basic items like prevailing wage standards, Buy American, standards that make sure that when direct federal investment goes into these projects that we are ensuring that high quality --

The Chairman. Give me some examples. You mentioned the electricity grid. What else? What bout pipelines? What about, you know, electric vehicles, you know?

Mr. Williams. Absolutely. So, for us to deploy electric vehicles across the country we will need a massive upgrade in electric vehicle infrastructure, charging stations, so on and forth, across the country. That is an incredibly important one.

You mentioned pipelines. Water infrastructure is absolutely critical. We often don't realize the amount of energy we use pumping water through our system. And when you are leaking

water out of leaky old systems you are losing energy and increasing pollution. So, simply by upgrading water infrastructure systems we actually would save energy and reduce pollution. And all of that could and should be high quality job creation.

The Chairman. And I, you know, I hear in, you know, New Jersey there are all kinds of pipelines being built. And, you know, different people are for it or against it. But I keep reminding them that, you know, rather than focusing on new pipelines, why not focus on repairing existing, even for the natural gas. I mean, you can do a lot with maintenance and repair there that makes a difference in terms of climate change too; right? It is not just water, it is also natural gas and.

Mr. Williams. Yeah. So we have long had a campaign for a number of years on repairing and replacing natural gas distribution systems, the distribution systems under the city that deliver natural gas to homes and businesses so that they can heat properly. And those systems are old and they are leaky and they can be dangerous, so repairing them should be an absolute priority, not only because of the pollution that would save but the high quality job creation, as well as the safety concerns.

The Chairman. Thank you. Thank you, Mr. Chairman.

Mr. Tonko. The gentleman yields back.

The Chair now recognizes Representative Walden, full committee Republican leader, for five minutes.

Mr. Walden. Thank you, Mr. Chairman. And thanks --

Mr. Tonko. Five minutes to ask questions.

Mr. Walden. Thank you. And thanks again for having this hearing. I want to thank our panelists. Your testimony really will inform our work, and we appreciate it.

And, Mr. Williams, I appreciate your comments about, I believe you talked about the grid and improving drinking water supplies and things of that nature. I think we did 12 hearings in the last two years on grid adequacy, security. As we look to integrate new resources onto the grid we have got to make sure it will handle the new renewables and the pikes in power. And so I think the committee did good bipartisan work there. And, of course, we reauthorized for the first time in about a decade the modernized Safe Drinking Water Act to deal with some of these issues.

And we tackled some of the pipeline siting issues as well. And small scale hydro and irrigation districts that have put their open canals into pipes, pressurized the systems, and put a little hydro facility in and now generate enough power for 3,000 homes just in central Oregon. So, we streamlined some of the licensing there for hydro which is an area where we get, you know, carbon-free renewable energy. And to your point, we manage that precious water very carefully.

Dr. Ekwurzel, I am curious. You mentioned wildfires. My

district is subject to it. As I pointed out, this is habitat. The committee twice held hearings on the human effects of the wildfire smoke. And scientists told us between 2,500 and 25,000 people die prematurely every year from consuming wildfire smoke.

And we had other forest scientists tell us that part of the problem in the west is overstocked stands, that historically you would have 1,000 tree -- 70 trees per acre and today you have 1,000 trees per acre. And, of course, we know trees are pumps, they take water out of the ground.

As you look at some of this science is that, knowing the effects of wildfires, is that something your organization would advocate for is modern forest management practices to reduce excess fuel loads.

Ms. Ekwurzel. I had the opportunity to be in Oregon with Forest Service scientists while fires were going. And seeing the sort of native practices to maintain more healthy forest reserves, definitely prescribed burns, other types of actors are really important. At the same time you want to keep the carbon of the forests being a net storage for a long time --

Mr. Walden. Right.

Ms. Ekwurzel. -- rather than we really do need advances in understanding how to keep wildfires safe and keep populations down-smoke shall we say. Because there were studies that it is almost like smoking several packs of cigarettes --

Mr. Walden. Oh, it is awful. Awful.

Ms. Ekwurzel. -- if you are in a summer situation breathing this smoke.

Mr. Walden. Yes.

Ms. Ekwurzel. Which we did breathe some of that Oregon smoke.

Mr. Walden. We were suffering under this for six weeks. Worst air quality in the world, absent Beijing. Or I mean, there were a couple of countries around the world that just at different periods had worse. But my district faced this all summer, summer after summer.

And we know the prescription is going to reduce -- we are always going to have fire, we are always going to have hurricanes, what do we do though to minimize the impacts? So, thank you for that.

Mr. Powell, as you have indicated, we have been pursuing policies on the committee to promote a range of clean technologies from nuclear energy, hydropower, grid modernization, energy efficiency, battery storage. But, clearly, we all know what work needs to be done.

The chart on page 2 of your written testimony shows the transition to a zero emissions energy system is not yet happening globally. That clean energy is just keeping up with energy demand. And we heard that I think from Mr. Worthington, too,

about the demand out there. But nations still strive for simply having electricity.

How do we build on what we have done domestically so far to increase the pace and scale of technological innovation? And can we do this without imposing economically harmful regulations? And how does deregulatory policy help in innovation?

Mr. Powell. If we are taking a global lens on this problem -- first, thank you for your leadership in the last Congress to expand many of these policies -- we are taking a global lens on this problem, the key is making clean technology cheaper, not traditional energy more expensive. If we are making clean technology cheaper then we are focused on things like, to Chairman Tonko's point, moonshot programs to set very aggressive technology goals, for example, at the Department of Energy, and develop most of our resources toward achieving those very aggressive cost and performance goals. And then we can do more to set targeted incentives that work with markets to help scale up these technologies and get some of the scale and learning-by-doing benefits that Mr. Duke discussed.

Then we can still do a great deal, for example, in streamlining permitting for new hydro projects. It still, despite the great work of this committee, takes far too long to put a new pumped hydrostorage facility in place or to relicense an existing dam, or to power up a non-powered hydro facility.

Mr. Walden. It seems to me we have led in energy development, clean energy around the globe. And certainly with fracking and natural gas replacing 16 gigawatts of coal, that has made a difference around the world and here at home. And I just want to see America lead in these efforts. And obviously we know industries are going to have to step up to the plate here too, but I sense they are willing to.

So, thank you, Mr. Chairman, again. My time has expired. And I appreciate all the testimony of our witnesses. Thank you for participating.

Mr. Tonko. Thank you. The gentleman yield back.

The Chair now recognizes Representative Peters from California.

Mr. Peters. Thank you, Mr. Chairman. Thank you for having this hearing.

We all know the causes of climate change. I respect and appreciate hearing from the witnesses. Now we need to identify the practical ways to stop it, whether that is through regulation, deregulation as in the example of hydropower, putting a price on carbon -- I think that is probably useful -- carbon capture, R&D, or some combination. Some, some of these are more feasible than others. But let me clear, feasible is not a euphemism for lack of ambition, it is just the opposite, feasible means achievable.

And I want to say from the bottom of my core is that we have

to do this in a bipartisan way. What I have learned here is that if it is not bipartisan it won't pass. And if it is not bipartisan it won't last. And I really want to make sure that we get everyone on board.

If it was up to me, we would enact a national version of SP100, which commits California to 100 percent carbon neutrality by 2045. We would take those steps. It is not up to me. It is not up to any single one of us to do that. So, I am looking forward to working with everyone on this committee to make progress.

We know we have to transition to a clean energy economy. There is not widespread agreement in either party what clean energy means. Maybe it's 100 percent renewables to some people, renewable electricity for some other people. And whether renewable electricity is all zero and low-carbon sources of renewables or net zero, we can, we can talk about that. But there is a need to move.

And I also just want to, finally, note the presence of Reverend Woodberry here. There is a moral component to this, too. And I am aware of Pope Francis speaking out on this as well as the Evangelical Environmental Network.

Let me ask a couple questions of the witnesses. I will start with Mr. Powell.

Climate models show that we are going to need significant deployment of currently new clean energy technologies, including

renewables, nuclear, carbon capture renewal removal. While regulation is an important driver for technology deployment in the U.S. to help global emissions reductions, one of the most important things we can do is to lead on clean energy innovation.

What is the Federal Government not doing right now that we should be doing to accelerate the deployment of these technologies?

Mr. Powell. Well, first let me thank you, Representative Peters, for your leadership, especially in nuclear innovation and co-sponsoring the Nuclear Energy Innovation Capabilities Act, which we were pleased to see passed through Congress last year. That set a good precedent for creating a test bed in the Federal Government for developing and expanding these technologies.

And so now I think the next step is, well, how can we go further? And how can we use other powers of the Federal Government to ramp these up more quickly? I think a good idea would be something like the Nuclear Energy Leadership Act which takes the next step. It sets an aggressive goal to demonstrate multiple advanced reactor technologies within the next decade.

It expands the power of the Federal Government to use its PPA authority to purchase some of the power from those reactors, to get them set up, and to get them financed.

It expands the availability of fuel that they would use.

And I think we could take those kinds of approaches and apply

it across all of the different clean energy technologies in order to scale them up more quickly.

Mr. Peters. Okay. I am interested in talking to all of you about deployment as well on other technologies.

Mr. Williams, I believe action on climate change is an opportunity to create economic growth. But it is undeniable that a shift away from fossil fuels will have an impact that is tough on certain sectors. I think we need to provide workers in those sectors with a path to jobs that just pays, pay just as well or better, including retirement benefits and protections, the kind of jobs that can support families.

In your testimony you talked about specific things the committee could do in the an infrastructure package. What do you see as the most important things for Congress to include in any climate legislation to protect workers?

Mr. Williams. Thank you for that question, Mr. Peters. We agree completely. That is a critical issue. In my verbal testimony I made sure to lean into the statement that we cannot let any workers or communities be left behind in this effort.

There are a number of ways to do that. And the best way, among the best way is to direct the investments that would come from this to workers and communities that may be harmed, but just generally a commitment that we don't -- we want to actually retain as many jobs as possible, first and foremost. And then, if that

is unavoidable, make sure that there is that deep commitment, as you mentioned, to ensure that wages, benefits, healthcare, so on and so forth, people are taken care of throughout that process and that there is significant economic development in communities that see that dislocation.

Mr. Peters. We have seen, I think, a lot of progress in California that we can learn from as well on that front.

Finally, I just want to say with respect to Mr. Worthington, I haven't had a chance to ask you a question, but we talk about all the people who are underserved in terms of energy around the world, it strikes me that the cell phone is a good thing to look at. You know, a lot of places without phones didn't build out whole set sort of telephone grids, analogous to the energy grid, they did essentially microgrids with cell phones.

And I would suggest that a large part of our foreign policy should be the deployment and promotion of microgrids, just like the United States Marine Corps has at Camp Pendleton near my district, that don't rely on a centralized fossil fuel-based source but can rely heavily on renewables and on storage. And I think it is very feasible that we should really make that part of the mix.

Mr. Chairman, I yield back.

Mr. Tonko. The gentleman yields back.

The Chair recognizes Representative McMorris Rodgers.

Mrs. Rodgers. Thank you, Mr. Chairman, and all of the witnesses that are here today. I appreciate you being here and sharing your perspective on the environment.

As you may know, I come from Washington State. And we are a leader in hydropower production. And because of research and innovation, new technologies, we are seeing even better salmon returns because of the fish, new, improved fish ladders and turbines. You know, we could double that hydropower without building a new dam in America simply by investing in hydroelectricity also. Only 3 percent of the dams actually produce electricity. And this is a, this is a clean, renewable, reliable, affordable source of electricity.

So I, I wanted to start with a question to Mr. Powell. In the last Congress I led legislation to streamline the hydropower licensing process. It takes on average 10 years to relicense a dam right now in America, compared to 18 months for natural gas. In your view, how does hydropower fit into the bigger picture? And what are we risking with proposals such as Green New Deal that ignore the positive environmental benefits of hydropower?

Mr. Powell. First, thank you, Representative McMorris Rodgers for your leadership on hydropower and preserving and expanding this very important resource. As you know, historically hydropower has been the most important of our renewable resources in the United States, and is appropriately

viewed as a renewable energy resource right alongside wind, and solar, and biomass, and geothermal, and other renewables resources.

In many ways it is the most valuable renewable resource for three reasons:

First, it has the highest capacity factor of the renewable resources, so it is available for more of the year;

Second, it is a flexible resource. It can be turned on and off, and ramped up and down in a way that many other renewables resources cannot be, and;

Third, it can also be part of a storage solution. So, pumped hydropower can serve as a, you know, vast battery. In fact, the very largest storage facilities in the United States are pumped-storage hydro facilities.

So, we see expansion of hydropower, either by powering up non-powered dams or certainly ensuring that our existing hydropower facilities around the country are relicensed, and that we can continue to get good use out of them, and modernizing those facilities as key priorities of the clean energy portfolio.

Mrs. Rodgers. What do you think Congress could do to expand hydropower production in the United States? And why do you think that should be a part or a central part of a climate-focused policy?

Mr. Powell. It needs, so it needs to be a central part of

a climate-focused policy. As Chairman Tonko said, at this point the climate challenge is too urgent to leave any of our tools off the table. And so certainly the largest renewable resource can't be left out of that solution.

The idea that we would de-power all of that hydropower, which I believe powers between 6 and 8 percent of our power grid right now, and replace it with new power, you know, the billions of wasted dollars that would be spent in doing something like that would be very counterproductive to a climate solution, and would certainly not be a cost-effective way to advance climate policy.

Mrs. Rodgers. As we add more intermittent renewables to the grid like wind and solar, grid-scale energy storage will be critical to ensuring a flexible and resilient system that can delivery affordable and reliable electricity to consumers when the wind isn't blowing or the sun isn't shining. I share ClearPath's goals to expand energy storage.

Last Congress we passed legislation. Mr. Griffith led it. We have also upped research dollars for new, innovative energy technology. I rep -- or I am very close to the Pacific Northwest Laboratory. They are doing a great work in this space.

Can you just help us understand more about what is going on in the private sector and what specifically we need to do here in Congress to accelerate innovation in energy storage?

Mr. Powell. Sure. Well, first I should acknowledge PNNL's

leading role in the energy storage innovation space. They have pioneered some of the most promising new technologies that are already being scaled up and commercialized in grid scale energy storage.

I think the first thing to remember is that energy storage is far more than just batteries; right? It can also include things like pumped-storage hydro. It can include innovative ways of using water pressure to store energy underground. It can include heat storage and many other solutions. So I think first and foremost as we fund against that priority for our federal R&D engine we should be thinking of what we want to come out of a storage solution as opposed to the necessary technology that would go into the storage solution.

And I think we can set very aggressive goals against that, as some legislation introduced in the past Congress did, and then drive most of our dollars and coordinated activity across the Department of Energy toward achieving those performance milestones.

Mrs. Rodgers. Thank you. With that I am going to yield my time. And I appreciate your sharing that, that info.

Mr. Powell. Thank you.

Mr. Tonko. The chairwoman yields back.

The Chair now recognizes Representative Barragan.

Ms. Barragan. Thank you, Mr. Chairman.

Last night at the State of the Union the President may have ignored the threat of climate change. But with Dems in control of the House, this committee and Congress will no longer ignore the threat of climate change.

I also want to take a moment to thank Reverend Woodberry and Mr. Williams for mentioning the impact to communities of color and low income communities that climate change is having. When I think of climate change I don't think in terms of green. I think in terms of black and brown. When I think of climate change, I think of my black and brown constituents who make up 88 percent of my district and who are disproportionately impacted by negative impacts of climate change.

I think of black and brown communities throughout the nation forced to live under discriminatory environmental policies that cripple their cities and towns economically, and leave them vulnerable and dependant on the very companies that are polluting our neighborhoods.

When I think of climate change I think of black and brown people who are confined to communities where decades of lax environmental policies and enforcement have literally sickened entire generations. I think of black and brown people across the country, this nation, who face the painful reality of shortened lifespans filled with health complications caused by the toxic environment in which we live.

I think of black and brown children forced to live in neighborhoods where the air quality standards are astonishing low and the use of asthma inhalers is alarmingly high. I think of black and brown communities and children whose asthma diagnosis amounts to nothing more than a death sentence, with brown children in these communities having 40 percent or more likely to die from the affliction that their white -- than their white counterparts.

So, ultimately when I think of climate change I do not see an environmental crisis, I see a systematic environmental racism that needs to be acknowledged and addressed.

Dr. Reverend Woodberry, do you acknowledge that environmental racism is a real threat to black and brown communities?

Rev. Woodberry. Yes. Thank you for your question.

Absolutely. And we want to urge Congress that as we move forward with legislation we ensure that we are not replicating models of injustice. Let me give you an example.

Last year in August we cut a ribbon on a solar farm, small solar farm in Dillon County on Highway 9 in the middle of a soybean field. But we were very careful while working with Duke Progress Energy, the utility, over a 2-year period to make sure that this solar farm was built in a just and equitable manner. And so, out of the 1,200 households that will be supplied with energy from this community solar farm we made sure that one-third of the

residents who were 200 percent of the federal poverty limit had the $250 emission connection fee waived.

And in addition to that, we have to be careful that as we move toward renewable energy or we do energy grid upgrades that we are not once again replicating models of injustice. So, we were able to get the utility to do 1,500 free energy efficiency upgrades. Because whether a environmental justice home is connected to fossil fuels or renewable energy, if that home is energy inefficient and they are heating and cooling the outdoors and paying a disproportionate amount of their income on energy costs, we have not solved the problem.

And what we want to avoid is creating an energy divide the way that we have done in the past by creating an educational and digital divide.

Ms. Barragan. Thank you, Reverend Woodberry.

If I could with the last 20 seconds, Mr. Williams, what are your recommendations to the committee to address environmental inequalities in black and brown and low income communities, including opportunities to create these clean jobs?

Mr. Williams. Sure. Well, first, thank you so much for your statement and your question. If we put forward a wholehearted effort to solve climate change but in the process do not remove toxic chemicals and other forms of pollution from workers' communities, then we haven't succeeded. So we agree.

So, there needs to be a significant comprehensive effort that incorporates that into efforts to reduce greenhouse gas emissions as well.

In terms of job creation in those communities, absolutely, targeted investments in disadvantaged communities, previously overlooked communities, absolutely needed. Policy items like community benefits agreements, local hire provisions, all are absolutely critical as we invest in trying to find, invest in trying to find new solutions.

Ms. Barragan. Thank you. I yield back.

Mr. Tonko. The gentlewoman yields back.

The Chair now recognized Representative McKinley.

Mr. McKinley. Thank you, Mr. Chairman.

Mr. Powell, I would like to have a conversation with you or some interaction with my remarks here. I think we have heard on the panel so far most Republicans and Democrats agree that there is a -- the climate is changing, and that industrial activity is a major contributor to that. But I think the reinforcement is that we strongly disagree with solutions on how that might be.

Would you agree that America acting alone, America acting alone is going to make a difference to the global environment?

Mr. Powell. It will not.

Mr. McKinley. Thank you. Let me, let me add to that.

So, I want to add that if anyone thinks that decarbonizing

America is going to save the planet, whether that is 10 years or 20 years from now, you are delusional. Just three years ago the EPA administrator said that, her quote was American action alone will not make the difference needed to impact global climate change.

The Cato Institute came out and said that decarbonizing the United States would lower the global temperature by just one-tenth of 1 degree Celsius by the year 2050.

But without this global commitment that everyone seems to be ignoring this is what we are having to deal with. Do we really think, any of you on this panel, that if we decarbonize America we won't be faced with severe weather, we won't have droughts, that coastal communities won't be flooded? How can we say that without the rest of the world on board?

Here is what is going on, as CRS has already published, this is what is going on that China from 2000 to 2016, China has increased its global emissions or its emissions by 290 percent. India, 235 percent. And at the same time America has reduced it by 16 percent.

Are you familiar with the MIT report, their technology review report that -- maybe you are. And what that said was, and it was just a recent report, it came out and said that unless India reduces its emissions the result will be a climate catastrophe regardless of anything the United States does.

I want to make sure we always keep this in context. We don't live in a vacuum. We don't live in a little microcosm here that the air of the United States is, if we can get it clean we will be fine. We involve from the globe on this.

So, we get down to what are our solutions or what are our options? And so if I could from you, you and I have had this conversation, it appears that most of the Democrats or people on the other side of the aisle are saying that they want to use a hammer approach. Let's put more regulations, cap in trade, carbon taxes, some kind of hammer approach. Isn't that what you are hearing as well primarily, Mr. Powell, that it is a hammer approach to solve this problem rather than a carrot and incentives for innovation?

Because think if we could do the innovation that we started last year with 45Q, with 48A, we could go on with that. Look, we have already talked about the Allam cycle, the net power plant, the turbine efficiency. Aren't those things going to be really the best solution rather than the hammer approach?

Because I am assuming you are aware of the hammer approach throughout Europe, France particularly lately with the yellow vests, what happened there when they rejected that notion of a hammer approach. So, if we could just continue this innovation, this effort for research, I think many of you talked about the research concept, if we could do that we could, America, use our

science and technology that we have used to do space, medicine, healthcare, all, and implement a strategy. Wouldn't it, wouldn't it be something that we then could export to the other nations so that, like Mr. Worthington was saying, a billion to a billion five that don't have energy, if we develop the technology to reduce emissions and we could see that, export that technology and give them a chance for a better life wouldn't that make more sense than a hammer approach that people are rejecting?

Mr. Powell. So, technology is the genie you can't put back in the bottle. And the political will for climate solutions will come and go here in the United States and around the rest of the world, but technology will last.

Mr. McKinley. Okay.

Mr. Powell. So we can export the technology and we can have a higher confidence that that will be taken up around the world.

Mr. McKinley. I just hope that everyone on the panel will recognize that what we do here is, we are just part of a big system. We have got to get the rest of the world engaged in this, otherwise we are still going to have severe weather, we are still going to have drought, and we are going to have flooding of our coastal communities.

Thank you very much.

Mr. Tonko. The gentleman yields back.

The Chair recognizes Representative McEachin for five

minutes.

Mr. McEachin. Thank you, Mr. Chairman. Mr. Chairman, I want to start by thanking you for your leadership in the fight to stop climate change. I can't think of a more important discussion with which to begin the new Congress. And I also would like to thank our panelists, especially Reverend Woodberry who has been a great champion for environmental justice, and Mr. Williams, whose organization has helped show that organized labor and the environment movement share the same goals and can succeed by working together.

And in that vein, Mr. Williams, I would start with you and build a little bit on the question that Mr. Pallone stole from me, quite frankly.

You know, one of my proudest accomplishments as a state legislator was to help clear the way for an offshore wind farm, which means well-paying jobs for Virginia workers. And I believe that we can replicate that success across the country. So, how do we ensure that the coming green energy revolution helps all workers, even those who right now are working in the fossil fuel industry? That is the part I want you to build onto your answer that you gave Mr. Pallone.

Mr. Williams. Sure. Offshore wind -- well, first, thank you for your leadership, Mr. McEachin, it has been extraordinary. And we are already seeing benefits in Virginia for offshore wind

investment and those policies working. Offshore wind is an extraordinary opportunity and one where we have seen, especially from the labor movement and the environmental movement, really the co-benefits percolating up in such a beautiful way.

There is only one project currently built. But there are thousands of megawatts on the cusp of being built up and down the east coast. That is going to create high quality union jobs in coastal areas up and down the east coast. But then going into the country, the supply chain potential of that and helping build out and support American manufacturing is just critical and incredibly impressive.

We think that there needs to be significant support to make sure that that industry keeps moving forward and that policies deployed ensure that these projects are using project labor agreements, that they are, if needed and if possible, targeting it to communities that certainly need economic investment.

So I just couldn't agree more, offshore wind is an absolutely critical part of this conversation.

Mr. McEachin. Thank you.

Reverend Woodberry, we know that environmental injustice hurts minority, rural, and low income communities. But does facing unique challenges means those communities also enjoy unique opportunities? For example, if we use the policy process to create new green collar jobs, can we expect those jobs to be

created in an economically just way? And if not, are there steps that we can take to make sure that they are, that they are done in an economically just way?

Rev. Woodberry. Absolutely. Thank you for that question.

What we need to do is work on a macro level but also on a micro level so that we are putting in place community-based climate solutions and also doing community in-place training. So, we have seen this done successfully in Buffalo, New York, with Push Buffalo where in the community that was being gentrified they were able to get a building that was abandoned and convert that building into housing for senior citizens as well as offices for NGOs and a community center.

We also have seen it done, we had some training back in 2017 where we did a train the trainer for a solar installation for non-profit leaders from Georgia, from your state in Virginia, from Mississippi, and South Carolina. And they have gone back in their communities to do solar projects and low income people of color communities.

As a matter of fact, Monday I had the privilege of speaking at the University of Virginia. And we are going to be launching a solar project in the Buckingham community in June.

And we can actually take these small-scale community-based successful programs and projects and actually export them overseas. So, I co-chair an 88-year-old organization called

Agricultural Missions, Incorporated. We are just completing an 8-year project in Sierra Leone and Liberia where we brought community water pumps to 47 towns and villages. And we will be going to Sierra Leone and Liberia in April so that we can work with those same community leaders and organizations in these towns that have never had electricity so that we can work on implementing a 4-phase solar project in those towns and villages.

So, we can export the technology. We can also export community-based climate change solutions with renewable energy, providing jobs and opportunities for low income people, low income communities and people of color in this country and around the world.

Thank you for your question.

Mr. McEachin. Thank you, Reverend.

And, Mr. Chairman, I yield back.

Mr. Tonko. The gentleman yields back.

The Chair now recognizes Representative Long for five minutes.

Mr. Long. Thank you, Mr. Chairman. And before I begin my remarks I would like to ask for everybody to keep John and Debbie Dingell in their thoughts and prayers. Debbie had tweeted out this morning that "Friend and colleagues that know me and know I would be in Washington right now unless something was up. I am home with John and have entered into a new phase. He is my

love and we have been a team for nearly 40 years. I will be taking each day as it comes. We thank people for their friendship and support and ask for prayers and privacy during this difficult time."

I know reading this in an open hearing may not be privacy, but she tweeted it so I am assuming that she would be okay with that. And John was sworn into Congress the year I was born, 1955. And Debbie has followed in his footsteps. And very good friends of my wife Barbara and I. So just want everyone to keep John and Debbie in their thoughts and prayers if you will.

I want to focus my questioning here today on how to reduce carbon dioxide emissions while keeping energy and commodity prices low, particularly in rural and agricultural communities like those that I represent. I have a large rural area.

Mr. Worthington, coal represents 81 percent of Missouri's power generation in 2017. And two of the biggest industries in my district are farming and trucking. And from what I have seen with the New Green Deal wants to completely replace fossil fuels with renewable energy and decarbonize our economy, which would be a very worthy goal if it was anywhere near possible within the time frame they want to do it.

Do we currently have any technology to decarbonize the farming and trucking industries while continuing to produce and move goods to market without harming consumers?

Mr. Worthington. That technology does not exist today at scale to accomplish those goals. We can possibly get there, given time and given tremendous investments in research and technology. Agriculture presents a significant percentage of greenhouse gas emissions. You might think of them as being naturally occurring in the agricultural business. I don't think we are going to change that component over time. There is no technology fix for the emissions out of agriculture.

We have a long, long way to go to develop the technologies that would allow for a 100 percent renewable economy.

One recent report that came out in December, part of a scientific journal called Joule, indicated that if such energy storage options existed a $100 kilowatt hour for lithium ion batteries, for example, that is a third of the current cost. The cost would be $7 trillion, $7 trillion just the storage component of a 100 percent renewable system. $7 trillion is 19 times the amount that Americans spend on electricity in one year, 19 times the amount of electricity in one year.

And that would be, again, a cost of lithium ion batteries that is a third of what the cost is now. So, even with additional R&D investments the cost is still going to be staggering --

Mr. Long. Okay.

Mr. Worthington. -- for the Green New Deal.

Mr. Long. Thank you.

And, Mr. Powell, I will turn to you. And I travel quite extensively with my duties here in Congress. Been to China several times. And I think one time I have seen the sun while I was there. I mean, sun dials are not big sellers because you can't tell if the sun is up or not or what part of the sky that it is in. So anyone in their right mind wants clean air to breathe, clean water to drink, and I hope that hearings like this will bring out common sense solutions that we can all agree on as Republicans and Democrats and come together to eventually reach these goals.

And, Mr. Powell, I share your desire to reduce carbon emissions, as any right-thinking person would I would think. And in your opinion what is the right way to do that? Should Congress encourage market-based solutions to encourage cleaner energy? Or should we follow the New Green Deal which would raise taxes and impose the stringent mandates that have potential costs we just heard about to communities and industries like those that my district deals with?

Mr. Powell. Well, first, Representative Long, thank you for your leadership on advancing nuclear power and solutions to the spent fuel issue and your work with leader Shimkus on that issue.

Market-based solutions, all things being equal, should be the more cost-effective solution to the problem both here in the United States and also the things that we can export to other

economies like China. It is very difficult for us to export our policy over there. They do their own thing. But they are happy to buy, and take, and scale up our technology. In fact, the real risk is that the Chinese in many of these things are actually moving very quickly and attempting to take also parts of the global market in those technologies as well.

And so, I think from the U.S. economic perspective there is a real priority that we stay competitive with these technologies alongside the Chinese.

Mr. Long. Okay, thank you. I am past my time. I yield back.

Mr. Tonko. The gentleman yields back. The Chair now recognizes Representative Blunt Rochester for five minutes.

Ms. Blunt Rochester. Thank you, Mr. Chairman. First I want to thank you for your leadership and also for your charge to the committee that we rise to the challenge. I want to thank you for that. I would like to thank the witnesses as well.

I can think of no more pressing topic for us to be addressing than climate change. Actually, as we were sitting here, over my phone a New York Times article came out to say that it is official, 2018 was the fourth warmest year on record. It is happening to us right now.

And in Delaware we are the lowest lying state in the country. We are urban, we are rural, we are suburban, and we are also

coastal. So the consequences of climate change and sea level specifically impact my state directly.

I also wanted to just says a word about the global conversation that we are having as well. I actually did live in China. And I actually do think that we need to stay competitive. But the real issue is not whether the world recognizes it, it is do we recognize it? When we get out of the Paris Climate Accord we send a message to the world.

My first question is to Dr. Ekwurzel. And if you can just talk a little bit about the potential impact of sea level rise for a state like mine if we don't immediately take steps to address carbon emission and climate change more broadly?

Ms. Ekwurzel. Delay in action on reducing global emissions is absolutely critical for the state of Delaware. As you know, the low lying communities we also have situations where there are churches that the parking lots people can't even get to church on Sundays.

Ms. Blunt Rochester. Yes.

Ms. Ekwurzel. It is really affecting the daily lives. And we have been working with communities to share those stories and to figure out how can we adapt.

Adaptation is really key for the state of Delaware for coastal resilience.

Ms. Blunt Rochester. Thank you so much.

2085 And I would like to turn, turn it to Reverend Woodberry. And
2086 thank you also for your work.
2087 One of the things, a lot of people think that sea level rise
2088 really only impacts those coastal communities and beaches. But
2089 as was said, in Delaware we have areas that are considered
2090 environmental justice communities. And I was hoping, Reverend
2091 Woodberry, if you could just talk about strategies that you have
2092 seen that are effective in helping those communities voice, get
2093 their voice out there and also advocate for themselves, actual
2094 strategies.
2095 Rev. Woodberry. Actual strategies, we have to look at being
2096 more proactive rather than waiting for, for climate impacts to
2097 take place. And thank you for lifting that up. And sea level
2098 rise impacts even fresh water. So, we are finding waterways,
2099 estuaries that are becoming more brackish. It is impacting sea
2100 life. It is impacting fishing. A lot of low income people
2101 actually don't fish for sport but they fish because they need the
2102 food in order to survive, to feed their families.
2103 Some of the solutions that we discussed recently in New
2104 Orleans after, after experiencing the Hurricane Florence and
2105 Hurricane Michael, was that we need to work desperately to put
2106 people to work to make our homes more resilient to deal with
2107 adaptation. So, I mentioned briefly in my statement that we can
2108 look at doing bioswales. In a lot of our communities we have

brownfields that are polluted, being polluted by industries that are gone that we can actually create bioswales and use plants for remediation that can draw out heavy metals, and toxins, and actually provide drainage and pools so that urban areas or rural areas do not have to be as flooded as they are now.

Also, it is very important that we keep our forests and our trees standing, particularly along our river areas. Hardwood is very valuable. But what we are finding is that a lot of low income communities are actually losing their forests and their trees. We have a lot of folks, particularly people of color, who have heir property that is owned by several families, and oftentimes they are not able to pay the property taxes and the only option that they have is to have the trees cut down.

Ms. Blunt Rochester. Thank you, Reverend.

Rev. Woodberry. So, adaptation reserve is really important.

Ms. Blunt Rochester. Thank you so much.

And, Mr. Williams, my last question is really about, in relation to Reverend Woodberry, many of these communities like Southbridge where I, where we live in Delaware bear the brunt of these economic impacts. Can you talk about jobs that can be created to help mitigate and also strengthen the community?

Mr. Williams. Sure. And thank you for the question.

Again, this is an infrastructure discussion. This is

directing investments directly towards those communities. We should target them to communities that are going to be hardest hit, are already hard hit economically, and we should make sure that we are not just tossing money and saying, Go forth.

But there should be standards there to make sure that there are good jobs and they are lifting up people who haven't had the opportunities, whether it is building sea walls, or retrofitting buildings, or even working in healthcare and such, just making sure investments get targeted there.

Ms. Blunt Rochester. Thank you. I am out of time. I yield back.

Mr. Tonko. The gentlewoman yields back.

The Chair recognizes Representative Flores.

Mr. Flores. Thank you, Chairman Tonko. And thank you, Chairman Tonko and Leader Shimkus for hosting this meeting today. I was pleased that all the panel and almost everybody up here on the dias has agreed that climate change is real. The question is, how do we deal with it?

Reverend Woodberry, I want to thank you for your closing comments where you said that we have got to focus on mitigation, and adaptation, and resilience. And then you further closed by saying that forests are by far the best carbon sink that is available today, and that we need to not forget about that as a source of carbon capture.

I would, I want to say this. You know, we have already heard this, the U.S. leads the world in emissions reduction. And everybody keeps talking about Paris. And the EU countries that are part of the Paris Accord have failed to meet their carbon reductions.

We, on the other hand, have been leaders in this. And it in large part to technology that has created that American success story, partially because of the transition to cleaner-burning natural gas and the development of cost-effective renewables.

For my own part, I am doing my part. Right before I ran for Congress, I didn't know I was going to run for Congress, but I commissioned the largest residential solar system on my house in Central Texas. And so I am glad to be part of that. And over the course of the last three years I have converted over 90 percent of my light fixtures to computer-controlled LED technology. So, I have one of the lowest emissions footprints per square foot of anybody up here on this dias.

That said, you have got to be careful how you do this. I don't think we get it through a chaotic, headlong rush toward decarbonization. I think we get it through thoughtful use of technology and figuring out what is the pathway for this moonshot, and what is the realistic time period that it gets there.

One of the things that, one of the technologies I think that gets us there is nuclear. We hear a lot of projections about

replacing the existing fossil energy power generation with solar and wind. But there are mixed messages about the role of nuclear energy in the future. And it seems to me that if we are really serious about climate change, we need to get serious about the role of nuclear power.

I don't understand why some advocates for that chaotic decarbonization do not take nuclear seriously. They are ignoring the role of next generation nuclear power as a significant source of baseload zero emissions power with a much smaller land and environmental footprint than non-baseload power sources like wind and solar.

Mr. Powell, your organization ClearPath is doing significant, a significant amount of work in the nuclear area. What is your organization focused on in the form of clean energy over others, this form of clean energy over others?

Mr. Powell. Well, first, Representative Flores, thank you for your leadership on advanced nuclear energy, both in promoting solutions for advanced nuclear fuel --

Mr. Flores. We are going to bring it up again, too.

Mr. Powell. Appreciate that. And also for co-sponsoring the nuclear moonshot approach that Representative Higgins has brought to the House Science Committee.

We think that a number of priorities are necessary to scale up the next generation of nuclear power. Obviously we need the

fuel for those reactors.

Mr. Flores. Right.

Mr. Powell. We already have a test bed that has now been established in the last Congress. Now we need a moonshot goal to demonstrate multiple advanced reactors and deploy most of our resources through the Department of Energy towards achieving that goal.

We also need to use the full resources of the Federal Government, like its PPA authority to scale it up.

And then, lastly, to this global problem we need to be thinking about how we use nuclear as a toll -- as a tool of diplomacy and economic development around the world and how we use new authorities like the BUILD Act and the Development Finance Corporation to start exporting that good U.S. nuclear technologies to other countries and help them solve their emission problems with 24/7/365 clean energy.

Mr. Flores. The United States is developing advanced next generation nuclear technologies. But it has also been demonstrates that we have a great record for our current light water reactor fleet. The United States nuclear reactors have operated for over 4,000 reactor years without a major accident, according to the Nuclear Regulatory Commission.

If this knowledge and successful safety record can be shared with the rest of the world, we could make great strides in reducing

emissions through safe nuclear power, particularly next generation nuclear power, to generate clean, zero emissions electric power.

So, Mr. Worthington, and then I will ask you the same thing, Mr. Powell, should the U.S. promote more nuclear as part of a global emissions reduction scheme?

Mr. Worthington. Absolutely.

Mr. Flores. Okay. Mr. Powell? Pretty simple answer.

Mr. Powell. Yes, absolutely.

Mr. Flores. Okay. For both of you, has anyone looked at the environmental impacts of scaling up to 100 percent renewables? My home state of Texas is the nation's leader in wind production. And but then we have got a lot of land, open land in West Texas that makes it feasible to do that where it is not a problem.

Wind, however, is intermittent and does not provide always long baseload power. And so when we saw that with the impact of the power demands coming out of the recent polar vortex, what are the environmental and land use impacts of wind and solar versus nuclear and natural gas? Mr. Powell?

Mr. Powell. Well, certainly nuclear is a more compact solution.

Mr. Flores. Right.

Mr. Powell. It produces more power on a smaller amount of land. And in terms of the broader environmental impacts, there

are tradeoffs with all of these technologies.

So, renewable technologies and the storage that would have to go along with them have a lithium problem and sort of a lithium sourcing problem for where they come from. Just as nuclear has a spent fuel problem.

Mr. Flores. Right.

Mr. Powell. All of these technologies have their own local environmental impacts, and all of those need to be managed as part of a holistic solution.

Mr. Flores. Mr. Worthington?

Mr. Worthington. What we are worried about is with the rapid deployment of solar photovoltaics these systems have a shelf life. And after, after they no longer function they are going to have to be recycled. And there are some pretty nasty chemicals that are contained when they are manufactured.

And so, we are concerned that we don't really have the rules in place necessarily to safeguard that those units are recycled properly and the chemicals are properly disposed of. I think that is something that has not been adequately studied and --

Mr. Flores. Right.

Mr. Worthington. -- warrants some more review.

Mr. Flores. Thank you. I do agree that as we have future hearings on this subject we need to consider the gnarly environmental footprint that some storage technologies have.

Mr. Chairman, thank you for your forbearance. I yield back.

Mr. Tonko. The gentleman yields back.

The Chair recognizes Representative DeGette.

Ms. DeGette. Thank you very much, Mr. Chairman.

You know, I really want to thank you for having this hearing as your first hearing of this committee. I have been on this committee for many, many years and seen the, shall I say, evolution of thinking about climate change. And this, this panel is the perfect example of that.

And so I want to start out in the grand tradition of our beloved friend and mentor John Dingell and ask you all a couple of questions that will only require a yes or no answer.

The first question is do you all agree that climate change is real and that human activity contributes to it? Doctor?

Ms. Ekwurzel. Yes.

Mr. Powell. Yes.

Mr. Duke. Yes.

Rev. Woodberry. Yes.

Mr. Worthington. Yes.

Mr. Williams. Yes.

Ms. DeGette. Thank you. That in itself is a revolutionary step for this committee. Thank you all for that.

My second question is do you all agree that we need to address climate change in a way that builds the resilience of our

communities, especially of those most vulnerable to climate impacts, while growing our economy and providing well-paying jobs? Doctor?

Ms. Ekwurzel. Resounding yes.

Mr. Powell. Yes.

Mr. Duke. Yes.

Rev. Woodberry. Absolutely yes.

Mr. Worthington. Yes.

Mr. Williams. Unequivocally.

Ms. DeGette. Thank you. My last yes or no question -- so far you are all getting 100 percent. My last question is do you agree that driving innovation in clean energy is an essential part of the solution and that it is time that we committed ourselves to doing that?

Ms. Ekwurzel. Yes.

Mr. Powell. Yes.

Mr. Duke. Yes.

Rev. Woodberry. Yes.

Mr. Worthington. Yes.

Mr. Williams. Yes.

Ms. DeGette. Thank you very much.

You know, all of this agreement here in this panel with the Democratic and Republican witnesses makes me really hopeful that, as what Mr. Powell said, bipartisan cooperation on climate change

can be attainable. And I want to thank all of you for committing to this.

I just have a couple of more questions.

One of my questions for you, Dr. Ekwurzel, is, as you know, I am from Colorado and the last few years we have had the 30-year low in snow pack. And what is even worse than that is that the snow is melting earlier and so the water is going down. Can you let us know what the impact, what kind of impact climate change is going to continue to have on the snow pack in the western United States?

Ms. Ekwurzel. Thank you. And that snow pack is a critical water resource for Coloradans and all downstream --

Ms. DeGette. Right.

Ms. Ekwurzel. -- in the Southwest.

I want to say that there are three things that climate change does to the snow pack. It causes it to melt earlier. We have a shorter snow season. Even if you have an atmospheric river delivering wonderful amount of snow, the extra heat in the winter season is causing it to melt, and sublimate, and evaporate into the atmosphere.

We have what is called a hot drought in the Colorado River. We could lose up to 50 percent of that flow just from the climate change impacts if we were to do unabated, you know, course that we are on now.

Ms. DeGette. Second, so thank you, a second issue that we have, in particular in my congressional district which is primarily Denver, is a persistent smog problem. And of course we all know what the issues with smog are in terms of asthma and the work and school days, outdoor recreation days, et cetera. But what can you tell us, and you talked, we talked a lot and we know in the West about the impact of wildfires, what can you tell me about the impact of climate change on air pollution and smog?

Ms. Ekwurzel. We call it the climate penalty of smog. One of the ingredients you need for greater ozone ground level production is warmer temperatures. The warmer it is, the more smog you produce if you have those precursors of volatile organic carbon. And you need sunlight.

Therefore, if we were to reduce global emissions we would reduce the future climate penalty that could only get worse with climate change.

Ms. DeGette. Thank you.

Mr. Chairman, I just want to respond to a couple of the things our colleagues on the other side of the aisle have been saying. The first thing they have been saying is that, well, the rest of the world is not coming along.

Well, number one, we are the ones that pulled out of the Paris Climate Accord, not them. And so I would suggest maybe one of the first things we could do is get back into the Paris Climate

Accord.

And the second thing I will say is just because other people aren't moving as quickly as we are, the President said last night in the State of the Union, America is the best country in the world. Why don't we be the trendsetter? Why don't we be the one exporting all of our technology to China and India? Why don't we be the one setting the standard?

And the last thing I will say is these other countries do want to act. Their citizens are demanding action for the same reason why we are demanding action. And I think that that is why this committee, this is just the first step, and I know you intend to work on legislation, and all of us intend to work on that with you because we are actually going to move this through. And I know we can do it in a bipartisan way.

I yield back. Thank you, Mr. Chairman.

Mr. Tonko. The gentlewoman yields back. And we thank you for your comments.

The Chair now recognizes Representative Carter.

Mr. Carter. Well, thank you, Mr. Chairman. And thank all of you for being here. This is an extremely important subject. I believe that my colleague just asked all of you a question on whether you believe that climate change is real or not. And I think if you were to ask that same question to everyone up on this dias they would say the same thing, yes, it is, it is real. It

is something that we have to, we have to address.

There may be some difference of opinions on how much of it is man-made. But regardless of how much of it is man-made, we still have to address it. There may be some who, who want to say that it is just cyclical in nature and that if you look back over time and this happens, well, that may be true, too. But regardless of that, we still have to see the impact and have to address the impact that man is having on this.

These are all givens. These are all things that I think all of us agree on and all of us are working toward.

I want to start -- and for that I want to thank all of you for being here and thank all of you for your interest and for your work on this because it is extremely important. We all recognize that.

I want to start if I could with Mr. Worthington and just ask you, I have always been one who subscribes to an all-of-the-above type energy policy. I think it is extremely important for a number of reasons for us to have safe, and secure, and dependable, and affordable energy. And it is important for our national defense. It is important for our citizens. It is just very important.

I know that you mentioned in your testimony that you believe that an all-of-the-above approach is essential as well. Once we get beyond solar, wind, hydro, geothermal, and even beyond the

traditional fuels, what are some areas that we should be looking for to play a greater role in the all-of-the-above fuels mix?

Mr. Worthington. Well, one of the, one of the promising technologies is hydrogen. And we have been dealing with hydrogen for decades now. We are not at a stage where it is economical but it has tremendous potential, both to serve transportation issues as well as electricity. It needs more work. It needs more research. But it is a very promising area that we are watching very carefully.

Mr. Carter. What about biomass? Let me ask you about that. I represent South Georgia. We have got a number of things in abundance in South Georgia, one of which is pine trees. And we have got a number of biomass manufacturers. And what about biomass, is that something we should be looking at?

Mr. Worthington. Absolutely. We are actually using biomass now in many different applications. We are using it directly to produce electricity. We are mixing it with coal to reduce the CO2 emissions from a coal plant. And we are actually pelletizing wood and shipping it to Europe. There are many, many countries in Europe heat their homes with American wood.

Mr. Carter. Why is that that it is used in Europe but not necessarily as much here in America? I always found that interesting. I have visited a number of these plants in South Georgia and that is what they tell me, we ship it to Europe.

Mr. Worthington. Yeah, it is a good, it is a very good question. I am not sure I know the answer. It may be a matter of convenience. Our industry has made heating with fuel oil and natural gas very convenient. We have liquified petroleum gas.

I think it is -- I have never answered that question before but I would have to say it is probably because we have more options than what the Europeans do. And particularly now with our abundant shale gas resources we are just literally awash in gas.

Mr. Carter. Right.

Mr. Worthington. And it is inexpensive, it is affordable, and it is going to be available.

Mr. Carter. Okay. Mr. Powell, I am going to you and ask you, and to kind of follow up on my colleague from Texas, nuclear power is certainly something I feel like we need to be looking at. Georgia Power right now has the only two nuclear reactors under construction in our country. That is something that we are depending on and something I think we should look at very carefully.

Can you tell me the role that you see nuclear power as playing in our country's energy future?

Mr. Powell. Absolutely. And, first, let me thank you for your leadership in nuclear power, for the state of Georgia's commitment in getting those reactors built. That is incredibly important for keeping the national nuclear supply chain robust

and strong going forward.

I think the next generation of nuclear power in the United States will be much smaller, less capital intensive, and more flexible. So I think the future of nuclear power --

Mr. Carter. We are certainly glad to hear that in Georgia.

Mr. Powell. Yes, exactly. I think it is unlikely we will build more gigawatt-scale reactors like the great technology going up in Plant Vogtle. I think it is much more likely we will build small modular and micro-reactors that can be combined together in the same way that wind turbines are combined together in large arrays with hundreds of units. I think that is the future of nuclear power.

Mr. Carter. Right. Again let me thank each of you for being here. I appreciate it. This is extremely important, something that we all agree on that we have to address in a reasonable and a rational way that it going to provide for safe, secure, dependable, affordable energy for our citizens.

And I yield back, Mr. Chairman.

Mr. Tonko. The gentleman yields back.

The Chair recognizes Representative Schakowsky for five minutes.

Ms. Schakowsky. Thank you so much, Mr. Chairman, after six long years, having a hearing directly on global warming, on climate change. And I wish it were that all of us that all of

us agreed. Maybe this tweet from the President, who never mentioned this crisis last night in the State of the Union, is a joke. I would like to think so, but maybe not.

During the polar vortex he tweeted, "What the hell is going on with global warming? Please come back fast, we need you!" Not so funny to me. I was in Chicago at the time anyway.

But I want to talk about transportation and its contribution to climate change. The transportation sector is the largest source of carbon pollution in the United States, and only getting worse. And I am very interested in improving our fuel economy standards and decreasing carbon emissions.

The past four decades the corporate average fuel economy, what we call the CAFE standards, have been an extremely valuable tool in reducing greenhouse emissions. Unfortunately, this administration is attempting to weaken vehicle fuel.

So, let me ask you, Dr. Ekwur -- you know who you are. I will leave it at that. If you could talk to me about the importance of the CAFE standards and making them perhaps even stronger than they are.

Ms. Ekwurzel. Absolutely. We do need to double down on lowering the carbon, decarbonizing our transportation sector, increasing incentives for electrification of the transport sector in cars, and buses, and trucks.

And what we see is that it is also going to lower the ground

level smog as well. It lowers emissions to the atmosphere that causes climate change. And also, we improve the health of incentives, reduce the inequities with asthma sufferers and so forth.

Ms. Schakowsky. I am wondering if you can explain, explain this to me. What we have seen over the recent years, some decrease in carbon emissions and global emissions, but we saw last year just in the one year that internationally 2.7 percent increase over the previous rates. One scientist called it a speeding freight train. And then in the United States last year, one year, marked the largest increase in eight years, 3.4 percent increase.

So, what is going wrong here?

Ms. Ekwurzel. Absolutely. The U.S. was decoupling our growth from a high-carbon economy. We have a lower-carbon economy. However, that turned around and now the U.S. is emitting more than it did in the prior few years.

So we cannot take our foot off the pedal, so to speak, on incentives that reduce and have cleaner options for when we move around, or power, or turn on the lights.

Ms. Schakowsky. Thank you.

Mr. Duke, what impact will rolling back efficiency standards have on greenhouse emissions?

Mr. Duke. Thank you for your attention to the extraordinary benefits that come from fuel economy standards on light duty and

heavy duty vehicles. And if we just look at the sweep of history on this program, I think it is important to recognize that it was actually Republican President Ford who put in place the first commitment to double our fuel economy back during the initial oil crisis.

And that worked. We got immense consumer benefits and national security benefits out of those efforts. Unfortunately, we then hit the skids on the program when we failed to update the standards for a 25-year period until 2010. And that cost us by some estimates a trillion dollars in additional expenditure at the pump.

So, the good news is that we have a set of standards now in place for heavy duty vehicles that are proceeding and that are going to be helping us transition to advanced technologies for super trucks and the like that will save quite a bit of fuel for industry and our economy.

The bad news is, as you suggested, there is a rollback under consideration which, frankly, goes much further than the auto makers themselves requested in engaging with the administration on this. And that is because they know that they need to compete with China. China already has 60 percent market share on electric vehicles. Our auto makers need to be competitive and they can be competitive. Tesla retains the number one spot. GM is in the top ten. But we need standards that are clear and steadily

improving to drive progress and make sure we stay in the game on technology. And fuel economy is part of that.

Ms. Schakowsky. Thank you. I want to thank all the panelists. This has been really enlightening.

Yield back.

Mr. Tonko. The gentlewoman yields back.

The Chair recognizes Representative Duncan.

Mr. Duncan. Thank you, Mr. Chairman.

If the Green New Deal policies are adopted, the price of utilities will inevitably go up. How would the increased cost of utilities as a result of this proposed Green New Deal, carbon tax, cap in trade, high costs associated with renewable energy generation improve the lives of, say, those in Marion County, South Carolina, that Reverend Woodberry spoke of? People who Reverend Newberry said were living on fixed incomes of $600 to $800 a month.

The average median income in Marion County is $30,562. And the average median income in my district is $47,000 a year. But the carbon taxes levied in South Carolinians -- on South Carolinians' electricity, gas, et cetera, will increase. These increased costs will impact every person and business in the state and, unfortunately, would disproportionately impact those in the lower income communities.

And at the end of the day people care about things that are

tangible to them: how much it takes to fill up their gas tank; how much their electric bill will be; and if they have any money left over at the end of the month to put food on the table that is what my constituents care about.

We here in America we take for granted what is known as 365 24/7 baseload power supply always on. That always on power is generated primarily in three ways: hydroelectricity, nuclear power, and fossil fuel generated power. Everything else is intermittent. The sun doesn't always shine, the wind doesn't always blow. And we don't have the technology available yet to hold large quantities of power in some sort of battery to provide power when it is needed. We take for granted that 365 24/7 baseload always on power.

But there are people all over the globe that don't take advantage of that. And those are in some European countries by the way. But think about how the United States can be a leader in improving the quality of lives of so many people around the globe with the export of our fossil fuels so that these folks can have always-on power.

Think about the infant mortality rate across the globe where people don't have a steady 24/7 baseload power supply. They can't keep the incubators on to keep the babies alive.

If we want to improve the quality of life, Mr. Worthington mentioned 1.3 billion people in the world don't have power, think

about the quality of lives issues that he was bringing up earlier. Air quality. Air quality kills, what, 400,000 people around the globe annually because of bad air quality. They are cooking on charcoal, and dung, and wood products. They can't keep food fresh because they don't have electricity to have a refrigerator to keep the food fresh, so the foods spoil, and they are having to eat it and constantly replenish it.

They can't keep windows in the window spaces because they don't have electricity to provide air conditioning, so at night they are trying to keep cool, mosquitoes fly in. When mosquitoes fly in they bring disease that kill so many people around the globe every year.

Food safety, preparation of food, cooking of that food, air conditioning, lights to read to their children and have their children read to them, these are quality of life issues that we take for granted here in America that fossil fuel generated power can provide for people around the globe. But yet we want to vilify and demonize fossil fuels that make our lives so much better.

Doctor, you are from Massachusetts; right?

Ms. Ekwurzel. I live right here in D.C.

Mr. Duncan. Okay. Well, Cambridge, Massachusetts is where the organization is located?

Ms. Ekwurzel. Yes.

Mr. Duncan. Unless you all rode a bike here today you came

in some fossil fuel generated power, whether it was an electric car, probably the electricity that went into that care was provided by some sort of power generation. Could be nuclear, could be hydro, but generally it is probably fossil fuel generated.

Many people in this room who came to this hearing today may have gotten on an airplane. And I know just about every member in this committee got on an airplane to fly here. An airplane is running on a fossil fuel. Folks, your cars, your trains, your planes, are all generated, are all powered by fossil fuels. And we have got a lot of work to do if we are going to make those airplanes fly on electricity. We have got a lot of work to do if we are going to provide electricity through intermittent power supplies to give us that 24/7 baseload power.

But it is not the government's role to incentivize or penalize companies and individuals that aren't investing in this, it is up to the marketplace. And I am going to use Elon Musk because I think he is a leader in two areas, he is a leader in EVs with Tesla, but he is also a leader in space exploration. And guess what? He is not being incentivized that I know of for space exploration. He actually said let's pull away from NASA and the bureaucracy and let's think outside the box and figure out how we can save costs, make renewable rockets so that we can travel to the moon and then, ultimately, to Mars. He didn't do that with

the government forcing him to do it. And he didn't do that with the government incentivizing him to do it. He did it because he had a desire to do that and he brought the best people together in a capitalist, free market environment to think and come up with a solution.

That is the solution if we truly believe in global warming and improving the lives of so many people around the globe, we do it through the innovation and the innovators, not through punitive or incentives from government.

Mr. Chairman, with that I yield back.

Mr. Tonko. The gentleman yields back.

Reverend Woodberry, you were made mention of. Do you want to respond in a minute or less, please?

Rev. Woodberry. I will say that I do believe that innovation, I do believe that America could move quickly. My family is actually from Marion County. In the 1960s my grandparents, my grandfather was a sharecropper. He used kerosene lamps. They had a stone fireplace and a wood burning stove for heat. In 20 years we went from having two roads paved to every road paved, everybody moving from outhouses to indoor plumbing. No more kerosene but instead having electricity for everyone.

We can move quickly and we can use technology. We can use the government to help because that is who made this happen.

Thank you.

Mr. Tonko. The Chair now recognizes the gentlewoman from California, Representative Matsui.

Ms. Matsui. Thank you very much, Mr. Chairman. I really do appreciate the witnesses here today.

I find this really refreshing at this point because I think everybody believes that climate change is real. There seems to be that agreement. And I think that is, in essence, great progress. This is agreement of a national climate assessment which really said that it is real and the risk is now.

And it really concludes that greenhouse gas emissions from human activities are the explanation for global warming over the last 60 years. And for the second year in a row, the transportation sector was the largest emitter of greenhouse gases in the United States. And the International Energy Agency has found it is the only sector that has become less energy efficient over the last 15 years.

My colleague Ms. Schakowsky brought this up, and I want to have a further conversation on this about fuel economy and decreased auto greenhouse emissions. That is what the Obama administration did for light duty vehicles through 2025, and how important it is in combating climate change. These standards were written in 2012 with the support of the auto industry, the environmental groups and the states.

Now, these are good for consumers who save billions of dollars at the pump over the life of their vehicles. And they are good for the American workers who benefit from the development of innovative technologies that create profits and support jobs. The standards are projected to reduce gas emissions by 540 million metric tons, and reduce oil consumption by 1.2 billion barrels, and nearly double the fuel economy of light duty vehicles to an average of about 54 miles per gallon.

Now, at a time when our country desperately needs to become more resilient when it comes to adapting to climate change I am really disappointed that the Trump administration moved to reverse much of our progress with their proposal to roll back the curtain on fuel economy and greenhouse gas standards. And that is why I was pleased to introduce the Clean and Efficient Cars Act yesterday which will protect our fuel economy and greenhouse gas emission standards through 2025.

My legislation maintains the Federal Government and auto manufacturers' promise to the American people, a promise for clean, efficient cars that cost less at the pump, better for the environment, the health, and the future of our children and grandchildren.

Mr. Duke, you mentioned in your testimony that despite our clean technology edge, the United States is not moving quickly enough to reduce carbon pollution. What effects do you believe

the Trump administration's proposed rule to freeze the current fuel economy and greenhouse gas standard have on climate-related environmental impacts?

Mr. Duke. Representative Matsui, thank you for the question and thank you for your leadership on this crucial topic. It is absolutely correct that the transportation sector has now emerged as the most emitting sector of our economy. And it is one where there are extraordinary solutions today and on the horizon to deal with the challenge.

What industry needs in order to scale up these solutions is clarity and certainly against which they can make their investment decisions. And we had that, for example, in that President Ford, President Ford's initial push to double fuel economy the first time --

Ms. Matsui. Right.

Mr. Duke. -- provided exactly that clarity. And we saw the industry deliver. We saw the Big Three at that time deliver.

Once again we have the potential to double fuel economy with the 2010 standards for light duty vehicles and, with that, also move into the electric vehicle competition with China in a complete way where I am confident that our automakers can win the day.

What is troubling is that with the proposed rollbacks which, again, really exceed what industry itself was calling for, maybe

not what certain other industries were calling for but what the autos themselves were calling for, with those rollbacks it basically makes it harder for us to compete in this global marketplace. Again, China has a 60 percent electric vehicle share, so we don't want to cede that ground.

And I should also note that there is plenty more that can be done and should be done to improve internal combustion engine vehicles as well. There are opportunities to cut emissions from those conventional vehicles much more than we already have today, and cost effectively. And so we need to stick with the plan that we had in place and keep that investor certainty in place so that we can continue to compete.

Ms. Matsui. Exactly right. Because we keep moving forward and we have the momentum, and we have to pull back. Business does not like a lack of consistency. We all know that.

Mr. Williams, you mentioned in your testimony that millions of American jobs depend on continuing American leadership on clean vehicle technology that includes over 250,000 Americans employed across 500 U.S. factories and engineering facilities that build technologies that improve fuel economy and reduce pollution. Can you really on a global scale discuss what this will do, just this simple kind of pullback that we have?

Mr. Williams. Sure. One of the immediate impacts of it, the agency's own analysis says that it will cause, result in the

billions less in technology investment that supports 50,000 to 60,000 jobs in the U.S. that we would immediately potentially lose.

But the other piece of it is that this is devaluing the investment that a number of other companies across the supply chain have made based upon those 2010 standards. So, whether you look at ALCOA making aluminum in Iowa and Tennessee, or ArcelorMittal steel making steel for the auto sector in Illinois, those investments they made because of the need and the standards set forth to make more efficient vehicles. If we step back, countries like China and countries in Europe and throughout the world will take over this industry and completely leave us in the dust.

Ms. Matsui. Thank you. I have run out of time. I yield back.

Mr. Tonko. The gentlewoman yields back.

The Chair recognizes Representative Johnson, five minutes.

Mr. Johnson. Thank you. Thank you, Mr. Chairman.

You know, last Congress we began a discussion on our domestic nuclear industry's ability to compete on the world stage, particularly with state-backed enterprises coming from countries like China and Russia. I hope to continue that discussion in this session of Congress.

And I also would like to point out a similar issue occurring

on the coal front. As Mr. Powell's testimony states, China is financing about 100 gigawatts of coal projects in at least 27 countries. Like with our nuclear energy deployment, I worry the U.S. is missing an opportunity here, especially as ongoing public/private work is driving down the cost of carbon capture and storage technologies, as well as making ultra-super critical projects feasible here in the U.S.

In other words, the United States is capable of solving these technological problems but we have got to make sure that we stay engaged on the global front in doing that.

So, Mr. Worthington, can you discuss why so many countries are looking to China for their energy needs?

Mr. Worthington. Yes, sir. Thank you very much for that question.

The World Bank made a decision a couple years ago that they were going to refuse to consider financing for a new coal plant. There are countries in the world that coal is their only option. Kosovo is a great example. Kosovo has a 50-year-old coal plant that badly, badly needs to be replaced. The World Bank made a commitment to finance a new project. And as soon as they made that commitment they started figuring out how they were going to get out of their commitment.

The Chinese have stepped in in Asia, Africa, and South America and they have been willing to finance projects that the

World Bank refuses.

Mr. Johnson. And I have heard from, I have heard from our State Department and from our former U.N. ambassador, Ambassador Haley, China is doing this kind of stuff.

Mr. Worthington. Right.

Mr. Johnson. I mean, they are doing this kind of stuff all over the world, all over their region. And they are using these energy projects as a way to get their foot in the door. And then they have big influence in those countries.

So, are the technologies supplied by China the most advanced fossil technologies in the world?

Mr. Worthington. Not what they are selling to other countries.

Mr. Johnson. Right. Exactly. Would it benefit these nations if the United States participated in these markets, could we bring the best to the table?

Mr. Worthington. There is no question. And the other thing that the Chinese do is they insist that the developing country buy Chinese products.

Mr. Johnson. Okay.

Mr. Worthington. So they are not just financing, they are providing all, they insist on providing all of the equipment.

Mr. Johnson. Right, right. So, so how can the U.S. do better from an international engagement standpoint? What should

we be doing?

Mr. Worthington. Well, we have tools ourselves with the Export-Import Bank, Overseas Private Investment Corporation, Trade Development Agency and so forth. Some of these U.S. agencies over the last number of years also adopted an anti-fossil energy --

Mr. Johnson. Right.

Mr. Worthington. -- approach. I believe that is being reversed. And I believe that they are open for business now for fossil, fossil projects.

But the key becomes the new president of the World Bank. President Trump should identify a new president of the World Bank shortly. Hopefully he will not, he or she will not have the anti-fossil bias that the predecessor did.

Mr. Johnson. Okay. Mr. Powell, have you got any comments on that before I move on to another question quickly?

Mr. Powell. I think we can use the new instruments that we created in the BUILD Act, like the Development Finance Corporation. And to your point about sort of China using this strategically, I think we should remember with a nuclear plant for example, 10 years to build, 80 years to operate, 10 years to decommission. That is a century-long relationship --

Mr. Johnson. Oh yeah.

Mr. Powell. -- that they are getting with that other

country. We have that opportunity as well in so may countries, and it does seem like we are squandering that opportunity.

Mr. Johnson. Absolutely.

Mr. Worthington, your testimony states that natural gas emissions have declined while production has increased. And that is thanks primarily to technological innovations throughout the industry. I know eastern and southeastern Ohio have benefitted greatly from this increased production, especially as proposed new ethane crackers and other new job opportunities, ethane storage hubs, et cetera, continue to emerge.

So, how can we ensure other countries and the world benefit from these technological advances? And what role can U.S. L&G play?

Mr. Worthington. U.S. L&G can play a pivotal role. We have got a couple units exporting now. We have four more that are coming online either still this year or the early part of next year. We have an opportunity to more than double our L&G exports and to countries like Poland, China, India, Italy, even the U.K. So it is a tremendous opportunity.

We are a dependable supplier. We don't use L&G, we don't use natural gas as a political weapon the way some of our competitors do. And we should just do everything we can to expedite the next fleet of L&G export facilities.

Mr. Johnson. Yeah. Russia in particular they get about,

Mr. Chairman, they get about 50 percent of their revenue from the sale of oil and gas, much of that to our allies in the region.

I yield back. Thank you very much.

Mr. Tonko. The gentleman yields back.

I now would recognize Representative McNerney from California for five minutes.

Mr. McNerney. I want to thank the Chairman and I thank the panel for your, your testimony this morning.

First I would like to observe how reasonable the Republicans sound today on the issue of climate change. There must have been a conversion on the road to Damascus recently.

Dr. Ekwurzel, do you agree that most or all climate models consistently under predict the climate change rate?

Ms. Ekwurzel. Yes. Because there is a double-edged sword of uncertainty with climate change. The best case scenario is we could do that well. But the worst case scenario tends to keep surprising us. It is a bigger error bar on that.

Mr. McNerney. And given the lag between CO2 emissions and its impact on the climate, do you believe there is a realistic way we can avoid temperature increase of less than 2 degrees C by carbon reduction emissions alone?

Ms. Ekwurzel. We have to have a mix of emissions reductions, all, all sources of carbon storage as well that we can think that is safe for communities so we can get to the next zero situation

by mid-century.

Mr. McNerney. So, then what are our -- what our alternatives are to reduce emissions to avoid climate catastrophe? What are our emission alternatives?

Ms. Ekwurzel. As been said, we have to manage our forests so that they don't go up in flames and lose the carbon they are sequestering. We have to increase the land sink in agriculture practices. We also have to perhaps carbon capture and sequestration, there may be a bridge for innovation through utilization, however, it has to transition. We have to figure out to sequester the carbon and keep it out, away from the atmosphere.

Mr. McNerney. Well, considering climate intervention or geoengineering such as injecting sun-reflecting particles into the stratosphere, how much understanding do we have of climate intervention as to its effectiveness or its possible side effects?

Ms. Ekwurzel. We have a lot to do with the social sciences of the governance of such an issue of just injecting stuff into the stratosphere that would affect perhaps monsoon rains and all sorts of consequences around the world and give us perhaps hazy skies, beautiful sunsets but hazy skies and other consequences. We need more research in this space before.

Mr. McNerney. Well, what, what do we need to do to develop sufficient expertise in climate intervention to even decide if

it is a possible way to manage climate change while we reduce our carbon emissions?

Ms. Ekwurzel. First of all, make sure we invest in NASA and NOAA and our infrastructure to make sure that every time a volcano emits anything that we are able to track it and figure out what the consequences are because that is the modern, the natural analog to what these experiments would say. And there are many other ways we can study this problem before we would do some other experiments.

Mr. McNerney. Well, then do agencies such as NOAA and NASA and the DOE have the capabilities to generate a baseline understanding of the stratosphere?

Ms. Ekwurzel. Absolutely. And there are sensors and satellites we would love to have deployed and to double down on science investment on these persnickety problems, as you say.

Mr. McNerney. Well, I might be proposing legislation to do that.

And before I finish I just want to say, Mr. Shimkus, thank you for attributing the quote to me that it is just an engineering problem. But I have to say that was taken out of context. I was referring to nuclear waste being an engineering problem, but I also said that nuclear waste will need a political solution. Now, that whole context also applies to climate change. There are engineering solutions that need to be addressed, but we need to

have the political will to put those solutions into effect. And so instead of just sounding reasonable, please work with us to find solutions that are sufficient to the threat.

I yield back.

Mr. Tonko. The gentleman yields back.

The Chair now recognizes Representative Ruiz of California for five minutes.

Mr. Ruiz. Thank you, Mr. Chairman.

Dr. Ekwurzel, the National Climate Assessment outlined many several, or many severe public health effects of climate change due to increases in air pollution and expansions in the ranges of disease-carrying organisms. I ask this question because I am an emergency physician with a public health expertise as well.

In addition, in a study recently published in the New England Journal of Medicine by Haynes and Christie found that in the United States it is estimated that almost 60 percent of the excess deaths may be caused by the use of fossil fuel from power production and traffic. A previous study in 2009 from the same journal, the New England Journal of Medicine, found that a decrease in air pollution is associated with an increase in life expectancy of more than nine months.

This is real. This has real effects for individuals back home when they ask, How does this affect me? It is not an esoteric, ideological, partisan kind of conversation. This is

real pragmatic life effects on your relatives and your children.

In Riverside County where I am from and represent ranks amongst the worst in the nation for ozone pollution. High ozone days contribute to many hospital admissions, especially for children who suffer from asthma, and seniors with COPD. I know because I personally have treated many of them in the emergency department.

Let me ask you a question. Isn't it true that climate change is making it more difficult to improve air quality?

Ms. Ekwurzel. Yes. The ozone, ground level ozone with higher temperatures we call it kind of a climate penalty on health.

The other thing is that Southern California and Arizona have a situation with the extra dust and the conditions in the spring lead to something that is called a Valley Fever that people can be in hospital emergency rooms. We lose lives to things that are climate influenced.

Mr. Ruiz. And as a public health expert I am concerned about the impact climate change is having on the spread of vector-borne diseases. Is it true that climate change is expected to influence the spread of vector-borne diseases? And what kind of new illnesses will Americans be at risk for and/or have succumbed to more?

Ms. Ekwurzel. What we see is that a lot of the pests and some of the disease-carrying situations in the tropics are moving

into southern parts of the United States.

Mr. Ruiz. Like what?

Ms. Ekwurzel. Such as Dengue fever and other mosquito-borne illnesses.

Other things like West Nile Virus that used to be in a part of the U.S. is now spreading northward and westward.

Mr. Ruiz. Yes. So Dengue fever, describe the symptoms, would you?

Ms. Ekwurzel. Yes. I defer to your medical expertise on those symptoms.

Mr. Ruiz. Well, I mean it is not pleasant, put it this way. So because we are running out of time.

As a physician I have seen firsthand that the public health infrastructure serving people in rural areas and in other vulnerable communities, under served communities, is often under-resourced and overburdened, working over capacity. And the residents of these areas, like in my district, are often coping with multiple challenges that make their health conditions more severe.

So the National Climate Assessment discusses the special problems and increased vulnerabilities of individuals in under served communities. Can you describe these problems?

Ms. Ekwurzel. Sure. Climate change exacerbates the historical inequities. And we have to consider these solutions

to help. Low income communities, children, older adults, people of color are often at greater risk. And low income communities are often exposed to these risks and due to historical decisions.

And the health impacts, it is really important that we ensure the vulnerabilities of front line communities are identified an extra precautionary measures are taken to keep people safe.

Mr. Ruiz. So, oftentimes decisions are made by, you know, governments or corporations to start a business with some potential air pollution without the consent or the meaningful consultations with the communities that they are going to affect currently and in the long term. These communities, like those in my district, have a very bad physician shortage crisis. They don't have clinics to go to. They already are experiencing high asthma rates because of the living conditions in which they exist. And they face a higher morbidity and mortality at a younger age than other folks.

That is why I introduced an environmental justice act which will specifically address this issue for vulnerable populations with Senator Cory Booker. We have introduced that together.

So, we are all well aware that prevention is far less expensive than treatment and is obviously much more beneficial to patients. I hope we will listen to the warnings of the National Climate Assessment and the IPCC report and start to address climate change. It is not only an environmental problem, it is

clearly a significant public health threat with real consequences for real people. I know, because I treated them in the emergency department.

Mr. Tonko. The gentleman yields back?

Mr. Ruiz. Yes.

Mr. Tonko. The gentleman yields back.

And we recognize Representative Soto from Florida for five minutes.

Mr. Soto. Thank you, Mr. Chairman. First I want to thank Dr. Ekwurzel for defining the challenge that we have to avoid surpassing 1.5 degrees Celsius. Global carbon dioxide emissions would have to drop around 45 percent below 2010 levels by 2030, and reach net zero emissions by around 2050.

And, you know, I was thinking about those dates. And it may seem far off for a lot of us. However, I want to put it in perspective. And we have a special guest that I want to recognize here, Lincoln, who just came in. A name that both Democrats and Republicans can get behind by the way. So, by 2030 Lincoln will probably be just a teenager by then. And by 2050 he will be in his 30s. Relatively young and still s starting his life.

This question, this challenge is not about the folks behind the dias. It is not about most of the folks in the audience. It is about Lincoln and his generation and what we are going to do. In 2050 we are going to look back and say, Did we do what we needed

to get done to protect Lincoln and his generation? Or did we let it slip past us in an irrevocable fashion?

So, what is the cost? The cost is the long-term survival of the human race. That is the cost. And the threat is existential.

And this is the greatest country in the world. We should be leading on energy policy, not defining it by the worst polluters on the plant.

So, I think this isn't science fiction to get to these levels. I think we already know what we have to do, a mix of nuclear, solar, wind, hydro, and perhaps biofuels. Imagine utilities adopting all this. Electric plug-in cars, and trucks, and ships, and planes, and trains running on it. That we resolve the energy storage crisis with a massive energy efficiency effort.

So I want to ask each of you all in a yes or no question, if we gave you the resources with that mix, could we get to the 45 percent drop?

First, Dr. Ekwurzel, could we get there?

Ms. Ekwurzel. If we start now it is a challenge but we have a chance.

Mr. Soto. I also want to ask Mr. Williams, could we get there if we had the resources with that mix?

Mr. Williams. We need to start now.

Mr. Soto. Reverend Woodberry, do you think it would be

possible?

Rev. Woodberry. Possibly, but we must start now.

Mr. Soto. With the Lord's help; right?

Rev. Woodberry. Absolutely.

Mr. Soto. And Congress' help.

And, Mr. Duke, do you think we could do that with that mix?

Mr. Duke. We could get it done and could get it done cheaper and faster with a broader mix.

Mr. Soto. Mr. Powell, would it be possible with that mix?

Mr. Powell. I would second the broader mix getting it done cheaper and faster.

Mr. Soto. And then, Mr. Worthington, with the, with the mix I referred to could we get it done?

Mr. Worthington. I think you would have to add carbon capture and storage to the technologies that you suggested.

Mr. Soto. Okay. Well, thanks for your opinions on that.

It is my belief the only resource we really need is the will of this committee to meet the challenge of climate change now for Lincoln and his generation. And I believe we have been elected to do just that.

With that, thank you, Lincoln, for being here today. Look at that. See, he has got his political career starting today. And I yield back, Chairman.

Mr. Tonko. The gentleman yields back.

Lincoln and I have met in the past. And, Lincoln, it is great to have you here again. And thank you for being super inspiration.

Now to the very patient Representative Castor from Florida. We offer you five minutes to question the panel.

Ms. Castor. Thank you, Chairman Tonko and Ranking Member Shimkus. I look forward to tackling these issues with you. Thank you to all of our witnesses.

We are facing the crisis of our generation. The climate crisis threatens all of our districts, all of our communities, as well as America's national security, our economic prosperity, the health of our families, and the world that our children will inhabit. I appreciated my colleague from Florida Mr. Soto's remarks. We are, we feel like we are in the bullseye in Florida.

And my district in the Tampa Bay area is one of the most vulnerable in the country to the impacts of climate change. Hotter and longer summers, deadly storm surge risk because of rising sea levels, more intense hurricanes. It is all impacting the water we drink and the even down to the stormwater and wastewater systems that we all rely on every day.

But we are not alone. This is impacting everyone across America. And the costs are very high. Chairman Tonko and I have often talked about the costs of inaction. And right now people are bearing the brunt of higher property insurance costs, flood

insurance costs, electric bills. The list goes on and on.

But the good news is there are solutions. We have seen major advances in energy efficiency, renewable energy, innovation, and other strategies to reduce greenhouse gases. The Fourth Climate Assessment Report said that future risks from climate change depend primarily on decisions made today. And it has been heartening to hear some of our Republican colleagues talk about a new understanding of what is at stake.

But, you see, the time is short. The time is short now to avoid the worst impacts and the escalating costs of the climate crisis.

And to my colleague Mr. Duncan who kind of symbolizes a lot of the discussion we hear on the other side, no, it is absolutely vital that the Congress and this country provide some bold national policies to get there and to tackle the challenges ahead. We have got to tackle the challenges of reducing greenhouse gases, especially in the electric generation sector and transportation sector.

So, to close out, I would like Mr. Duke and Dr. Ekwurzel to talk to us a little bit about that. In the past decade the average costs of wind and solar electric systems have dropped dramatically and the markets are rapidly growing. With your best handy spirit, talk to us about the opportunities ahead for this country and communities when it comes to clean energy and the jobs we will

create with it.

Ms. Ekwurzel. I will be real short on the resiliency aspect, then I will turn it over to Mr. Duke. Because this is really important. When those are senior citizens that are trapped inside the facility after a hurricane because there is no power because it was disrupted, and the fuel supply lines are disrupted, when the storm passes, the sun comes up and the air still is blowing wind, and you can have a renewable, you know, community solar community wind that can get you back up on your feet and you can be more independent as you deal with the climate impacts.

Mr. Duke. Thank you, Representative, for the question.

And I just want to underscore how much progress we have made and how much opportunity we have now to cut emissions faster than ever before. The CEO Jim Robo of the largest utility in America predicts that within a few years renewables, wind and solar, with storage will be 2 to 4 cents a kilowatt hour and able to broadly compete with conventional power. That is an indication of what we have got in front of us as we seek to electrify all of our end uses, and building, and vehicles and beyond.

And I also want to note that there is lots of innovation happening in other sectors. The industrial sector is more complicated. It is one that is hard to get your hand around, your hands around sometimes but I want to give an indication of what is going on there.

There is a company in Boston that is creating metals out of electricity in a way that can be cost-competitive even for steel down the line. You have got companies that are using CO2 to strengthen cement in buildings in Atlanta and all across the country. And much more coming in terms of CO2 utilization as part of the overall toolkit.

And, of course, we have long known how to cut energy waste. And increasingly what companies are doing is getting into the system so that they can help with demand response, with flexible loads. For example, there is no reason why you have to charge your electric vehicle right now whenever you first plug it in. It is easy to have that respond to the kinds of rate variations that California is now sending to consumers so that you can charge your electric vehicle when the electricity is most plentiful and cheap.

And this is just a small snapshot of the innovation that it happening right now. Much more to come from small modular reactors to carbon capture and storage, precision agriculture. We can and are in many ways still leading on this but we need the same kind of 90-plus major policies that China has to make sure that our industries can continue to scale with confidence on all these solutions.

Mr. Tonko. The gentlewoman yields back?

Ms. Castor. Yes.

Mr. Tonko. You do.

The Chair recognizes the gentleman from Maryland, Representative Sarbanes, for five minutes.

Mr. Sarbanes. Thank you very much, Mr. Chairman. I appreciate you all being here today. I am sorry I couldn't be here for a good portion of the hearing but I did get notes. And I know it has been a very rigorous examination of what we need to do in terms of addressing climate change. And I want to thank the chairman for bringing this hearing and bringing attention to these issues.

Having gotten all the questions that you have received and responded to them over the course of the hearing, I invite you to kind of give a wrap-up perspective on what you think will be the most -- pick one, two things -- the most effective things that we can do in the nearest term to try to address this crisis of climate change.

And I am also particularly interested, Mr. Duke, in your views on what we can do to incentivize progress on this point other than to the detached issues that have been discussed. If you can start with that and then we can have others give a kind of final perspective.

Mr. Duke. Thank you, Representative, for the closing questions.

I would like to underscore that the United States has been

and really remains the most important player on the world stage for dealing with climate change. It really was the United States and China jointly announcing their targets in 2014 to cut emissions, with China committing to peak their emissions for the first time, and they are delivering on that by the way, that is what kickstarted the move to the Paris Agreement and that is the kind of leadership that we had shown historically and can and will show again.

To be in the position to do that, though, we need to have the right incentives in place that are as far-reaching and market-based as possible. The best way to do that is with a price on carbon that is congressionally bipartisan and that reinvests the revenue that comes out of that carbon price in order to create the right infrastructure, from transmission to electric vehicle charging stations, and to do right by the communities that are on the front lines of this transition, whether it is coal communities or low income communities suffering from pollution today.

And I can tell you that when we do that, not only will be lead on technology and on the diplomatic stage again, but we will also clean up our public health problems in a dramatic way. When you move to clean energy you clean up everything, you don't just clean up CO2, you clean up all the public health contaminants as well. And I look forward to seeing bipartisan action on a carbon

price that makes all that happen and that allows our business to do their job and compete with China and the rest of the world.

Mr. Sarbanes. Any other closing observations, this last?

Ms. Ekwurzel. Don't forget the damages of climate change and global emissions. When you stack that up against these low costs per kilowatt that are already happening, invest in the science, invest in the social science. This is big transformation that I think is going to be a cleaner, healthier world ahead when we act now.

Mr. Williams. Mr. Sarbanes, --

Mr. Sarbanes. Yes.

Mr. Williams. -- it was mentioned on both sides, the moonshot. And I think it is important to note that the moonshot involved federal intervention, federal targets, and date-specific goals that was connected with investments and incentives. We need the same thing for climate change.

Mr. Sarbanes. Reverend Woodberry.

Rev. Woodberry. Community-based solutions that will provide energy efficiency, renewable demand-side management tools that will create jobs, and also a price on carbon, ensuring that that money goes to communities that have a legacy of abuse and pollution.

Mr. Powell. I will say I heard broad agreement that climate change is a real and urgent problem that we need to address; that

we need much higher ambition policies than we currently have; that we need a full toolkit of solutions to solve the problem, we can't take anything off the table; and that innovation is a really good place to get started.

Mr. Worthington. I guess I am last. I would just reiterate that both from an energy production side and the efficiency side we need all of the above. We need every technology that is economically available. Plus, we can't ignore or take any technologies off the table, both on the supply and the utilization side.

Mr. Sarbanes. Thank you all. Mr. Chairman, again thanks for the hearing. I think we agree that we have to move super aggressively in the direction of the side of the portfolio that has to do with green, sustainable energy. The testimony we received today will help us do that.

I yield back.

Mr. Tonko. Thank you very much. And the gentleman yields back.

I believe that completes the list of members who chose to question the members of the panel. I do thank, very much thank the witnesses for their participation in today's hearing, my first hearing as chair. So I appreciate your cooperation immensely. Thank you for the great inclusion of ideas and thoughts and opportunities that lie before us. We appreciate it greatly.

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

And then, finally, I request unanimous consent to enter the following documents into the record. They include testimony of Jason Hartke, President of the Alliance to Save Energy, Climate Change in the Great Lakes Region: An assessment of Great Lakes Integrated Sciences; a January 8, 2019, letter from the Alliance to Save Energy that was forwarded to Speaker Pelosi, Leader McCarthy, Senate Majority Leader McConnell, and Senate Minority Leader Schumer; a letter from TechNet; a letter from the Advanced Energy Economy; a slide that was provided today by Representative McKinley in his questioning; and, finally, a presentation of slides by the witnesses that accompany today's involvement.

[The information follows:]

********** COMMITTEE INSERT 7 **********

Mr. Tonko. So, with all of that we again thank everyone for their participation and my colleagues for their interest in the issue. And at this time the subcommittee is adjourned.

[Whereupon, at 1:21 p.m., the subcommittee was adjourned.]