BUILDING A 100 PERCENT CLEAN ECONOMY: OPPORTUNITIES FOR AN EQUITABLE, LOW-CARBON RECOVERY

VIRTUAL HEARING

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT AND CLIMATE CHANGE

OF THE

COMMITTEE ON ENERGY AND COMMERCE

HOUSE OF REPRESENTATIVES

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[1] The information has been retained in committee files and is also available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD005.pdf.

[2] The information has been retained in committee files and is also available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD008.pdf.

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[3] The information has been retained in committee files and is also available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD007.pdf.

[4] The information has been retained in committee files and is also available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD010.pdf.

[5] The information has been retained in committee files and is also available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD004.pdf.

[6] The information has been retained in committee files and also is available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD009.pdf.

[7] The information has been retained in committee files and also is available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD011.pdf.

[8] The information has been retained in committee files and also is available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD012.pdf.

[9] The information has been retained in committee files and also is available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD015.pdf.

[10] The information has been retained in committee files and also is available at https://docs.house.gov/meetings/IF/IF18/20200916/111008/HHRG-116-IF18-20200916-SD016.pdf.

BUILDING A 100 PERCENT CLEAN ECONOMY: OPPORTUNITIES FOR AN EQUITABLE, LOW-CARBON RECOVERY

WEDNESDAY, SEPTEMBER 16, 2020

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENVIRONMENT AND CLIMATE CHANGE,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 10:07 a.m., via Cisco Webex online video conferencing, Hon. Paul Tonko (chairman of the subcommittee) presiding.

Members present: Representatives Tonko, Clarke, Peters, Barragán, Blunt Rochester, DeGette, Schakowsky, Matsui, McNerney, Ruiz, Dingell, Pallone (ex officio), Shimkus (subcommittee ranking member), Rodgers, McKinley, Johnson, Long, Flores, Carter, Duncan, and Walden (ex officio).

Staff present: Jeffrey C. Carroll, Staff Director; Jacqueline Cohen, Chief Environment Counsel; Adam Fischer, Junior Professional Staff Member; Waverly Gordon, Deputy Chief Counsel; Perry Hamilton, Deputy Chief Clerk; Rick Kessler, Senior Advisor and Staff Director, Energy and Environment; Brendan Larkin, Policy Coordinator; Elysa Montfort, Press Secretary; Joe Orlando, Policy Analyst; Kaitlyn Peel, Digital Director; Tim Robinson, Chief Counsel; Nikki Roy, Policy Coordinator; Rebecca Tomilchik, Policy Analyst; Mike Bloomquist, Minority Staff Director; Jerry Couri, Minority Deputy Chief Counsel, Environment and Climate Change; Tiffany Haverly, Minority Communications Director; Peter Kielty, Minority General Counsel; Ryan Long, Minority Deputy Staff Director; Mary Martin, Minority Chief Counsel, Energy and Environment and Climate Change; Brandon Mooney, Minority Deputy Chief Counsel, Energy; Clare Paoletta, Minority Policy Analyst, Health; Brannon Rains, Minority Policy Analyst; Peter Spencer, Minority Senior Professional Staff Member, Environment and Climate Change; and Callie Strock, Minority Press Secretary.

Mr. TONKO. The Subcommittee on Environment and Climate Change will now come to order.

And today the subcommittee is holding a hearing entitled Building a 100 Percent Clean Economy: “Opportunities for an Equitable Low Carbon Recovery.”

Due to the COVID-19 public health emergency, today’s hearing is being held remotely. All Members and witnesses will be participating via video conferencing. As part of our hearing, microphones will be set on mute for purposes of eliminating inadvertent background noise. Members and witnesses, you will need to unmute your microphone each time you choose to speak.

Documents for the record can be sent to Rebecca "Becky" Tomilchik at the email address we provided to staff. All documents will be entered into the record at the conclusion of the hearing, and I now recognize myself for 5 minutes for an opening statement.

OPENING STATEMENT OF HON. PAUL TONKO, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

When we began the 100 Percent Clean Economy hearing series, we set out to identify the challenges and the opportunities for our Nation to achieve scientifically necessary pollution reduction targets. Over the past year we have heard from experts about how to achieve these goals while strengthening our economy, creating new jobs and industries, modernizing our infrastructure, and addressing historic environmental injustices, all while transitioning every sector to a low-carbon future.

When we began this work, we had a pretty good idea that wildfires, hurricanes, and extreme heat, all exacerbated by our changing climate, were serious threats to Americans' lives and our near- and long-term economic outlook, but we had no way of foreseeing the COVID-19 pandemic. Closures due to COVID-19 have led to manufacturing reductions, supply chain disruptions, and increased installation of clean energy and energy efficiency technologies. Prior to COVID-19, clean energy sectors were adding jobs at twice the rate of overall U.S. employment. Today over one half a million clean energy workers have lost their jobs.

And, undoubtedly, the pandemic has shed light on systemic inequities. Many of the people that have been most likely to lose their lives to COVID are most likely to be unemployed because of it, more likely to experience harmful pollution in their communities, and most at risk to the dangers caused by climate change.

It has never been more obvious that our collective climate response, future economic prosperity, and commitment to building a more just and equitable society are intertwined. As we continue to consider how these goals should be achieved, given our current circumstances, I believe it is imperative that we start with targeting Federal investments to ensure that an economic recovery and clean energy transition will benefit workers and frontline communities while delivering a healthier and more resilient environment for all Americans.

Throughout the 116th Congress, this subcommittee has heard many ideas to do just that. Programs in the committee's jurisdiction can support the creation of American jobs, especially in labor-intensive sectors like construction and manufacturing. This isn't some unrealistic dream. There are real and existing programs that can be leveraged. We just need to increase the scale of our ambition and the depth of our commitment. This includes investments to modernize the grid, retrofit buildings, manufacture clean vehicles, develop a modern energy workforce, and research innovative technologies.

These efforts can also make us more resilient to unforeseen disruptions like COVID. For example, building domestic, low-carbon manufacturing capacity can shorten supply chains, while creating new jobs in emerging industries. These were ideas included in our comprehensive climate plan last year. And they make just as much sense today, given their climate and economic benefits.

And it may surprise some people, but in recent years, we have worked on a bipartisan basis on many important components of such a plan to support redevelopment of brownfields, remediation of Superfund sites, and improvements to water systems. These types of programs can be at the heart of our Nation's recovery to put people to work modernizing and climatizing our infrastructure while reducing pollution, especially in frontline communities.

Putting Americans back to work should be a top priority, but that is not the only important metric. We need to ensure that the jobs we are creating are of high quality. We need to create a support system for workforce development and training that isn't just putting people into transitional jobs but into long-term careers. We need to make strategic and sustained investments to develop new industries that will employ Americans for decades to come, and we need to make certain that these investments reach all communities.

While the need for action is as urgent as ever, we can be confident that this approach can have a meaningful impact. Much of the clean energy progress made in the past decade can trace its origins back to the historic investments of the Recovery Act. The cost of solar, wind, LEDs, and lithium-ion batteries have declined at an unthinkable rate, supported by those investments and incentives. Those investments created jobs while having long-term benefits: technology breakthroughs from ARPA-E, deployment of smart meters, and the first carbon capture demonstration projects to name just a few.

We are approaching 200,000 COVID deaths, and meanwhile, millions are unemployed, and we continue to see terrifying images of wildfires from the West and hurricanes from the Gulf. At our first hearing of the 116th Congress, I suggested that we wore at an inflection point. And how our committee responds in this moment will define our Nation for the next one-half century and beyond. This is truer today than ever before. And I look forward to today's discussion of the tremendous opportunities available to put Americans back to work in the short term while realizing the long-term benefits of a cleaner, more resilient, more competitive, and more just economy.

[The prepared statement of Mr. Tonko follows:]

PREPARED STATEMENT OF HON. PAUL TONKO

When we began the 100% Clean Economy hearing series, we set out to identify the challenges and opportunities for our nation to achieve scientifically necessary pollution reduction targets.

Over the past year, we have heard from experts about how to achieve these goals while strengthening our economy, creating new jobs and industries, modernizing our infrastructure, and addressing historic environmental injustices, all while transitioning every sector to a low-carbon future.

When we began this work, we had a pretty good idea that wildfires, hurricanes, and extreme heat—all exacerbated by our changing climate—were serious threats to Americans' lives and our near- and long-term economic outlook.

But we had no way of foreseeing the COVID-19 pandemic.

Closures due to COVID-19 have led to manufacturing reductions, supply chain disruptions, and decreased installation of clean energy and energy efficiency technologies.

Prior to COVID-19, clean energy sectors were adding jobs at twice the rate of overall U.S. employment.

Today over half a million clean energy workers have lost their jobs.

And undoubtedly, the pandemic has shed light on systemic inequities.

Many of the people that have been most likely to lose their lives to COVID are also more likely to be unemployed because of it, more likely to experience harmful pollution in their communities, and most at risk to the dangers caused by climate change.

It has never been more obvious that our collective climate response, future economic prosperity, and commitment to building a more just and equitable society are intertwined.

As we continue to consider how these goals should be achieved given our current circumstances, I believe it starts with targeting Federal investments to ensure that an economic recovery and clean energy transition will benefit workers and frontline communities, while delivering a healthier and more resilient environment for all Americans.

Throughout the 116th Congress, this Subcommittee has heard many ideas to do just that.

Programs in the Committee's jurisdiction can support the creation of American jobs, especiallyin labor-intensive sectors like construction and manufacturing.

This isn't some unrealistic dream. There are real and existing programs that can be leveraged.

We just need to increase the scale of our ambition and the depth of our commitment.

This includes investments to modernize the grid, retrofit buildings, manufacture clean vehicles,develop a modern energy workforce, and research innovative technologies.

These efforts can also make us more resilient to unforeseen disruptions, like COVID.

For example, building domestic, low-carbon manufacturing capacity can shorten supply chains while creating new jobs in emerging industries.

These were ideas included in our comprehensive climate plan last year, and they make just as much sense today given their climate and economic benefits.

And it may surprise some people, but in recent years, we've worked on a bipartisan basis on many important components of such a plan- to support redevelopment of brownfields, remediation of Superfund sites, and improvements to water systems.

These types of programs can be at the heart of our nation's recovery to put people to work modernizing and climatizing our infrastructure while reducing pollution, especially in frontline communities.

Putting Americans back to work should be a top priority, but that is not the only important metric.

We need to ensure that the jobs we are creating are of a high quality.

We need to create a support system for workforce development and training that isn't just putting people into transitional jobs, but into long-term careers.

We need to make strategic and sustained investments to develop new industries that will employ Americans for decades to come.

And we need to make sure these investments reach all communities.

While the need for action is as urgent as ever, we can be confident that this approach can have a meaningful impact.

Much of the clean energy progress made in the past decade can trace its origins back to the historic investments of the Recovery Act.

The costs of solar, wind, LEDs, and lithium-ion batteries have declined at an unthinkable rate, supported by those investments and incentives.

Those investments created jobs while having long-term benefits-technology breakthroughs from ARPA-E, deployment of smart meters, and the first carbon capture demonstration projects, to name just a few.

We are approaching 200,000 COVID deaths, and meanwhile millions are unemployed, and we continue to see terrifying images of wildfires from the west and hurricanes from the gulf.

At our first hearing of the 116th Congress, I suggested that we were at an inflection point, and how our Committee responds in this moment will define our nation for the next half century and beyond.

This is truer today than ever before.

I look forward to today's discussion of the tremendous opportunities available to put Americans back to work in the short-term while realizing the long-term benefits of a cleaner, more resilient, more competitive, and more just economy.

And, with that, I now recognize Mr. Shimkus, our ranking member of the Subcommittee on Environment and Climate Change for 5 minutes.

Representative, please, your opening statement.

OPENING STATEMENT OF HON. JOHN SHIMKUS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. SHIMKUS. Thank you, Mr. Chairman.

For any community to be prosperous and healthy, it takes energy. I think there is no dispute on this committee that promoting economic recovery, growing an economy, building and spreading prosperity, themes of today's hearing, require that energy be both affordable and reliable. The American people overwhelmingly agree. Recent polling found Americans prioritize affordability and reliability over emissions reduction. The same poll found 50 percent of people could not afford an electricity bill increase of $15 or more, including 25 percent who said that they could not afford an increase of any amount.

Higher energy costs also disproportionately hurt the poor more than the rich because low-income families spend a higher percentage of their income on those bills. The burden of higher energy costs is even more acute in communities of color. A study by the American Council for an Energy-Efficient Economy found that, on average, Black, Hispanic, and Native American households spend a much larger portion of their income on energy bills than White, non-Hispanic households.

It is our responsibility as policymakers to closely examine the costs, the effectiveness, and other impacts of the environmental policies that affect energy. Failure to do this, especially when addressing climate change risks, harm to public health and hurts most of those who can afford it the least. Let's not lose sight of that today as we consider a low-carbon recovery that aims to benefit all Americans.

This is a laudable goal, but I think we should look very carefully and cautiously at any measures that rush towards a national energy transition that results in new insecurities and other problems. On August 14th and 15th last month, for the first time since its energy crisis in 2001, California's grid operator had to institute rolling blackouts for some two million people. This was because the state supply of electricity could not meet demand during the later hours of the day. This is when the sun sets and the State's estimated 12 gigawatts of utility-scale solar no longer provides power to the grid. And so, the grid operator has to draw upon other power sources if they are available. The immediate cause of this crisis was the unexpected drop-off in wind energy and a loss of power plant, coupled with limited electricity availability for import as the heat wave hit other Western States.

But the chronic cause of the crisis in California is its increasing reliance on wind and solar, driven up by the State's mandate that 60 percent of its electricity must come from renewables by 2030, up from about 36 percent today. This rush to green in California is driving out baseload generation, including clean nuclear energy, and locking in a system that its own authorities warn is more vulnerable to supply disruption and that charges among the highest electricity rates in the Nation.

Tellingly, the Diablo Canyon Nuclear Power Plant, which represents 20 percent of the State's carbon-free energy and a thousand high-paying jobs is scheduled to begin shutting down in four years. That State's overcapacity of solar and wind forced regulators to curtail Diablo's output, making it uneconomical, even though nuclear offers equally clean but far more reliable power than wind and solar.

I don't think we want to impose California's green new normal on the rest of the Nation. But what else are we failing to consider as we look at clean economy policies, especially policies that drive toward the mandatory reliance on renewables and electrification?

One witness today, Dr. Michot Foss, from Rice University's Baker Institute, will offer some important considerations that will help us understand more fully where these clean economy policies that depend on renewables and electrification are going. She will speak to the energy and economic security risks we face concerning the materials that will be needed for building out complex green energy systems. These include the critical minerals and raw materials for batteries and for components for wind and solar as well as other systems and machines that make up our Nation's energy and transportation infrastructure.

A growing dependence on critical minerals in these new energy systems raises serious supply chain, national security, and economic security and environmental issues that have not received the attention they deserve. After 50 years of national energy policies that sought to protect America's energy security, it would be a shame to reverse all those gains we have made because we didn't confront the hard questions that proposed energy transitions raise. We can begin asking those questions this morning.

Thank you, Mr. Chairman. I look forward to an informative hearing.

With that, I yield back my time.

[The prepared statement of Mr. Shimkus follows:]

PREPARED STATEMENT OF HON. JOHN SHIMKUS

For any community to be prosperous and healthy, it takes energy.

I think there's no dispute on this Committee that promoting economic recovery, growing an economy, building and spreading prosperity-themes of today's hearing-requires that energy be both affordable and reliable.

The American people overwhelmingly agree. Recent polling found Americans prioritize affordability and reliability over emissions reductions. The same poll found 50 percent of people "could not afford an electricity bill increase of $15 or less—including 25 percent who said they could not afford an increase of any amount."

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It's our responsibility as policymakers to closely examine the costs, effectiveness, and other impacts of environmental policies that affect energy. Failure to do this, especially when addressing climate change, risks harm to public health and hurts most to those who can afford it least.

Let's not lose sight of that today as we consider a "low-carbon recovery" that aims to benefit all Americans. This is a laudable goal. But I think we should look very carefully and cautiously at any measures that rush towards a national energy transition that results in new insecurities and other problems.

On August 14th and 15th last month, for the first time since its energy crisis in 2001, California's grid operator had to institute rolling blackouts for some two million people.

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A growing dependence on critical minerals in these new energy systems raise serious supply chain, national security, economic security, and environmental issues that have not received the attention they deserve.

After fifty years of national energy policies that sought to protect America's energy security, it would be a shame to reverse all the gains we have made because we didn't confront the hard questions that proposed energy transitions raise.

We can begin asking those questions this morning.

Thank you, Mr. Chairman, I look forward to an informative hearing.

Mr. TONKO. The gentleman yields back.

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

OPENING STATEMENT OF HON. FRANK PALLONE, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. PALLONE. Thank you, Chairman Tonko.

Today's hearing is the latest in the committee's series on building 100 percent clean economy, which becomes even more crucial to the future of our country and our planet by the day. The images and the stories from the wildfires that are engulfing large parts of California, Oregon, and Washington are devastating. The destruction of homes and businesses and the loss of life is heartbreaking. And the fires are producing some of the worst air quality in the world.

And these fires are climate fires, and it was disheartening to watch the President on the ground in California earlier this week where he once again fully denied scientific facts. 2020 is on track to be one of the two hottest years, if not the hottest year, on record.

On the East and Gulf Coasts, it has been a record-breaking Atlantic hurricane season. For the first time in recorded history, 18 tropical storms have formed before October. And now Hurricane Sally is predicted to drop about 30 inches of rain on part of the Gulf Coast.

Unfortunately, this is all a preview of what is in store for the future if we don't take bold, decisive action to combat the climate crisis. And now as the COVID-19 pandemic has changed the economic landscape, the path to 100 percent clean looks difference today than it did last year, but the science based target of transitioning to 100 percent clean economy by no later than 2050, which we adopted last year, is still important. In fact, we really need to move much faster. And achieving that goal remains critical if we are to avoid the most damaging and costly consequences of climate change.

Now, in January, our committee released a draft of the CLEAN Future Act, which outlined tools to put the United States on the path to 100 percent clean economy, and today we will look at how those tools and others can help our economy recover stronger and cleaner than it was before the pandemic.

Over the last seven months, nearly 200,000 Americans have died and nearly 3.4 million Americans have permanently lost their jobs, and less than half of the 22 million jobs lost since February have been recovered. Even worse, job growth has slowed with each passing month. And this crisis has not hit all Americans equally. Communities of color have been disproportionately affected by the health and economic impacts of the pandemic. These are the same communities that have endured disproportionate exposure to air and water pollution for far too long. As we begin to recover from the current crisis, we have an opportunity and an obligation to build a fair, better future for these communities and for all Americans.

So today we will examine the role of the Federal Government in enabling such a recovery, a recovery that not only jump-starts the economy but one that centers on equitable, inclusive climate action. A recent report from the Commodity Futures Trading Commission offers a startling view of the economic costs of climate inaction. The report found that climate-related extreme weather events will wreak havoc on our financial systems, undermining long-term economic growth. And that dire warning builds on the Federal Government's prior estimates that climate change could cut U.S. gross domestic product by ten percent by the end of the century.

These figures are alarming. But they simply confirm what we already know, that the climate crisis is real, it is devastating, and it is unfolding before our very eyes. The public health, economic, and climate crisis are all happening simultaneously. And we have no choice but to tackle all of these challenging head-on as we rebuild. We cannot recreate the problems—or I should say we should not recreate the problems of the past but instead create a future that is cleaner, more equitable, and more inclusive.

An ambitious recovery effort focused on climate action will give us the tools to build back better and stronger and create millions of new, good-paying jobs. And I look forward to hearing from our witnesses about how Federal support can reinvigorate our economy and put us on a path to a cleaner, more equitable future.

I just want to thank Chairman Tonko and also our Ranking Member Shimkus, Greg. This hearing is very important and, obviously, we spent a lot of time on climate change both in the subcommittee and the full committee, and we need to continue to do so as a committee.

So thanks again, Paul.

I yield back.

[The prepared statement of Mr. Pallone follows:]

PREPARED STATEMENT OF HON. FRANK PALLONE, JR.

Today's hearing is the latest in the Committee's series on building a 100 percent clean economy, which becomes even more crucial to the future of our nation and our planet by the day.

The images and the stories from the wildfires that are engulfing large parts of California, Oregon and Washington are devastating. The destruction of homes and businesses and the loss of life is heartbreaking, and the fires are producing some of the worst air quality in the world.

These fires are climate fires, and it was disheartening to watch the President on the ground in California earlier this week, once again, fully deny scientific fact.

2020 is on track to be one of the two hottest years—if not the hottest year—on record. On the east and Gulf coasts, it's been a record-breaking Atlantic hurricane season. For the first time in recorded history, 18 tropical storms have formed before October, and now Hurricane Sally is predicted to drop about 30 inches of rain on parts of the Gulf Coast.

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And now, as the COVID-19 pandemic has changed the economic landscape, the path to 100 percent clean looks different today than it did last year. But the science-based target of transitioning to a 100 percent clean economy by no later than 2050, which we adopted last year, must remain the same. Achieving that goal remains critical if we are to avoid the most damaging and costly consequences of climate change.

In January, our Committee released a draft of the CLEAN Future Act, which outlined tools to put the United States on the path to a 100 percent clean economy. Today, we will look at how those tools, and others, can help our economy recover stronger and cleaner than it was before the pandemic.

Over the last seven months nearly 200,000 Americans have died, nearly 3.4 million Americans have permanently lost their jobs, and less than half of the 22 million jobs lost since February have been recovered. Even worse, job growth has slowed with each passing month.

This crisis has not hit all Americans equally. Communities of color have been disproportionately affected by the health and economic impacts of the pandemic. These are the same communities that have endured disproportionate exposure to air and water pollution for far too long. As we begin to recover from the current crisis, we have an opportunity and an obligation to build a fairer, better future for these communities and for all Americans.

Today we'll examine the role of the Federal Government in enabling such a recovery - a recovery that not only jumpstarts the economy, but one that centers on equitable, inclusive climate action.

A recent report from the Commodity Futures Trading Commission offers a startling view of the economic costs of climate inaction. The report found that climate-related extreme weather events will wreak havoc on our financial systems, undermining long-term economic growth. That dire warning builds on the federal government's prior estimates that climate change could cut U.S. gross domestic product by ten percent by the end of the century.

These figures are alarming, but they simply confirm what we already know: that the climate crisis is real. It is devastating. And it is unfolding before our very eyes.

The public health, economic, and climate crises are all happening simultaneously, and we have no choice but to tackle all these challenges head-on as we rebuild. We must not recreate the problems of the past, but instead create a future that is cleaner, more equitable, and more inclusive.

An ambitious recovery effort focused on climate action will give us the tools to build back better and stronger, and create millions of new, good-paying jobs. I look forward to hearing from our witnesses about how federal support can reinvigorate our economy and put us on the path to a cleaner, more equitable future.

Mr. PALLONE. I can't hear Paul.

Mr. TONKO. I can teach myself here.

The Chair will now recognize Representative Walden, ranking member of the full committee, for 5 minutes for his opening statement.

OPENING STATEMENT OF HON. GREG WALDEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OREGON

Greg, before you take the floor here, let me extend my condolences to you and other members of this subcommittee who have witnessed and absorbed some terrific damage in your districts. I am sure the entire subcommittee shares its thoughts and its concerns with you, and let's go forward and make certain we can do the best in response to that damage that has occurred in your area.

Mr. WALDEN. Well, thank you, Mr. Chairman.

Thank you, Mr. Chairman, and thanks to all of you for your thoughts and prayers, especially for my constituents and those of Kurt Schrader as well who have lost everything. This hit the poorest of the poor. Those with the least were wiped out the most, and so we have got a lot of recovery. It is a long road back. So, I appreciate that.

And today's hearing does come as Oregon and much of the West, California and Washington, have suffered from these horrific and devastating wildfires, kind of hitting us all, all at once. In Oregon, more than 40,000 people are displaced, lives have been lost, thousands of homes have been destroyed, and an area the size of Rhode Island has burned. Our hearts go out to those impacted by these catastrophic fires.

Sadly, our Federal forests have lacked proper management for years, resulting in our Federal forests becoming tinderboxes. We got nearly 63 million acres of national forestlands the Forest Service has determined need active management and thinning to get them back in balance with nature. So that is something we, I think, should all be able to agree upon, because when these fires come, the emissions are just extraordinary. And by the way, upwards of 70 percent of carbon emissions come after the fires are out from the decaying material left behind.

Proper forest management reduces fire risks, lowers carbon emissions from fires, and it creates good jobs. It also allows us to utilize our natural resources in a sustainable way to protect and grow our communities and our forests.

Today's hearing is also relevant in the wake of California's most recent rolling blackouts, affecting hundreds of thousands of people in the middle of both a heat wave and a pandemic. There is a lot we can do as a Nation to improve reliability and resilience of our electric grid, and I think that is good bipartisan work.

Mr. Chairman, you referenced it in your statements as well.

We have to prioritize energy security and affordability for consumers, as Mr. Shimkus said, and use experience and science as our guide for our energy policy. We share the goal of a clean economy. Republicans put consumers and innovation first as we balance many complicated issues impacting our economy, our environment, and national security.

Regrettably, California's current energy crisis was predictable, and it was avoidable. California policymakers ignored the scientists and the engineers who maintained the electric grid and, instead, mandated their version of a Green New Deal. California forced the retirement of the most stable baseload nuclear natural gas-fired power generation without a reliable backup option in place. California regulators, I believe, failed in the most basic responsibility, and that is ensuring adequate electric generation is available whenever and wherever needed.

So, as a result, hundreds of thousands of Californians were forced to endure rolling outages when they needed their electricity the most, and, in fact, had the Bonneville Power Administration not been able to ramp up hydropower regeneration on the Columbia and Snake Rivers, it would have been even worse. If California, the world's fifth largest economy, cannot keep the lights on during a heat wave, that is a serious warning for anyone considering placing these mandates on the rest of the Nation.

I would also like to highlight another major challenge we must confront, and that is the growing reliance on foreign-sourced critical minerals which serve as raw ingredients to manufacture all kinds of electronics, batteries, solar panels, and windmills. These critical minerals are largely controlled by China and mined beyond our borders now and without our high environmental and worker safety standards. This is a supply chain issue I hope the committee will look at and those of our colleagues on other committees.

The U.S. has an extraordinary abundance of these very same mineral resources, both onshore and offshore. We are the world's number one producer of oil and gas and a leading producer of coal. These traditional energy resources have powered our Nation's economy and strengthened our hand diplomatically. Today we are more energy secure than ever in the history of the United States. Millions of people have good jobs in the energy industry, and our businesses and consumers have some of the lowest and most stable energy prices anywhere in the world.

Despite our abundance energy resources, though, we do rely on other countries for dozens of other vital minerals. We are 100 percent net-import reliant on some minerals used in many electronics, batteries, solar panels, and windmills. If the vision is to power the Nation on these technologies alone, we could be in serious trouble if we don't deal with the supply chain issue.

As we have learned from this pandemic, our reliance on foreign, especially Chinese, supply chains is a strategic vulnerability. Given our innovative strength and the progress we have made to become energy secure, it would be unconscionable to sacrifice these gains for a Green New Deal fantasy that bans hydraulic fracturing and discards decades of progress. So, let's learn from the mistakes of the past and not move too quickly without a full understanding of the facts and science.

Is transitioning to 100 percent renewables and electric vehicles a good idea if it means we are going to be 100 percent dependent on China for the minerals to produce them? Do Americans want to transition to 100 percent renewables if it means rolling blackouts? These are the issues that I know the committee takes seriously.

We need to have a serious solutions-oriented discussion about dealing with climate change. We all want affordable, clean, and reliable energy options. The question is, what is the best way to get there?

So, Mr. Chairman, thanks for the hearing. I look forward to the testimony. I will be going back and forth because I am dealing with the emergency in my district in real time.

But I yield back and thank you.

[The prepared statement of Mr. Walden follows:]

PREPARED STATEMENT OF HON. GREG WALDEN

Today's hearing comes as my home state of Oregon and much of the west reels from devastating wildfires. In Oregon over 40,000 people are displaced, lives have been lost, thousands of homes have been destroyed, and an area the size of Rhode Island has burned. Our hearts go out to all those impacted by these catastrophic fires.

Sadly, our federal forests have lacked proper management for years, resulting in our federal forests becoming tinderboxes, with nearly 63 million acres of national forest the Forest Service has determined needs fire prevention treatment. This is something we should all be able to agree on.

Proper forest management reduces fire risk, lowers carbon emissions from fire and creates good jobs. It also allows us to utilize our natural resources in a sustainable way to protect and grow our communities and our forests.

Today's hearing is also relevant in the wake of California's most recent rolling blackouts, affecting hundreds of thousands of people in themiddle of both a heat wave and pandemic. There is a lot we can do as a nation to improve the reliability and resilience of our electric grid.

We have to prioritize energy security and affordability for consumers and use experience and science as our guide for our energy policy. We share the goal of a clean economy. Republicans put consumers and innovation first, as we balance many complicated issues impacting our economy, our environment, and our national security.

Regrettably, California's current energy crisis was predictable and it was avoidable. California policy makers ignored the scientists and the engineers who maintain the electric grid and instead mandated their version of the Green New Deal. California forced the retirement of the most stable base-load nuclear and natural gas fired power generation, without a reliable backup option in place.

California regulators, I believe, failed in their most basic responsibility—ensuring adequate electric generation is available whenever and wherever it is needed.

As a result, hundreds of thousands of Californians were forced to endure rolling outages, when they needed their electricity the most. In fact, had the Bonneville Power Administration not been able to ramp up hydropower generation on the Columbia and Snake Rivers, it would have been even worse.

If California—the world's fifth largest economy—can't keep the lights on during a heatwave, that is a serious warning for anyone considering placing these mandates on the rest of the nation.

I'd also like to highlight another major challenge we must confront: growing reliance on foreign sourced critical minerals, which serve as raw ingredients to manufacture all kinds of electronics, batteries, solar panels, and windmills. These critical minerals are largely controlled by China and mined beyond our borders and without our high environmental and worker safety standards. This is a supply chain issue I hope the Committee will look at.

The U.S. has an extraordinary abundance of mineral resources, both onshore and offshore. We're the world's number one producer of oil and gas, and a leading producer of coal. These traditional energy resources have powered our nation's economy and strengthened our hand diplomatically.

Today, we are more energy secure than ever in the history of the United States. Millions of people have good jobs in the energy industry,and our businesses and consumers have some of the lowest and most stable energy prices anywhere in the world.

Despite our abundant energy resources, we rely on other countries for dozens of other vital minerals. We are 100% net import reliant on some minerals used in many electronics, batteries, solar panels, and windmills. If the vision is to power the nation on these technologies alone, we may be in serious trouble.

As we have learned from this pandemic, our reliance on foreign and especially Chinese supply chains is a strategic vulnerability. Given our innovative strength and the progress we've made to become energy secure, it would be unconscionable to sacrifice these gains for a Green New Deal fantasy that bans hydraulic fracturing and discards decades of progress. Let's learn from the mistakes of the past—and not move too quickly without a full understanding of the facts.

Is transitioning to 100% renewables and electric vehicles a good idea if it means we are going to be 100% dependent on China for the materials to produce them? Do Americans want to transition to 100% renewables if it means rolling electricity blackouts? These are the issues I know the Committee takes seriously.

We need to have a serious, solutions-oriented discussion about dealing with climate change. We all want clean, affordable, and reliable energy options. The question is, what is the best way to get there?

So, Mister Chairman, thanks for the hearing. I look forward to it.

Thank you, I yield back.

Mr. TONKO. The gentleman yields back.

The Chair would like to remind Members that, pursuant to committee rules, all Members' written open statements shall be made part of the record.

I now will introduce the witnesses for today's hearing. First, we have Dr. Devashree Saha, Ph.D., senior associate with the World Resources Institute; Mr. Lonnie R. Stephenson, international president of the International Brotherhood of Electrical Workers, IBEW; Dr. Denise Fairchild, Ph.D., president and chief executive officer, Emerald Cities Collaborative; and, finally, Dr. Michot Foss, Ph.D., fellow in energy and minerals, Baker Institute for Public Policy at the Center for Energy Studies of Rice University.

I will now recognize Dr. Saha for 5 minutes to provide an opening statement. Welcome again.

STATEMENTS OF DEVASHREE SAHA, PH.D., SENIOR ASSOCIATE, WORLD RESOURCES INSTITUTE; LONNIE R. STEPHENSON, INTERNATIONAL PRESIDENT, INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS (IBEW); DENISE FAIRCHILD, PH.D., PRESIDENT AND CHIEF EXECUTIVE OFFICER, EMERALD CITIES COLLABORATIVE; MICHELLE MICHOT FOSS, PH.D., FELLOW IN ENERGY AND MINERALS, BAKER INSTITUTE FOR PUBLIC POLICY, CENTER FOR ENERGY STUDIES, RICE UNIVERSITY

STATEMENT OF DEVASHREE SAHA, PH.D.

Dr. SAHA. Good morning, Chairman Tonko, Ranking Member Shimkus, and other members of the subcommittee. My name is Devashree Saha, and I am a senior associate at World Resources Institute. Thank you for this opportunity.

This year has been like none other, and I am sure all of you here agree with me on that. We are witnessing the impacts of COVID-19, an economic recession with millions of Americans unemployed, a rising racial and social justice movement, and the direct effects of climate change with historic wildfires raging on the West Coast.

With all these intersecting crises, I want to talk about the important role that clean energy and other low-carbon technologies can play in enabling an economic recovery that benefits all Americans, that increases stability in the financial markets, and puts the United States on the path to 100 percent clean economy.

A new analysis by WRI reviewed the latest economic and policy literature, and it clearly concluded that better economic growth and better climate go hand in hand. They are not incompatible. My written testimony has more details, but I want to highlight three key findings from our report.

First, strong climate action and investments in low-carbon infrastructure can be effective in stimulating jobs and economic activity as part of the recovery process and also ensure our long-term competitiveness and growth.

Clean energy is already a major U.S. employer. It supports 3.6 million American workers, and these are jobs this which are well-distributed all over the country and, prior to COVID-19, had been growing at a much faster pace than overall employment. With today's high unemployment level, investments in these technologies can create more jobs than similar level of investment in carbon-intensive sectors of the U.S. economy.

Let me give you one example. $1 million spent on clean energy generates about seven to eight full-time equivalent jobs per year. A similar level of investment in fossil fuel technology generates only two to three jobs. There are other economic benefits. The domestic and global clean tech market is booming. It has been growing significantly in the last decade. The U.S. advanced energy industry generated $238 billion in revenues in 2018. This is only about 14—15 percent off the global total, but the sector's 11 percent growth in 2018 was almost four times the growth of the U.S. economy. In short, America can improve its manufacturing competitiveness by building a domestic market for low-carbon technologies and tapping into foreign markets.

The second key finding is that delaying action on climate will further expose the United States to costly damages from climate impacts, air pollution, and other public health crises, as well as create instability in the financial markets, which is why it is so heartening to see that the financial sector is increasing the ability to recognize the risks associated with climate change and also realize the significant opportunities that emerge from climate action.

As Chairman Pallone said, the Commodities Futures Trading Commission put out a report which warned that climate change poses a major risk to the stability of the U.S. financial system, and it has recommended that enacting a carbon price is the most important step that the U.S. needs to take now. And it is significant that the report and its findings have been endorsed by some of the largest banks, asset manager and owners, Big Agriculture, including Cargill as well as a major oil company, which brings me to the third and final finding.

The investments needed for the low-carbon transition are significant, but the returns in economic opportunities, improved public health, and avoided climate catastrophes will far exceed the costs. America stands to benefit economically from taking strong climate action, which is why it is well past time for Congress to enact comprehensive climate legislation to accelerate America's transition to a clean, thriving economy.

Thank you.
[The prepared statement of Dr. Saha follows:]

WORLD RESOURCES INSTITUTE

Hearing on "Building a 100 Percent Clean Economy: Opportunities for an Equitable, Low-Carbon Recovery"
U.S. House of Representatives, Energy and Commerce Committee
Subcommittee on Environment and Climate Change
September 16, 2020

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My name is Devashree Saha and I am a Senior Associate at World Resources Institute (WRI). I appreciate the opportunity to provide written testimony on "Building a 100 Percent Clean Economy: Opportunities for an Equitable, Low-Carbon Recovery." WRI is a nonprofit, non-partisan environmental think tank that goes beyond research to provide practical solutions to the world's most urgent environment and development challenges. We work in partnership with scientists, businesses, governments, and non-governmental organizations across the globe to provide information, tools and analysis to address problems like climate change, the degradation of ecosystems and their capacity to provide for human well-being. With my colleague, Joel Jaeger, I have been researching the economics of a low-carbon transition in the United States.

The United States is facing unprecedented challenges: a health crisis and an economic crisis due to COVID-19. More than 190,000 people have died and millions of Americans are unemployed, with the U.S. economy down by 11.5 million jobs from where it was in February when the pandemic hit. Racial and economic inequalities remain undeniable forces in American life and the pandemic has further exacerbated those inequalities.

At the same time, we are also facing a looming climate crisis. The evidence that climate change is underway and impacting our everyday lives is growing stronger each day, along with the evidence that human activities are largely contributing to it.

To avoid the worst effects of climate change, the United States and the world must dramatically reduce greenhouse gas emissions in the next 30 years. There is widespread consensus that in order to limit the increase in the global average temperature to 1.5^{O}C above pre-industrial levels, all regions of the world should reach net-zero emissions by 2050.

As we prioritize economic recovery and job creation, we can and must do so in a way that simultaneously makes progress on climate goals. While rebooting the U.S. economy from the coronavirus fallout, we are presented with an opportunity to rebuild the economy in a way that will be resilient to future shocks, including from climate change.

In our latest report, **"America's New Climate Economy: A Comprehensive Guide to the Economic Benefits of Climate Policy in the United States,"**[i] my coauthor Joel Jaeger and I found:

- Strong climate action and investments in low-carbon infrastructure can be an effective way to stimulate jobs and economic activity in the wake of COVID-19, as well as set the economy up for long-term success.
- On the other hand, delaying action on climate will further expose the United States to costly damage from climate impacts, air pollution, and other public health crises.
- While the investments needed for the low-carbon transition are significant, they will not break the budget and the returns—in economic opportunities, improved public health and avoided climate catastrophes—will far exceed the costs.

In what follows, we highlight the evidence from the latest economic and policy literature on how the United States stands to benefit economically from taking strong climate action. Deep decarbonization of the U.S. economy must be viewed as an investment in our collective future, which presents not just long-term benefits but also immediate, near-term opportunities. If the investment is made wisely, it will generate a wide range of opportunities for growth, development, and inclusion along the way.

<u>Charting Progress Toward America's New Climate Economy: Where Are We Today?</u>

There has been significant momentum in the past decade towards a low-carbon economy, but the COVID-19 outbreak will cause disruptions. In a post-COVID-19 world, U.S. policymakers must continue building upon the significant progress already made, and in forthcoming economic recovery and stimulus packages should prioritize climate-smart investments.

In recent years the United States has been growing its economy while reducing emissions, debunking the myth that economic growth and climate protection are incompatible. Forty-one states and the District of Columbia reduced their energy-related CO_2 emissions while increasing real economic growth between 2005 and 2017.[1] U.S. states, cities, and counties committed to climate action in line with the Paris Agreement now represent almost 70% of U.S. GDP and population and more than half of U.S. emissions.[2] The private sector, including the biggest asset managers like BlackRock, is also committing to making sustainability and climate risks central to their investment strategies. The U.S. Commodity Futures Trading Commission's report is the latest to warn that "climate change poses a major risk to the stability of the U.S. financial system and to its ability to sustain the American economy." The report, which included feedback from representatives from banks, investors, environmental groups, and a

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[i] Devashree Saha and Joel Jaeger. (2020). "America's New Climate Economy: A Comprehensive Guide to the Economic Benefits of Climate Policy in the United States." World Resources Institute. https://www.wri.org/publication/us-new-climate-economy

major oil company, calls for Congress to impose a price on carbon and decisively work to address the looking economic damage from climate change.

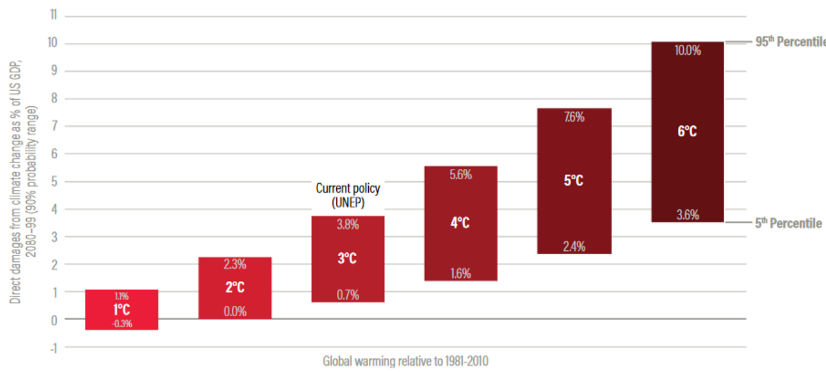
The United States, however, is not on track to meet the targets it agreed to under the Paris agreement or to keep within a carbon budget for 1.5^0 C warming, and robust federal engagement and policies are required to achieve deeper, long-term emissions reductions. U.S. emissions will have to decrease more than twice as fast from 2018-2030 as they did during 2005-2018.[3] Low-carbon investment needs to scale up significantly. However, under the Trump administration the U.S. federal government has not implemented any new climate policies is dismantling the limited policies that we have, which makes it difficult for the country to truly reach a low-carbon economy and costs American consumers money. The rollback of vehicle fuel efficiency standards alone is expected to cost American drivers more than $200 billion over the next 15 years.[4] A comprehensive effort to address climate change will require the federal government to promote the transition to America's new climate economy rather than sit on the sidelines or actively try to slow it down.

The economic downturn imposed by the COVID-19 pandemic presents a window of opportunity to scale up urgently needed climate action. At this critical juncture, channeling public investment into low-carbon infrastructure and adopting new climate policies can catalyze the shift toward the low-carbon economy. More importantly, it will NOT come at the expense of U.S. economic growth or a healthy job market. In fact, designed properly it will present both near-term and long-term economic benefits and opportunities. We must not miss this opportunity.

<u>The Economic Case for a New Climate Economy</u>

The costs of climate inaction are significant, with the impacts of climate change estimated to shave several percentage points off U.S. GDP every year. Like the COVID-19 pandemic, climate change is a threat multiplier, and the earlier we respond the easier it will be to limit the impacts. The cost of damage from extreme weather and climate disasters has been steadily increasing every decade as climate change makes them more frequent and intense.[5] The hurricane in Puerto Rico in 2017 caused more than $90 billion in damages, wildfires in California in 2018-2019 cost more than $40 billion, and flooding in the Midwest in 2019 cost more than $10 billion.[6] Without new policies, global mean temperature is expected to rise about 3.5°C above preindustrial levels by 2100, which would lead to annual damages from climate change equal to around 1-3% of U.S. GDP by the end of the century.[7] In the worst case scenario with rising emissions and limited or no adaptation, economic damages could reach 3.7-10% of GDP per year. [8,9] The South and parts of the Midwest will be the hardest hit, as will the poorest communities. Bringing down emissions could greatly reduce these costs for all regions of the country.

Figure 1: U.S. Economic Damages at Different Levels of Global Warming



Note: GDP = gross domestic product; UNEP = United Nations Environment Programme. Average global temperatures were already 0.63°C higher in 1981–2010 compared to preindustrial levels, which are generally used as the reference point for the Paris Agreement's goals (Climate Change Service. 2019. "Last Four Years Have Been the Warmest on Record—and CO_2 Continues to Rise." January 7. https://climate.copernicus.eu/last-four-years-have-been-warmest-record-and-co2-continues-rise).

Source: Hsiang, S., R. Kopp, A. Jina, J. Rising, M. Delgado, S. Mohan, D.J. Rasmussen, et al. 2017. "Estimating Economic Damage from Climate Change in the United States." Science 356 (6345): 1362–69.

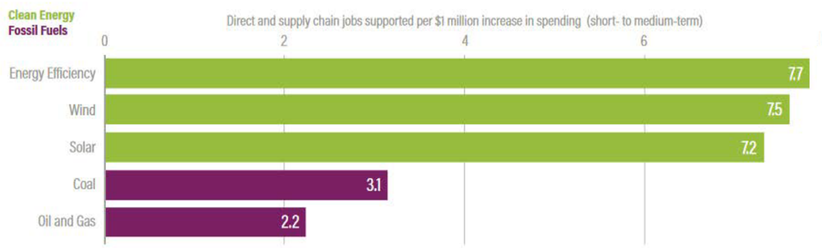
The clean energy industry has become a major U.S. employer, and while many of these jobs are threatened by the COVID-19 crisis, the sector is still set up for promising growth. In 2019 there were 3.6 million Americans employed in various clean energy jobs, with about 2.4 million U.S. jobs in energy efficiency, 248,000 in solar energy, 114,000 in wind energy, 108,000 in biofuels, 266,000 in electric and alternative fuel vehicles, and 66,000 in battery storage.[10] These jobs are well distributed all over the country and had been growing at a faster pace than overall employment. Clean energy jobs offer higher wages than the national average, and many are available to workers without college degrees, though there are some concerns about the duration of the jobs and access to benefits.[11]

Although the impacts of COVID-19 are still uncertain, over half a million clean energy workers had lost their jobs by the end of July.[12] There are signs though that the renewable energy industry is weathering the crisis far better than fossil fuels, but there is still a need to extend and make all renewable energy tax credits refundable so that the industry can sustain the momentum it has built for the past decade .[13]

With high unemployment, investing in clean energy and other low-carbon sectors as part of the economic recovery from COVID-19 can be an effective way to create jobs in the near-term. An increasing body of literature shows that investments in clean energy and other segments of the low-carbon economy create more jobs than similar levels of investment in carbon-intensive sectors of the U.S. economy. $1 million spent on renewable energy or energy efficiency generates about 7-8 full-time equivalent jobs, while $1 million spent on fossil fuels in the U.S. generates about 2-3 jobs).[14]

Investments in transit, pedestrian, and cycling projects have bigger employment impact than investments in roads. For example, as part of the American Recovery and Reinvestment Act, each dollar spent on public transit projects created 70% more job-hours than a dollar spent on highways.[15] Every $1 billion invested in public transportation creates nearly 50,000 jobs and returns $5 billion in economic activity.[16] Investments in restoration and sustainable forest management, EV charging infrastructure, and biofuels have also been identified to have high employment multipliers.[17] Every $1 billion of electricity transmission investment can generate 13,000 full-time-equivalent years of employment and every $1 invested creates $2.40 in economic benefits.[18]

Figure 2: Clean Energy Supports More Jobs Than Fossil Fuels Per $1 Million of Spending



Source: Garrett-Peltier, H. 2017. "Green versus Brown: Comparing the Employment Impacts of Energy Efficiency, Renewable Energy, and Fossil Fuels Using an Input-Output Model." Economic Modelling 61 (February): 439–47.

Strong climate action is also consistent with long-term economic growth and a healthy job market. Decades of empirical evidence debunk the simplistic narrative that environmental protections are bad for the economy. Given that growth or contraction of the U.S. economy is driven by broad macroeconomic factors, the net effects of climate policies on GDP and employment are likely to be relatively small compared to the size of the economy. A range of economic models have found that with strong climate action, U.S. GDP will be between 0.6% lower and 0.7% higher compared to the baseline in 2030, and employment will be between 0.25% lower and 0.6% higher compared to the baseline in 2030.[19] These models likely underestimate the benefits of climate action because they do not include the air quality benefits of climate action, the risks of economic damages without action, and the potential benefits of disruptive change. While these models were conducted before the COVID-19 crisis began and unemployment rose, there has been some early research on the economic impacts of new U.S. green stimulus spending (see Table 1). These new reports have identified substantial job opportunities from green investments and climate action post-COVID.

Table 1: 2020 U.S. Studies on the Jobs Potential of Climate Action and Investment

Source:	Proposal	Jobs	Emissions	Other Quantified Economic Benefits
ACEEE[20]	$83.5 billion present value investments in energy efficiency	660,000 more job-years through 2023 and 1.3 million added job-years over the lifetime of the investments and savings	900 million MMT of reduced carbon dioxide emissions	$120 billion in present value energy bill savings
E2[21]	$99.2 billion federal clean energy stimulus with investments in energy efficiency, renewable energy, and grid modernization	860,300 full time direct, indirect and induced jobs that will last for at least five years (a total of 4.3 million job-years)	Not quantified	$330 billion in GDP over the next 5 years, more than triple the amount of investment
Rewiring America[22]	An aggressive national commitment to electrify all aspects of our economy, with the government's share of overall costs about $300 billion per year for 10 years, mostly through loans	Up to 25 million good-paying American jobs over the next 15 years and 5 million sustained jobs by mid-century.	Rapid and total decarbonization of the economy as a whole	Up to $2,000 annual savings for the average household on energy costs and better health outcomes for American families
PERI/Sierra Club[23]	Public investments of $320 billion per year in clean energy and agriculture programs and $260 billion per year for upgrading infrastructure more broadly.	The clean energy and agriculture investments could create 4.5 million gross jobs every year for 10 years. The investments in infrastructure more broadly could create an additional 4.6 million gross jobs every year for 10 years.	On track to reduce emissions in line with the Paris Agreement	Not quantified

Past experience demonstrates that clean energy investments can be effective economic stimulus. In response to the Great Recession, the United States passed the 2009 American Recovery and Investment Act (ARRA). It included about $94 million for green measures, about 12% of the total package, which was the largest clean energy investment in U.S. history.[24] Looking back at these investments as a whole and sector-by-sector, a variety of research has found that the green investments created jobs (see Table 2).

Table 2: Ex-post analysis of green spending in the 2009 U.S. stimulus shows that it was effective at creating jobs[25]

Sector	Ex post evaluations
Overall green investments	• The American Recovery and Reinvestment Act (ARRA) supported 900,000 job-years (full time jobs over one year) in clean energy fields from 2009 to 2015.[26] • Each $1 million of green ARRA investments created 15 new jobs, which mostly arose from 2013-2017.[27] • The ARRA was successful in stimulating job creation in renewable and energy efficiency sectors.[28]
Renewable energy	• $25 billion in cash grants estimated to support 44,000-66,000 short-term jobs in wind energy and 8,300-9,700 short-term jobs in solar PV from 2009-2013, and 4,500-4,900 permanent jobs for wind and 610-630 permanent jobs for solar for the 20-30 year operational lifetime of the projects.[29] • $2.5 billion in loans estimated to support 8,000 short-term construction jobs and 500 permanent jobs. Helped fund the first five large utility-scale solar PV facilities in the country and one of the largest wind farms in the world.[30]
Energy efficiency	• In 2010, the Weatherization Assistance Program directly and indirectly supported 28,000 jobs and reduced carbon emissions 7.4 million metric tons.[31] • With $3.1 billion, the State Energy Program supported 51,000 job-years from 2009 to 2013, and expected to lead to GHG emissions reductions of 164 million metric tons from 2009-2050, equivalent to taking 35 million cars off the roads for a year. It resulted in $7.7 billion in energy bill saving.[32]
Public transit	• When U.S. states had the choice of where to spend ARRA transportation money, each dollar spent on public transit projects created 70% more job-hours than a dollar spent on highways.[33]
Coastal habitat restoration	• $167 million created about 17 job-years in the immediate term per $1 million spent, higher than other research has found for investments in fossil fuels. There are also longer-term benefits, including increased property values and future job creation from rebounded fisheries and tourism, and resilience to climate impacts.[34]

Reducing fossil fuel-based emissions to address climate change will also help address another public health scourge: air pollution. Fine particulate and ozone pollution are estimated to cause more than 100,000 premature deaths in the United States annually, with damages valued at around 4% to 5% of U.S GDP.[35] Recent research has indicated that people living in areas with poor air quality may be more susceptible to COVID-19, highlighting further interconnections between human and planetary health.[36] If the United States reduced emissions in a way consistent with the Paris Agreement, it would also decrease harmful air pollutants enough to prevent thousands of premature deaths per year, while reducing the impacts of future respiratory diseases on human health. In addition, natural climate solutions that preserve and restore natural and working lands have myriad benefits, including decreasing soil erosion and improving water availability and quality.[37]

Low-carbon technologies are becoming more efficient and affordable for households and businesses. In the past decade, the costs of solar panels, wind turbines, LED bulbs, and lithium-ion batteries have fallen dramatically while performance has improved.[38] As low-carbon technologies have matured, they have become increasingly competitive with fossil fuel technologies, even without subsidies. Building new clean energy portfolios for power generation is now cheaper than keeping most existing coal plants in operation and cheaper than building and operating most proposed gas-fired plants.[39,40] This has changed the calculus of many utilities. Utilities in Arizona, Colorado, and Florida have recently decided to close coal plants and replace them entirely with renewables, without building new gas-fired plants.[41] 68% of all customer accounts in the US are now served by utilities with carbon reduction goals, including 27 utilities with goals to be carbon-free or net-zero emission by 2050.[42] Significant room exists to further bring down the costs of various low-carbon technologies. Electric cars and SUVs are already cheaper to operate than gasoline or diesel vehicles — even with low gas prices due to the coronavirus — and are expected to reach purchase price parity in the mid-2020s.[43,44,45] At the same time, the adoption of many low-carbon technologies remains out of reach for low-income households, highlighting the need for an equitable transition to a low-carbon future.

The investments needed for low-carbon infrastructure are significant but manageable, and economic recovery in the wake of COVID-19 crisis presents an opportunity to speed up the low-carbon transition. Historic low-interest rates provide an opportunity to accelerate private investments in low-carbon technologies in the near-term. Over the longer-term, the most conservative estimates suggest that the United States will need to increase its spending on energy systems by the equivalent of 2% of its GDP to transition to a low-carbon economy.[46] Other estimates find that there may even be net savings since the savings on fossil fuel expenditures would outweigh the additional costs of low-carbon energy infrastructure.[47] Most estimates of the investment needs are using quite outdated technology cost assumptions, but clean energy costs are falling rapidly, making it even cheaper. Even if the additional spending for a low-carbon economy did reach the equivalent of 2% of GDP, that is well within the historical range; energy spending in the United States is at a low point now at around 6% of GDP but has fluctuated to as high as 13%.[48] For another comparison, in 2020 so far Congress has passed stimulus worth 14% of U.S. GDP.[49]

<u>Renewing Economic Vitality in Key Sectors and Geographies</u>

The United States can increase its competitiveness by innovating, engineering, and manufacturing low-carbon technologies. The domestic and global cleantech market has grown significantly in the last decade and will continue growing. The U.S. advanced energy industry generated $238 billion in revenues in 2018 (about 15% of the global total), and the sector's 11% growth in 2018 was almost four times the growth of the U.S. economy overall.[50] A $23 trillion market for climate-smart investments is expected to be created by 2030 in 21 emerging markets as those countries work to meet the goals of the Paris Agreement.[51] COVID-19 has adversely impacted the U.S. manufacturing sector by shuttering factories and disrupting supply chains. Investment in low-carbon infrastructure as part of government-led stimulus can counteract some of the impact on manufacturing. Over the long run, it will enable U.S. manufacturing companies to incubate innovative products with massive growth potential at home and in emerging markets.

Opportunities to innovate and secure manufacturing preeminence exist for various technologies across sectors. Energy efficiency products are one such example. The global market for energy efficiency products and services generated $298.5 billion in revenue in 2018 and is increasing rapidly as climate targets and government regulations continue to drive adoption of efficient and intelligent building technologies.[52] The global demand for air conditioning units is going to explode over the next three decades, further providing opportunities for American manufactures of energy efficient air conditioners to tap into the market. Low-carbon hydrogen technology presents yet another business opportunity for American manufacturers. The United States can secure a share of the future global energy market—estimated to reach between $1 trillion to $2.5 trillion by the middle of this century[53]—by leading the development and commercialization of low-carbon hydrogen technology.

However, advancing low-carbon manufacturing in the United States requires the federal government to get serious about clean energy policy. Our competitors in other nations are already retooling their industries and infrastructure for a low-carbon future. China is the top country by far in terms of amount invested in renewables capacity during the last decade: $758 billion committed between 2010 and the first half of 2019, compared to $356 billion by the United States.[54] The European Union is planning to implement a border adjustment mechanism that would impose a carbon tax on products from other countries with less strict climate policies.[55] The United States risks being left on the sidelines if it cannot retool its economy to meet the needs of growing global cleantech market.

While climate change presents a tremendous challenge for rural America, climate solutions can provide several economic benefits to these communities, helping to reduce the rural-urban divide. Rural households across America often pay higher energy costs than urban areas, but energy efficiency retrofits could save the average rural household hundreds of dollars annually. Retrofitting the median rural household to be more efficient per square foot (by adding insulation and sealing air leaks, for instance) would result in a 25% reduction in overall rural energy burdens.[56] This translates into more than $475 in savings annually for rural households.

Renewable energy can diversify the economies of rural communities, adding to the tax base and providing new streams of income for farming and ranching communities that host wind turbines or solar panels. In 2018 wind farms paid $761 million in state and local taxes plus $289 million in lease payments to farmers and landowners who host wind turbines on their land.[57] In Adair County, Iowa, 10 new wind farms built over the last decade have added 30% to its tax base.[58] In Jackson County, Minnesota—one of the most active counties for wind farm development in the state—wind farms generated 16% of the county's operating revenues in 2017. [59] These revenues are being channeled into school districts and community development projects, in the process having a significant impact on the quality and accessibility of public resources.

Natural carbon capture in farms and forests has the potential to enhance productivity, profitability, and resilience. According to a recent WRI study, restoring trees to the landscape represents the single largest near-term opportunity to deploy carbon removal at scale in the United States.[60] The study estimated that restoring trees to the American landscape can remove up to 540 $MtCO_2$ per year through 2050, without displacing agricultural production. In addition to carbon removal, tree restoration provides other economic benefits. One study has found that every $1 million invested in reforestation and sustainable forest management has the potential to support 40 full-time equivalent jobs.[61] An annual federal investment of $4 to $4.5 billion in tree restoration can thus create over 150,000 new jobs, three times as many jobs as logging currently supports in the country. It would also generate $6-12 billion per year in economic activity. Other benefits such as building soil health, improving water quality, creating recreational opportunities, and in some cases providing farmers with additional revenue streams through agroforestry projects help promote the well-being of rural communities.

Ensuring a Fair and Equitable Transition for All

Progress towards a new climate economy must be equitable and fair, ensuring that people are not left behind and are able to share the benefits of America's new climate economy. The low-carbon transition will be disruptive for some workers and communities, regardless of the overall, shared benefits of a low-carbon economy. If managed well, the transition to a low-carbon economy can help reduce the human, social, and economic costs of disruption from various climate policies. It can also create new jobs and opportunities in America's new climate economy, while producing sustainable and inclusive growth into the future. If poorly managed, U.S. decarbonization strategies will lead to stranded workers, communities, and assets, slowing the transition and contributing to instability.

There are a few things that need to be kept in mind though. Low-carbon jobs cannot directly replace every job lost in carbon-intensive industries due to skills, geography, and timing mismatch. This means that it will be important to provide opportunities for workers in all areas of the economy, not just in low-carbon areas. Second, even though workers in clean energy are expected to earn more than the average U.S. workers, wages and job quality issues remain of concern, especially in comparison with the fossil fuel industry. Many workers in fossil fuels earn more than workers in renewable energy, and the rate of union representation among the former is higher too. These challenges can make the delivery of fair transition complicated but not impossible to attain. The proposed Environmental Justice for All Act, which calls for the creation of a Federal Energy Transition Economic Development Assistance Fund to support fossil fuel workers and communities, among other things, represents a crucial step forward in incorporating fair transition issues into federal policies.

A second priority is to ensure that decarbonization policies do not unduly harm low-income and disadvantaged households and communities and that the benefits of low-carbon technologies are available to all individuals and communities. Doing so will require a range of policies that take economic inequality into consideration, including targeted subsidies for electric vehicles, funding for expansion of public transit in high-capacity routes and for adoption of clean energy technologies in underserved communities, and agreements that enable communities hosting clean energy projects to receive a share of the project's benefits.

Policy Priorities for Congress

As the United States begins its recovery from the health and economic impacts of COVID-19, it is imperative that we address the next big global challenge. COVID-19 has exposed the danger of failing to plan ahead and the nation can ill afford to forget the lesson. Climate change presents serious risks to the U.S. economy and the ecosystems on which we depend, and it demands an urgent response from the federal government. American energy systems, transportation, industry, and land use will have to change at a fast pace and a massive scale, but a more prosperous and sustainable new climate economy is achievable.

Near-Term Priorities:

In the near term, additional stimulus and recovery packages provide a valuable opportunity to create jobs and stimulate economic activity by directing federal resources towards building low-carbon infrastructure. In the months ahead, the economic recovery process offers the chance to undertake energy efficiency building upgrades, roll out multigigawatt utility-scale solar and onshore and offshore wind projects at low costs, build high-voltage direct current transmission lines than can bring renewable energy from distant locations to major population centers, and modernize and electrify the nation's public transportation system, among other things. These initial investments would lay the foundation for a new climate economy.

Specifically, WRI has identified five priority areas where Congress can take immediate action that can help create jobs and boost economic recovery.

1. **Building Energy Efficiency and Energy Assistance**
   - Increase the funding allocated to the Low-Income Home Energy Assistance Program (LIHEAP) to $20 billion.
   - Increase the funding allocated to the DOE Weatherization Assistance Program to $5 billion annually.
   - Increase grant funding to states by $100 billion across the State Energy Program, the Energy Efficiency and Conservation Block Grant, and Community Development Block Grant to support upgrades of hospitals, schools, and public buildings to make these high-performance buildings, improve energy efficiency, improve indoor air quality, and lower capital, operating, and maintenance costs of these buildings.
   - Increase consumer incentives for appliance replacement, including the Nonbusiness Energy Property Credit and the State Energy Efficient Appliance Rebate Program.

2. **Public Transit and Transportation Infrastructure**
   - Increase funding to $25 billion annually to fill the budget gaps of local transit agencies and support their ongoing operating costs.
   - Reorient transportation funding toward "fix-it-first" principles that focus on maintaining and repairing existing roads, bridges, and transit systems over the expansion of new roads and

highways, and "complete streets" infrastructure projects that offer space for biking, walking, driving, and public transit
- Invest in electric vehicle (EV) charging infrastructure in every state across the country.
- Establish 'Buy Clean' incentives for the concrete used in transportation infrastructure projects.

3. Manufacturing Electric School and Transit Buses
- Scale up the Clean Cities, Clean School Buses and Low and No Emissions Vehicle programs to provide $20 billion in grants to school districts and transit systems—enough to replace 60,000 school and transit buses, or about 10 percent of the national fleet.

4. Grid Modernization
- Make existing renewable energy tax credits refundable.
- Extend the federal renewable energy tax incentives for five years and make energy storage systems and transmission projects eligible for the Investment Tax Credit.
- Reauthorize DOE's Smart Grid Investment Grant program and fund it at $20 billion to promote investments in smart grid technologies, tools, and techniques.
- Expand low-cost loans and grants to rural electric co-ops to expand electricity transmission and broadband access through USDA's Rural Utilities Service (RUS).
- Authorize the Department of Transportation to provide $5 billion annually over 10 years in Transportation Infrastructure Finance and Innovation Act (TIFIA) loans to transmission projects that emphasize the integration of renewable energy.
- Leverage the DOE's Loan Guarantee Program to incentivize investment in transmission infrastructure.
- Make strategic investments in energy storage deployment.

5. Restoring Trees to the Landscape
- Add new dedicated funding for tree restoration to the Environmental Quality Incentives Program (EQIP).
- Expand incentives for tree restoration projects on historically forested lands through the Conservation Reserve Program (CRP).
- Issue grants to state and local governments to boost tree restoration using their own policy tools.
- In total, across these programs Congress could dedicate $4–4.5 billion per year for tree restoration

Medium-Term Priorities:

During the next Congress, the United States will need bold, visionary policies to steer the country on a path that leads to carbon neutrality by 2050. During the last decade, U.S. states, cities, and private actors have emerged as leaders of the U.S. response to climate change. They will have to keep up their momentum and even ratchet up their climate ambition, and **the federal government will need to support and complement their actions** to create durable, uniform policies and regulations for the entire country. These should include a combination of sector specific investments and regulations as well as economy-wide climate policy. Here we outline just a few of the most important policies that will be needed as part of a comprehensive plan to solve climate change.

A carbon price is needed to embed climate change costs into economic decision-making while providing clear incentives for the development and deployment of low-carbon technologies and shifts in operations to reduce carbon emissions. **An economy-wide carbon price should be one of the central elements of a national climate policy** and paired with complementary policies can be designed to help achieve net-zero emissions by mid-century while also building a prosperous economy that offers good jobs, minimizes impacts on families and helps address environmental justice. Historical experiences in U.S. states and other countries that have implemented a carbon price shows us that it has been compatible with strong economic growth. Economic models find the same thing.

However, while carbon pricing is necessary, it is not a sufficient approach to achieve long-term climate goals in an economically efficient manner. Complementary measures will be needed to address market barriers and sector characteristics not addressed by a carbon price that could limit the adoption of mitigation measures. In the transportation sector, Congress should overturn EPA's action to undermine the vehicle standards established in 2012 with the agreement of the automobile industry, and could consider mandating standards consistent with the agreement that California reached with Ford, Honda, VW, and BMW. **For the period from 2026 through 2035 Congress should consider adopting a mandate that EPA set standards that progressively reduces allowable emissions from new cars to zero**. Congress should also invest in low-carbon research and development that could transform the electricity and transportation sectors, including in batteries, green hydrogen, and other technologies of the future. Finally, Congress can consider a range of voluntary, regulatory, tax, and fiscal policy options to address industrial sector emissions. As a first step, **Congress could pass the American Innovation and Manufacturing Act of 2019, which would shift American industry to HFC alternatives**, enhancing its competitiveness in a growing global market and catalyzing economic activity.

Concluding Remarks

The United States stands at a historical crossroads. If it acts now, America can look forward to a future that is pollution free, healthier, inclusive, and prosperous. Millions of Americans would be employed in the new climate economy, receiving competitive wages while producing goods and services with an environmental benefit. American businesses would be exporting innovative low-carbon technologies to the rest of the world. The United States would be generating abundant, cheap electricity from renewable energy and other clean sources. Communities, especially those that have historically suffered from pollution, would breathe clean air. American consumers, including those in rural areas, would save on energy costs with affordable low-carbon technologies. New buildings and cars would be all electric. Farmers would be rewarded for practices that capture carbon.

For people, the planet, and the economy, the transition to a new climate economy might be the best bargain of our time.

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Mr. TONKO. Thank you, Dr. Saha.

Mr. Stephenson, you are now recognized for 5 minutes.

STATEMENT OF LONNIE R. STEPHENSON

Mr. STEPHENSON. Thank you, Chairman Tonko, Ranking Member Shimkus, and members of the House Energy and Commerce Subcommittee on the Environment and Climate Change. Thank you for inviting in me to participate in this morning's hearing.

My name is Lonnie Stephenson. I have the honor of serving as the International President of the International Brotherhood of Electrical Workers. The IBEW is the largest energy union in the world. We represent more than 775,000 members in the United States, U.S. territories, and Canada who work in a variety of energy-related fields, including utilities, construction, telecommunication, broadcasting, manufacturing, and transportation.

IBEW members are working on the front lines of the climate change. We are proud to be building and maintaining the zero- and no-carbon power generation sources from large-scale solar installations in the deserts of California to offshore wind farms off the coast of Rhode Island.

Our inside wiremen regularly retrofit older buildings with modern energy efficiency techniques that significantly reduce energy usage and lowers energy prices for consumers. In recent weeks, the IBEW outside linemen from all around the country have been deployed in response to the power outages caused by the severe weather events, such as Hurricane Laura, Tropical Storm Isaias, the Midwest derecho windstorm, and now the wildfires that are threatening the communities along the West Coast.

The COVID-19 pandemic has taken a terrible toll on America's workers and labor unions. The Bureau of Labor stats reported earlier this month that 13.6 million Americans are currently out of work, more than double since February. This includes tens of thousands of IBEW members who have lost work due to the temporary shutdowns or are victims of the sharp decline in the economic activity. Further troubling are the 2.1 million Americans who have permanently lost their jobs since this spring.

At the same time, the climate crisis is real and urgent and poses a threat to our Nation's long-term prosperity. The Federal Government needs to develop a plan to mitigate the impacts of climate change and responsibility—and responsibly reduce emissions to avoid the worst impacts of global warming.

For these reasons the IBEW supports Congress developing a stimulus plan that would create over a million family-supported, union-friendly jobs to rebuild our Nation's infrastructure, lower greenhouse gas emissions, and mitigate the impacts of climate change. In my written testimony, I address three areas of importance of the IBEW members in a low-carbon economy: labor standards, baseload generation, and manufacturing.

For our members, all the workers—all the workers, it is critical that Congress—labor standards to make sure that—to a future low-carbon stimulus legislation. Labor standards, such as prevailing wages, project labor agreements, and requiring employers to respect workers' rights to join a union, are some of the best policy tools available to ensure that our green economy will create family-supported jobs and provide equity for all workers.

Supporting baseload generation, including coal, gas, and nuclear generation is key to maintaining the security and reliability of our Nation's electric grid. Robust Federal investments in carbon capture and advanced nuclear technology will be critical to lower emissions and ensuring the reliability and preserving jobs.

The IBEW views the low-carbon economy as America's best opportunity to reinvigorate our manufacturing sector. A large percentage of green jobs in the low-carbon economy will come from manufacturing, whether here or overseas. Congress must take advantage of this opportunity and support the domestic manufacturing and American workers who will build the green products and the future before this sector is dominated by China or other foreign competitors.

Finally, I want to recognize and share the exciting partnership that the IBEW has started recently with the AFL-CIO and the Energy Futures Initiative, which was started by former Energy Secretary Ernest Moniz. Our initiative of labor-energy partnership will be developing State, regional, and national analysis that will focus on the intersection of job quality, equity, and climate change.

Thank you again for the opportunity to testify today, and I look forward to taking your questions.

[The prepared statement of Mr. Stephenson follows:]

Testimony of Lonnie R. Stephenson
International President
International Brotherhood of Electrical Workers
"Building a 100 Percent Clean Economy: Opportunities for an Equitable, Low-Carbon Recovery."
Before the Subcommittee on Environment and Climate Change
House Committee on Energy and Commerce
U.S. House of Representatives
September 16, 2020

Chairman Tonko, Ranking Member Shimkus, and Members of the House Energy and Commerce Subcommittee on Environment and Climate Change, thank you for inviting me to today's hearing.

Background

My name is Lonnie Stephenson. I have the honor of serving as the International President of the International Brotherhood of Electrical Workers (IBEW). The IBEW is the largest energy union in the world. We represent more than 775,000 members in the United States, U.S. territories, and Canada who work in a variety of energy-related fields including utilities, construction, telecommunications, broadcasting, manufacturing, and transportation.

IBEW members are working on the frontlines of climate change. We are proud to be building and maintaining new, zero carbon power generation sources, from large-scale solar installations in the desert of California to offshore wind farms off the coast of Rhode Island. Our inside wiremen regularly retrofit older buildings with modern energy efficiency techniques that significantly reduce energy usage and lowers energy prices for consumers. In recent weeks, IBEW outside linemen from around the country have been deployed in response to power outages caused by severe weather events, such as Hurricane Laura, Tropical Storm Isaias, the

Midwest derecho wind storm and now the wildfires threatening communities along the West Coast.

Meeting the Jobs and Climate Challenge

The COVID-19 pandemic has taken a terrible toll on America's workers and labor unions. The Bureau of Labor Statistics (BLS) reported earlier this month that 13.6 million Americans are currently out of work, more than double since February.[1] This includes tens of thousands of IBEW members who lost work due to temporary shutdowns or are victims of the sharp decline in economic activity. Further troubling are the 2.1 million Americans who have permanently lost their jobs since this spring.[2]

IBEW-focused sectors of the economy, such as construction, manufacturing, and transportation, have been hard hit by the pandemic. The unemployment rate for workers in natural resources, construction and maintenance industries has nearly doubled from just four percent in August 2019 to 7.9 percent in August 2020.[3] The U.S. Energy Information Administration (EIA) recently reported that 18 percent of proposed electrical generation units this spring were delayed due to COVID-19, equaling over three gigawatts of capacity.[4] Domestic manufacturing has been particularly hard hit, losing 720,000 positions in the past seven months.[5] Since August 2019, unemployment in the transportation sector has more than doubled, from 4.9 percent to over 11 percent, losing over a million jobs.[6]

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[1] U.S. Bureau of Labor Statistics, *Employment Situation Summary – August 2020* (Sept. 4, 2020) (https://www.bls.gov/news.release/pdf/empsit.pdf).
[2] *Ibid*, at Table A-11.
[3] *Ibid*, at Table A-13.
[4] U.S. Energy Information Administration, *COVID-19 mitigation has delayed construction of some electric generators* (July 15, 2020) (https://www.eia.gov/todayinenergy/detail.php?id=44376).
[5] U.S. Bureau of Labor Statistics, *Employment Situation Summary – August 2020*, p. 4.
[6] *Ibid,* at Table A-13.

At the same time, the climate crisis is real and urgent and poses a threat to our nation's long-term prosperity. The federal government needs to develop a plan to mitigate the impacts of climate change and responsibly reduce emissions domestically to avoid the worst impacts of global warming.

For these reasons, the IBEW supports the United States Congress developing a stimulus plan that would create over a million family-supporting, union-friendly jobs to rebuild our nation's infrastructure, rejuvenate our manufacturing sector, lower greenhouse gas emissions and mitigate the impacts of climate change.

For the remainder of this testimony, I will focus on several policy areas of importance for IBEW members and our new partnership with the Energy Futures Initiative.

Strong Labor Standards

A key feature of any federal stimulus effort and transition to a lower emissions economy will require the inclusion of strong labor standards to ensure that taxpayers' money will create high-road jobs with living wages. The need for deliberate policies that would create shared prosperity for working families was made clear in a study recently published by California Workforce Development Board that examined the intersection of climate policy and workforce needs. To quote the study:

> Maximizing shared prosperity for … working families from these transformations requires specific and intentional labor policy. Workers will experience changes unequally; some good jobs will disappear, and without policy intervention, they could be replaced by low-wage jobs. This outcome has implications not only for the broader economy, but also for the climate policies themselves … [A]bsent deliberate efforts to incorporate workforce goals, the economic changes, produced by climate policy may simply replicate—or even exacerbate—deep-seated economy-wide trends of persistent wage inequality and disparities by race and gender.[7]

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[7] California Workforce Development Board, *Putting California on the High Road: A Jobs and Climate Action Plan for 2030*, p. 4-5 (https://laborcenter.berkeley.edu/wp-content/uploads/2020/09/Putting-California-on-the-High-Road.pdf).

Among the policies needed to create the high-road, living wage jobs necessary to rebuild the middle class in a low carbon economy are:

- Prevailing wages, as defined by the Davis-Bacon Act;
- Project Labor Agreements (PLAs) for construction projects;
- Supporting apprenticeship and pre-apprenticeship programs;
- Strong rules against worker misclassification (falsely classifying employees as "independent contractors" in order to circumvent state and federal labor laws);
- Respecting workers' right to join a union;

On the final point, the evidence is overwhelming that labor unions raise wages and decrease inequality. Labor union have a "strong positive effect not only on the wages of union workers but also on the wages of comparable nonunion workers" and "unions makes wages among occupations more equal because they give a larger wage boost to low- and middle-wage occupations than to high-wage occupations."[8] Regarding issues of equity, the union wage boost is "larger for black and Hispanic workers than for white workers" and helps "raise the wages of women."[9]

While the Committee on Energy and Commerce is not the committee of jurisdiction regarding federal labor law, this committee does have the ability to require employers receiving funds under a low carbon infrastructure stimulus package or other authorized programs to abide by certain requirements, including requiring employers to remain neutral with respect to employees' right to organize and bargain. The IBEW requests that the committee look to the language included in the $80 billion broadband infrastructure program proposed in the Moving Forward Act (H.R. 2, Section 31301) as a model for protecting workers' right to organize and help address inequality and equity issues. Section 31301 not only requires employers that receive funds through the program to pay workers prevailing wages, but also requires employers to

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[8] Economic Policy Institute, *How today's unions help working people* (August 24, 2017), p. 7 (https://files.epi.org/pdf/133275.pdf).

[9] *Ibid.*, p. 7, 11.

remain neutral in workers' organizing efforts, require first-contract bargaining and binding arbitration, and prohibits subcontracting for the purpose of circumventing a collective bargaining agreement.[10]

Importance of Baseload Generation

The IBEW supports preserving key baseload energy sources, including natural gas, coal, and nuclear power. These baseload power sources are important to maintaining the security and reliability of our nation's electric grid. Supporting traditional baseload generation and reducing greenhouse gases are not mutually exclusive.

The IBEW sees existing and advanced nuclear generation as the cornerstones of a low carbon future. Based on EIA data, nuclear power accounts for 20 percent of the nation's total electrical generation and over half of all zero carbon emission generation in the country.[11] As the United States moves towards increasing reliance on renewable energy, such as solar and wind, the need for nuclear energy's reliability, the country's only carbon-free source that can ensure around-the-clock generation, even during inclement weather, has become even greater.

Over 14,000 IBEW members are permanently employed at nuclear facilities around the country, with thousands more who do construction work during nuclear facilities' periodic refueling outages. However, conventional nuclear energy is currently facing severe economic challenges. Ten reactors have closed prematurely over the past seven years, with additional reactors planning to close in the coming years. Most recently, Exelon announced three weeks ago it would prematurely retire the Byron and Dresden nuclear plants in Illinois due to market rules. The closure of Byron and Dresden will cost more than 1,500 full-time positions and 2,000

[10] U.S. House of Representatives, *Moving Forward Act,* HR 2, 116th Cong., 2nd sess., 2020, p. 1448-53.
[11] U.S. Energy Information Administration, *Electricity explained – Electricity in the United States*, March, 20, 2020 (https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php).

supplemental jobs in rural communities that cannot afford to lose these family-supporting union jobs. The IBEW asks the committee to consider policies that will help keep existing nuclear plants from prematurely retiring as part of its continuing legislative work on combatting climate change.

The development and deployment of advanced nuclear reactors is important for the United States to maintain its role as the global leader in nuclear technology and prevent nuclear proliferation. The IBEW is supportive of current efforts in Congress to pass legislation to support advanced nuclear research, development, and deployment. We hope advance nuclear technology, with the promise of smaller, cleaner, and cheaper reactors, has the potential to create thousands of family-supporting jobs and maintain the baseload generation we will need in a low carbon future.

The IBEW urges strong federal support for carbon capture, utilization, and sequestration (CCUS) and direct air capture as critical technologies to lower emissions in the power sector. We have endorsed the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act (H.R. 1166/S. 383) as an important step in the development of direct air capture and CCUS technologies that will reduce emissions from coal- and gas-generating power plants and industrial facilities and help create a new technology that can be exported while creating jobs at home. Robust federal support for CCUS will allow coal and gas powerplants to stay on-line and protect the large economic ecosystem and the tens of thousands of IBEW members who work in these sectors. We are gravely concerned that a failure to develop CCUS or direct air capture as a viable technology will eventually result in the closure of nearly every coal-fired power plant in the country. This would have a devastated impact on the workers and communities that these plants support.

Advanced Manufacturing

Three decades ago, manufacturing was the largest industrial sector in the IBEW. At that time, the IBEW represented roughly 400,000 workers in the manufacturing sector who produced electrical consumer and industrial products. Today, our manufacturing department represents about 30,000 workers. The IBEW views the low carbon economy as one of our nation's best opportunities to turn this trend around and reinvigorate the manufacturing sector. A large percentage of green jobs that will be created in the low carbon economy will come from manufacturing, whether in the United States or elsewhere. For example, the International Renewable Energy Agency (IRENA) found that manufacturing of equipment offers "the bulk of job opportunities in the [offshore wind] sector" accounting for 59 percent of all jobs created.[12] Congress must take advantage of this opportunity and support targeted programs that will invest in American workers, research and domestic manufacturers to win this race. We cannot allow the manufactured goods that will be central to the green economy, such as solar panels, wind turbines, high capacity batteries and electric vehicles, and their connected supply chains, to be dominated by China and other foreign competitors.

Areas of opportunity the IBEW sees within this committee's jurisdiction includes the development of a national manufacturing policy across industrial sectors that will protect the public, workers, and our nation's economy security from vulnerable supply chains. We also support the creation of a national infrastructure or climate bank that would help provide financing for the American-made products necessary to rebuild our infrastructure with labor standards tied to financing.

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[12] International Renewable Energy Agency, *Renewable Energy Benefits – Leveraging Local Capacity for Offshore Wind*, 2018, p. 7 (https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/May/IRENA_Leveraging_for_Offshore_Wind_2018.pdf).

Other policies that would help strengthen domestic manufacturing would include strong Buy America provisions that ensure that taxpayers' money is going towards buying American-made goods for the clean economy. We also support using the tax code to incentivize employers to manufacture and assembly goods in the United States and eliminating tax benefits for those manufacturers who outsource American manufacturing jobs overseas.

Labor Energy Partnership

The AFL-CIO and the Energy Futures Initiative (EFI) recently announced the creation of the Labor Energy Partnership, an initiative to promote economic equity based on quality jobs and the preservation of workers' rights while also addressing the growing climate crisis. The IBEW is an enthusiastic partner in this initiative and I am proud to be on the partnership's joint steering committee with fellow union presidents and former Energy Secretary Ernest Moniz. The Labor Energy Partnership is guided by four main principles:

1. Energy policy must be based on solid scientific review that acknowledges that climate change is real, anthropogenic, and represents an existential threat to human society.
2. Successful social solutions to climate change must be based on an "all-of-the above" energy source strategy that is regionally focused, flexible, preserves optionality, and addresses the crisis of stranded workers.
3. An essential priority of all climate policy solutions is the preservation of existing jobs, wherever possible, and the creation of new ones that are equal to or better than those that are displaced.
4. Climate policy represents an economic opportunity to the United States when the benefits of new technology deployment result in the creation of quality jobs and the creation of competitive domestic supply chains.

I have included an outline of the partnership's goals with this testimony. We hope the Labor Energy Partnership will be able to help policymakers develop policies that are the subject of this hearing.

Conclusion

The IBEW hopes Congress can come together in a bipartisan effort to address the multiple crises impacting the American people today. I am confident that the United States can and will overcome the current pandemic and meet the challenges of rebuilding America's middle class and climate change. With thoughtful consideration and bringing the relevant stakeholders to the table, we can successfully develop a greener, cleaner economy that creates millions of family-supporting jobs.

ENERGY FUTURES INITIATIVE

AFL-CIO
AMERICA'S UNIONS

Fact Sheet: Labor Energy Partnership

Commitment. The Labor Energy Partnership (LEP) is based on a shared commitment of the AFL-CIO and the Energy Futures Initiative to federal, regional and state energy policies that promote economic equity based on quality jobs and the preservation of workers' rights while also addressing the growing climate crisis.

Principles. The LEP is guided by the following principles:

1. Energy policy must be based on solid scientific review that acknowledges that climate change is real, anthropogenic, and represents an existential threat to human society.
2. Successful social solutions to climate change must be based on an "all-of-the above" energy source strategy that is regionally focused, flexible, preserves optionality, and addresses the crisis of stranded workers.
3. An essential priority of all climate policy solutions is the preservation of existing jobs, wherever possible, and the creation of new ones that are equal to or better than those that are displaced.
4. Climate policy represents an economic opportunity to the United States when the benefits of new technology deployment result in the creation of quality jobs and the creation of competitive domestic supply chains.

Activities. The Partnership will be implemented through a joint steering committee consisting of Richard L. Trumka, President, AFL-CIO; Cecil E. Roberts, President, UMWA and Chair, AFL-CIO Energy Committee; Lonnie R. Stephenson, President, IBEW and Vice-Chair, AFL-CIO Energy Committee; Ernest J. Moniz, President, Energy Futures Initiative; Melanie A. Kenderdine, Principal, Energy Futures Initiative; and Joseph S. Hezir, Principal, Energy Futures Initiative.

The LEP has identified an initial action agenda of energy and policy analyses over the next two years that includes, but is not limited to, the following focus areas:

1. A national action plan for the deployment of carbon capture, utilization, and sequestration technology.
2. A priority energy infrastructure analysis that provides a roadmap for key energy infrastructure needs, financing mechanisms, and approval and permitting pathways.
3. Policies needed to site and permit new electricity transmission projects in the near-term.
4. Options for safe, affordable preservation of the existing nuclear fleet and the deployment of next generation nuclear technologies.
5. Development of technology and policy pathways for the use of natural gas consistent with meeting climate goals.
6. An exploration of the economic challenges and cost benefits of the development of hydrogen fuels' alternatives for the transportation and industrial sectors.
7. The expansion of energy efficiency finance mechanisms and policy recommendations to enable the full utilization of energy efficient technologies in commercial and residential buildings, industrial processes, and transportation.
8. An assessment of the domestic capacity of the United States to mine, process, and manufacture the critical minerals and materials necessary for the domestic production of low-carbon technologies including rare earths, lithium, cobalt, copper, nickel, palladium, and other essential minerals.
9. An analysis of the offshore wind supply chain, including its raw material requirements, manufacturing technologies, and geographical differences between the East Coast, West Coast, and Great Lakes' resources and policy options to encourage domestic development

10. A roadmap for implementing carbon dioxide removal at scale.

This agenda will be flexible, as specific work projects are developed.

About the AFL-CIO Energy Committee

The Energy Committee of the AFL-CIO Executive Council was formed in 2013. The committee is chaired by Cecil E. Roberts, who has been president of the United Mine Workers since 1995 and is a sixth-generation coal miner. The committee's vice-chair is Lonnie R. Stephenson, International President of the International Brotherhood of Electrical Workers, who began his IBEW career in 1975 as an apprentice wireman in Rock Island IL. The committee also includes the Laborers International Union of North America, the United Association of Plumbers, Fitters, Welders & Service Techs, the International Union of Operating Engineers, the United Steelworkers, the Utility Workers Union of America, the International Brotherhood of Boilermakers, the International Federation of Professional and Technical Engineers, the International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers Union, and North America's Building Trades Unions.

AFL-CIO Resolution on Climate Change, Energy and Union Jobs: At its 2017 Convention, the AFL-CIO adopted Resolution 55, which calls for workers and unions to be at the center of creating solutions that reduce emissions while ensuring that millions of Americans have a "right to a strong, viable economic future, which includes good jobs at union wages and benefits." Read Resolution 55 in its entirety here.

AFL-CIO President Richard Trumka Speech to the Global Climate Action Summit: In September 2018, AFL-CIO President Richard Trumka delivered a keynote speech to a global audience calling for investments in technology, workers and communities that can build a sustainable economy of broadly shared prosperity.
Read the speech here.

About the Energy Futures Initiative

The Energy Futures Initiative advances solutions to the climate crisis through building coalitions, thought leadership, and evidence-based analysis. Under the leadership of Ernest J. Moniz, EFI analysis is published, and publicly available. Information about EFI, its mission, and analytical reports are available at energyfuturesinitaitive.org.

EFI Reports and Analyses: The Energy Futures Initiative conducts in-depth, unbiased analysis of energy and deep decarbonization in a decarbonized world. A sampling of its reports follows:

1. 2020 U.S. Energy and Employment Report and Five-Year Report, 2016-2020 (March 2020)
2. Regional Clean Energy Innovation (February 2020)
3. Clearing the Air: A Federal RD&D Initiative and Management Plan for Carbon Dioxide Removal Technologies (Sept. 2019)
4. Optionality, Flexibility, and Innovation: Pathways for Deep Decarbonization in California (May 2019)
5. 2019 U.S. Energy and Employment Report (May 2019)
6. Advancing the Landscape of Clean Energy Innovation (Feb. 2019)
7. Advancing Large Scale Carbon Management: Expansion of the 45Q Tax Credit (May 2018)
8. Leveraging the DOE Loan Program: Using $39 Billion in Existing Authority to Help Modernize the Nation's Energy Infrastructure (Mar. 2018)
9. The U.S. Nuclear Energy Enterprise: A Key National Security Enabler (Aug. 2017)

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Mr. TONKO. Well, thank you, Mr. Stephenson. Thank you for your leadership with the IBEW.

With that, we will now move to Dr. Fairchild.

Doctor, you are recognized for 5 minutes, please.

STATEMENT OF DENISE FAIRCHILD, PH.D.

Dr. FAIRCHILD. Thank you, Chairman Tonko, and the distinguished members of this committee. I appreciate the opportunity to talk to you today about how to build 100 percent clean economy with both low-carbon and an equitable focus. My name is Denise Fairchild. I am the president and CEO of Emerald Cities Collaborative, and we are a national nonprofit organization with a triple bottom-line mission: to green our cities, build our communities, and strengthen our democracy through equity and inclusion.

Since I am on the clock and I am not sure how you guys get this down to 5 minutes, I would like to start with my bottom line. We have a triple pandemic that we are dealing with. This is a pandemic of our environment and climate, our economy, and justice.

So, if we are going to make a difference, we have to have large-scale investments to, one, not just modernize our grid but decentralize it, decentralize our energy, food, and water infrastructure, to eliminate energy waste, to mitigate and also adapt to extreme weather, and to put the economy back into the hands of our communities, local, urban, and rural communities.

We need to scale a climate economy that ensures a just transition, high road jobs and business opportunities in order for our current workers and our future workers to move from the fossil fuel sector into the new clean economy.

We need to break systemic barriers to jobs and business opportunities that are faced by low-income communities, Black, indigenous and people of color. We need a flexible energy block-grant program that will fund and develop local energy, clean energy infrastructure. We need at least one percent of an investment to ensure that the capacity of low-income workers, frontline workers can compete in this new economy, as well as our businesses. And then we need to develop investment capital to fund a community-driven and -owned energy food and water sector.

So who are we? Emerald Cities was founded ten years ago when we had the last economic crisis. And it was really a coalition. We are a coalition of community business, labor, and sustainability organizations to build a high road economy that worked at the intersection of environment, economy, and equity. I am a witness to the possibilities of a justice-centered economy. We have retrofitted billions of dollars of public buildings to save energy, waste, money, and carbon emissions. We have created greener and healthier homes for low-income communities of color. We put Black and Brown youth into union apprenticeship programs. We created family wage jobs and minority contracting opportunities in rebuilding the infrastructure and the food sector.

We remain committed to a carbon-free economy, rebuilding our middle class, and connecting disadvantaged communities to this new economy. But there is a lot more to be done and to do this time around. We learned a lot in ten years, and we are in a different place today than we were ten years ago. In the energy sector, we know that ARRA, the ARRA climate recovery got us to the starting blocks, but these investments funded only short-term jobs, not years. They did not get us off fossil fuels. They did not mitigate our energy vulnerabilities to blackouts and brownouts, and it did not democratize our energy sector to benefit everyone.

Our food sector is failing us. Not only is it energy intensive but COVID exposed the deficiencies of our current centralized food system. Our food supply chain fell apart. Farmers were dumping milk, destroying food products they couldn't get to market. At the same time, people, the market, waited hours in line at food banks. Our water infrastructure is drowning us from floods, hurricanes, rising rivers, seas, and our new normal.

Inequity, we know that low-income communities of color are last to get clean infrastructure investments and are underrepresented in the clean economy. We will reproduce income inequalities, wealth inequalities if we do not get rid of the structural impediments to high-wage careers and business opportunities for low-income Black, indigenous, and communities of color.

We have seen this work take place. It is happening all around the country. What we need, however, is a real commitment, a political will to not bounce back but to bounce forward, to be a 100 percent renewable and generative economy, to invest first in communities most impacted by climate, to create shorter supply chains that narrow the gap between producers and consumers, to use the best in our technologies to decentralize and create a distributive infrastructure that increase redundancy and minimizes the disruptions that we are facing and to democratize our economy to the high road with labor and community standards.

Thank you very much for this opportunity. I look forward to the discussion.

[The prepared statement of Dr. Fairchild follows:]

ONE HUNDRED SIXTEENTH CONGRESS

Congress of the United States House of Representatives

COMMITTEE ON ENERGY AND COMMERCE

SUBCOMMITTEE ON THE ENVIRONMENT AND CLIMATE CHANGE

VIRTUAL HEARING

ON BUILDING A 100 PERCENT CLEAN ECONOMY:

OPPORTUNITIES FOR EQUITABLE, LOW-CARBON RECOVERY

TESTIMONY BY

DENISE G. FAIRCHILD, PH.D.

PRESIDENT/CEO

EMERALD CITIES COLLABORATIVE

SEPTEMBER 16, 2020

Chairman Paul Tonko, Environment and Climate Subcommittee
Chairman Frank Pallone, Jr, Energy and Commerce

Chairman Tonko and honorable members of the Environment and Climate Subcommittee, Thankyou for the opportunity to speak to you today about building a 100% clean economy that is both low-carbon and equitable.

My name is Denise Fairchild. I am the President & CEO of Emerald Cities Collaborative (ECC), a national non-profit organization with a triple-bottom line mission: to green our cities, build our communities and strengthen of democracy through equity and inclusion.

ECC formed 10 years ago during our last economic crisis - as a coalition of community, business, labor and sustainability organizations – to work across our special interests and to leverage our assets to build a new high road economy that worked at the intersection of environment, economy and equity.

I am witness to the possibilities in moving towards a justice centered clean economy, including retrofitting public buildings – saving energy, water, money, and carbon emissions. Creating greener and healthier homes for thousands of low-income families. Shepherding black and brown youth into union apprenticeships and increasing family wage jobs and minority contracting opportunities in the green building, green (water) and sustainable food sector.

We are proud of our hard-fought gains and to be an early leader in advancing high road policies and strategies. We remain fully committed to a carbon free economy, rebuilding our middle class and connecting disadvantaged communities to this new economy.

But there is a lot more to do this time around.

What We Now Know

We learned a lot and we are in a different place today than we were 10 years ago. We have both legacy and new 21st Century climate, economic and equity challenges that must be fixed.

Energy: The ARRA era climate economic recovery got us to the starting blocks. But we learned that these investments funded only short term jobs not careers. They did not get us off of fossil fuels. And most significant today… it did not mitigate our energy vulnerabilities to black out and brown outs. Above all, these investments did not democratize the energy sector to benefit everyone.

Food: The food sector is energy intensive. COVID exposed the deficiencies of our current centralized food system. Our food supply chain fell apart. Farmers were dumping milk, destroying food products that couldn't get to market. At that same time people (the market) waited hours in line at food banks.

Water: Our water/waste/stormwater infrastructure is also energy intensive, toxic and incapable of managing extreme weather. We need a climate resilient water infrastructure including installing, operating and maintaining green infrastructure, such as permeable pavements, shoreline restorations, watershed protection, erosion prevention, bioswales, tree planting and landscaping, among other projects.

Equity: We know that low-income, communities of color are last to get clean infrastructure investments and are under-represented in the clean economy. We will reproduce income and wealth inequalities if we do not get rid of the structural impediments to high wage careers and business opportunities for low-income, black, indigenous and communities of color (BIPOC) and women.

Emerald Cities COLLABORATIVE

We know $80 billion was not enough for a just transition for fossil fuel workers or BIPOC and women.

Bouncing Forward

These are the lessons to carry forward into a new clean economy.

- **Climate Change**: We still need large investments in a carbon free/clean economy to mitigate climate change. But climate change is here. We also need a climate resilient economy to help us adapt to our new climate realities – fires, floods, hurricanes, black-outs, water and food shortages and more. We are living in a new era of constant disruptions. .. natural, man-made, cyber - so our economic infrastructure must be designed to fend off disruptions and mitigate and adapt to our new normal.

- **Climate Economy:** We need high wage jobs and business opportunities. But more importantly, we need an economy that is generative and not extractive, that shares the benefits of our climate economy and is co-governed with those most climate impacted and underrepresented communities to ensure that we are all full participants in shaping a clean economy future and are beneficiaries of the new economy.

- **Climate Equity:** We need equity-first strategies to invest in community infrastructure in communities most impacted by climate. We also need to reject equity washing and tokenism and confront long-standing and deep structural barriers to careers, contracts, capital, networks for historically underrepresented communities. African Americans and women are especially underrepresented as workers and businesses in the clean energy space, including environmental organizations; the clean energy sector, unionized construction trades.

In other words, rather than a "bounce back" climate economic recovery strategy, we need a "bounce forward" justice-centered economic resilience investment plan to transform our energy, water and food sectors towards:

- 100% Sustainable and Renewable.
- The needs of communities most affected by disproportionate rates of environmental, climate, health and economic disparities and injustices;
- Shorter supply chains that narrow the gap between producers and consumers to lower carbon emissions generated from processing and distribution.
- Decentralized/distributive infrastructure to increase redundancy and minimize disruptions imbedded in centralized energy, food and water distribution systems. Bringing renewable energy production closer to its end use substantially shortens the energy supply chain and reduces as much of 65% of energy waste in making energy and 6% in transmission and distribution. It also reduces wholesale black outs and brown

outs – think Puerto Rico -- that cripple entire economies and communities, especially energy dependent facilities and populations

- Democratic governance – engaging local residents and businesses as full participants and beneficiaries of the climate solutions. Distributed energy (DER) infrastructure such as building and ground mounted renewables, micro-grids, smart meters, distributive storage and other demand-side management technologies create the foundation for a 21st Century climate resilient and democratic energy sector.
- High road labor and community standards in jobs and business opportunities must be imbedded in the investment requirements.

This work is taking place across the U.S. We are transforming our local economies through smart technologies. We are aggregating institutional food purchasing contracts to support small, local farmers – urban and rural - over large-scale commercial sector to build local sustainable food economies. We are connecting rural communities to urban markets. We are turning consumers into energy producers through DER and community-owned energy cooperatives. We are de-monopolizing our economy and building capacity of a new generation of union workers and socially responsible contractors to contribute to and thrive in a 100% clean economy. And in the process we are reducing carbon emissions through soil sequestrian (26% from carbon capture, 18% from food processing (converting produce from farm into final product), transport, packaging and retail, from decentralized energy and water systems.

It's doable. Its necessary. But this work is undercapitalized. And underdeveloped. An equitable clean energy future does not come cheap, quick or easy. The triple pandemic (Climate/Health, Economy and Racism) will require our nation's collective political will and muscle and large investments.

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FEDERAL LEGISLATION:

Legislation to advance an equity-centered 100% clean economy involves transformating the energy, food and water infrastructure to be climate resilient, high road labor and community standards, democratic and address the structural impediments to connect disadvantaged community to jobs and business opportunities includes:

1. Large-scale clean economy investments is a pre-requisite to: a) radically transform the major sectors of the economy to be climate resilient and to b) scale the climate economy to ensure a just transition for existing workers and to c) include historically underrepresented populations. Funding for local multi-stakeholder climate economic recovery plans

2. Flexible-block grant funding to develop and implement multi-stakeholder climate economic resilience plans

3. 1% of clean economy investment allocated to support high road workforce and minority business development.

4. Federal guidelines and incentives to diversify unions and to increase supplier diversity, through appropriate procurement, capacity and capitalizations.

5. Investment capital to fund community-driven and owned energy, food and water projects.

6. Enact national legislation at the federal level similar to the Farmer Equity Act that was passed in CA back in 2017 - see attached report on the implementation plan by the CDFA. USDA and state depts of ag need to make a strong commitment to supporting increased equity in agriculture - opportunities for funding, land tenure, contracting,

7. Continued support for the organic standard and an additional standard for "transition-to-organic", which helps producers who are in the process of transitioning from conventional to organic receive support for the costs of changing their production practices (can take 3-5 yrs) and get a fair, higher price for their healthier food products;

8. Improve access to clean, safe drinking water by addressing harmful contamination

9. Increase resources for water infrastructure and climate resiliency projects in underserved communities;

10. Help disadvantaged communities navigate the funding process and increase the availability of direct grants to ensure communities are no longer overlooked or disregarded

REFERENCES

Energy Sector Reference:

Energy Democracy Scorecard

Food Sector References:
Anchors in Resilient Communities (ARC) –
Anchors in Resilient Communities (ARC) Regional food system project. Value chain assessment
Anchors in Resilient Communities (ARC) Workforce Assessment
Alameda County Circular Economy for Food. A Pathway for Growth prepared by Mary Ruth Belsey Priebe for Alameda County Supervisor Wilma Chan (District 3) July 2020.

Water Reference:
The major issues and positions are articulated by the national Water Equity and Climate Resilience Caucus:
https://mail.google.com/mail/u/0/#inbox/WhctKJVzfQGbLzZHNVSkwLtsdQCtKkZrzXPWFhSMHWCTjnvpTDNxChBWnwdDTWkDTGjKWFV?projector=1&messagePartId=0.5

Mr. TONKO. Ms. Fairchild, you did that in 5 minutes. So thank you.

Dr. FAIRCHILD. I had about ten minutes more though.

Mr. TONKO. OK. Thank you.

And we now move to Dr. Michot Foss.

You are recognized, Doctor, for 5 minutes, please.

STAFF. I think she is muted, Chairman.

Mr. TONKO. You will have to unmute yourself, Doctor.

Dr. MICHOT FOSS. Got it. Technology accomplished.

Mr. TONKO. Thank you. Thank you. Welcome.

STATEMENT OF MICHELLE MICHOT FOSS, PH.D.

Dr. MICHOT FOSS. Good morning. I am happy to help out with this hearing today. I am Dr. Michelle Michot Foss. I am a fellow in energy and minerals at Rice University's Baker Institute for Public Policy at the Center for Energy Studies.

We can all agree that, whatever we do, especially when using scarce public resources, tax dollars, and natural resource endowments, we would like outcomes to be a net improvement. I am here to speak on the importance of nonfuel minerals for energy.

Minerals and materials criticality includes the distribution of natural resources, minerals resources, their geology, relative abundance, proximity to markets, among other things. The quality of minerals matters. Not all quality works for specific applications. A significant hurdle today and going forward is access for development in countries and locations where minerals resources are extracted.

A few facts and figures to add to what already has come up. Between 1984 and 2018, total tonnage output of nonfuel minerals increased more than two and a half times, exceeding what we have grown in energy. We know the demand will increase for alternative energy applications, and that material requirements will be higher. This is a logical function of lower energy densities.

In 2018, the U.S. constituted 12 percent of global nonfuel minerals production. We at the Baker Institute are currently tracking 41 minerals, including basic metals like copper, minerals essential for catalysts and magnets like the rare earths, minerals for catalytic converters and hydrogen fuel cells like the platinum group, minerals that could be used for advanced batteries and solar PV like niobium, indium, and others. We are among the top ten producing countries for only a few. We are a large consumer, and so our demand exceeds what our domestic supply chains can serve.

And, finally, advanced materials for high-performance electric power grids and equipment will expand our list of minerals. There is a lot going on in that space that we need to attend to.

With respect to critical mineral security, in my view, we should consider the following. One is price risk. In recent years, the prices of traded energy and nonfuel minerals have converged. There are good reasons for this. Both of these are linked to GDP. Higher mineral prices means higher cost energy and vice versa. The next one to worry about is supply chains: mines to wheels or mines to plugs and beyond, including end of life. Internal—international shipments of lithium battery products already rival those of traditional fuels in global extent. Nearly 80 percent of battery manufacturing is located in China. All of the raw materials for that battery manufacturing are sourced well beyond China, as already mentioned. This largely explains why lithium batteries are cheap, by the way. It is the Chinese capacity.

Supply chains for end of life, decommissioning, recycling, and disposal have their own ESG risks and uncertainties. Recycling could reduce raw material demand. Globally, we currently recycle less than lithium—less than five percent of lithium battery product.

Environmental security, roughly 80 percent of the lithium-based battery capacity in China is supported by nearly 3,000 coal-fired power plants, the backbone of China's electric power grid. This means an output of CO_2 emissions that rivals everything that we produce in our domestic oil and gas system, which we are in the process of lowering.

Sulfur hexafluoride, I don't know if the committee has dealt with this. SF6 is an insulator for electric power switch gear and electronics. It has a more powerful GHD than carbon dioxide or methane. It does not decay in the atmosphere, and it will increase with electrification.

Geopolitical risks, we have had long experience with oil import dependency. Our domestic petroleum and natural gas abundance has provided relief. Our import dependence for raw materials and alternative energy components, such as wind turbans and motors, solar PV and batteries, is very high. This presents a distinct security tradeoff in making a rapid shift away from our legacy energy fuels. Import dependence also affects our trade balance and represents a leakage of economic wealth from our country.

With respect to mining and minerals processing, attention to ESG risks is growing. We believe that these can be done well. We think governance matters. And this is a subject that I hope we come back to. Mr. Walden basically referred to this in terms of our regulatory oversight.

We submitted a brief with Missouri Science and Technology for the G20 meetings. We have five recommendations in those that I will share with you quickly. One is that we should include nonfuel minerals in G20 discussions. The second is that G20 members should fund research to develop a uniform mineral criticality index, that they should promote transparency of critical minerals, that members should engage relevant multilateral agencies to foster technical technological collaborations, and that we should commit to share best practices on mining and minerals processing.

And we would like to mention the energy resource governance initiative that we have here in the U.S. and that we are sharing with other countries as an example.

Thank you.

[The prepared statement of Dr. Michot Foss follows:]

RICE UNIVERSITY'S
BAKER INSTITUTE
FOR PUBLIC POLICY

Testimony

Critical Minerals Considerations for Energy Transitions

Michelle Michot Foss, Ph.D.
Fellow in Energy & Minerals
Center for Energy Studies

U.S. House of Representatives
Committee on Energy & Commerce
Subcommittee on Environment and Climate Change
Hearing on "Building a 100 Percent Clean Economy: Opportunities for an Equitable, Low-Carbon Recovery"

September 16, 2020

Summary

When it comes to the subject of this hearing, we can all agree that whatever we do, especially when we use scarce public resources (tax dollars and natural endowments), we would like outcomes to be a net improvement. I am to speaking to the role of critical minerals and the challenges associated with energy transitions along with consequences such as import dependency and the cluster of environment, social and governance (ESG) considerations. In my view, with regard to security and ESG, we need to look broadly across the energy landscape to ensure that "new energies" do not compromise gains achieved around legacy systems.

I can contribute several observations drawn from my written testimony.

- First, minerals and materials "criticality" is in the eyes of the beholder. Criticality has many connotations. One is minerals occurrence – the distribution of natural resource endowments, with what types of geologies, with what relative abundance and proximity to markets, among other things. Between 1984 and 2018, for the global economy that was in place pre-pandemic, total tonnage output of non-fuel minerals increased more than 2.5 times. We know that demand will increase for alternative energy applications and that material requirements will be higher (a logical function of lower energy densities). The challenge is not just gross tonnage but also quality. For high performance end uses and applications, the quality of raw materials matters a great deal. A significant hurdle is access for development. Ownership, terms and conditions for exploitation, economic development and industrial infrastructure to support mining and minerals processing – a number of factors impact timing and cost to deliver raw and intermediate materials that we rely upon for every aspect of life.
    - In 2018, the U.S. constituted 12 percent of global non-fuel minerals production. We are tracking 41 minerals that are essential to both legacy and alternative energy technologies and systems including new battery chemistries and designs for improved energy storage and release, advanced solar, hydrogen fuel cells and wind. We are not the dominant producer of any of the 41 minerals on our watch list, and we are among the top 10 producers for only a few (mainly basic metals). Ranking does not matter given that we are a large consumer and thus demand more than our domestic supply chains can serve.
    - Work by the USGS NMIC, published earlier this year, provides at least one version of criticality by devising risk factors for 52 minerals of interest. Of these, 39 rank high for supply risk and import dependence.
- Second, any conversation about energy choices should include security, for our nation, energy system and economy. Again, "security" can take many meanings. How we define security and the many complex interactions can influence attention to risks, uncertainties, mitigation and solutions.
    - Economic security can entail mitigation of price risk. In recent years, energy and non-fuel minerals commodities prices have converged, for many reasons but mainly because of interdependence – minerals are key inputs for energy production, from any technology and source, and energy is a key input for minerals production and processing. Both are vital for economic performance and linked to gross domestic product (GDP). Pressure on minerals prices impacts on the cost and affordability of energy, and vice versa.
    - Supply chain security is subject to myriad risks and uncertainties, about which we have been learning a great deal. Any industrial activity, including the provision of consumer products, involves many linked business segments.

Requirements include supply of raw materials, shipping, transformation, distribution and end use. Numerous sources of risk and uncertainty, including natural hazards and "acts of God" can create supply chain disruptions. Supply chains for energy and minerals are large and dominate bulk shipping. For example, already, global shipments of lithium battery products for all end uses rival global shipments of traditional fuels in geographic extent. Behind global shipments of lithium batteries are global shipments of all of the raw material battery inputs. Supply chains for batteries and other components will continue to grow and increase in reach and complexity.

  - A third is environmental security. We also are concerned about supply chains to support end of life decommissioning, recycling and disposal and all of these entail ESG risks and uncertainties. For instance, we know a great deal about waste, capture, recycling and disposal in established energy systems. We know relatively little about waste in the alternative energy streams and concerns are growing about end of life treatment of alternative energy components. We believe that we can recapture and reuse battery materials but currently less than five percent of lithium battery product is recycled. These functions and their associated supply chains are opaque and not well documented. We know that "e-waste" is growing, probably exponentially, and we know that global e-waste shipments and supply chains are expanding rapidly.
  - If we add "climate" to environmental security, then we introduce a great deal more complexity. All industries, businesses, governments and even households are beginning to attempt to assess emissions. Emissions associated with life cycle processes for batteries and alternative energy applications are extremely difficult to ascertain. For example, global lithium battery manufacturing, including for electric vehicles (EVs), stands at roughly 740 gigawatt hours (GWh). Nearly 80 percent of this capacity resides in China, supported by nearly 3,000 coal-fired power plants, the backbone of China's electric power grid. This means a potential output of carbon dioxide (CO2) emissions that nearly equals all of those associated with the U.S. domestic oil and gas systems, based on U.S. Environmental Protection Agency (EPA) estimates. We are starting to think about sulfur hexafluoride or SF6, an insulator for electric power switchgear. SF6 is a small contributor to global emissions but has stronger thermal properties and is expected to increase considerably with electrification.
  - Geopolitical security risk and uncertainty are prevalent across supply chains, including international sourcing and trade. We have geopolitical uncertainty within North America and political uncertainty across the states, a reflection of varying attitudes, laws and regulations. We have long experience with import dependency, and we are experiencing a reprieve for petroleum and natural gas. Given that our import dependence is high for both raw materials and alternative energy components (such as wind turbines and motors, solar photovoltaics or PV, and batteries for energy storage), a distinct tradeoff of a rapid shift away from our legacy energy systems is exposure to import dependency and associated geopolitical insecurities.
- Third, there is growing attention to ESG risks specific to mining and minerals processing. Mining and minerals processing are, and can be, conducted safely and soundly with best practice and enforcement.
  - Many countries have "informal mining" sectors where best practice and safety are limited, at best. Some governments are moving to "formalize" their artisanal

miners with notable examples in Chile and Democratic Republic of Congo. Exposure for multinational mining companies is yet to be determined.
  - International capacity for integrity and operating assurance need to expand. After the Vale tailings dam failure in Brazil, a distinct comment was that only 16 engineering groups worldwide are certified for tailings dam audits.
  - Communities, especially indigenous groups, are a focus for risk and uncertainty assessment and mitigation. Many existing, new and frontier minerals projects are and will be located in or proximal to indigenous lands and communities. In the U.S., we have many hard lessons from permitting and licensing that can be vetted. Achieving "social license" is demanding and even the most diligent efforts are not always successful.

With colleagues at Missouri Science & Technology, we contributed a policy brief for the upcoming G20 meeting. That brief focused on mining and minerals for energy transition with five recommendations that I will share in closing.

- Include non-fuel minerals in G20 discussions.
- G20 members should fund research to develop a uniform mineral criticality index.
- G20 member states should commit to promote transparency of critical minerals.
- G20 members should engage relevant multilateral agencies to foster technical collaborations.
- G20 members should commit to share best practices for extraction and recovery of critical minerals (an example is the Energy Resource Governance Initiative).

Background

Minerals and materials "criticality" is in the eyes of the beholder. Criticality has many connotations. One is minerals occurrence – the distribution of natural resource endowments, with what types of geologies, with what relative abundance and proximity to markets, among other things. Between 1984 and 2018, for the global economy that was in place pre-pandemic, total tonnage output of non-fuel minerals increased more than 2.5 times (based on data from the World Mining Congress, WMC, open source). We know that demand will increase for alternative energy applications and that material requirements will be comparatively higher. This is a logical function of lower energy densities.

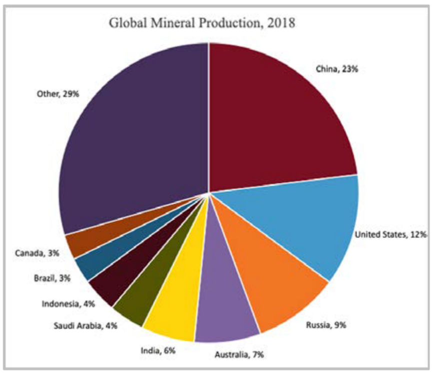
For example, even the best batteries today still cannot provide the performance of liquid fuels for vehicles. The energy density of gasoline is still 100 times higher than that of the best lithium battery designs.[1] In 2016, Argonne National Laboratory estimated that pure battery EVs (BEVs) could be at par with equivalent ICE vehicles by 2045.[2] Reduced vehicle weight and enhanced aerodynamic design would further increase engine efficiency. However, battery energy density (watt-hours per kilogram or W-h/kg) must advance along with motor power density (kilowatts per kilogram or kW/kg). Each metric will need to be

[1] Schlachter, Fred. 2012. "Has the Battery Bubble Burst?" APS News 21, no. 8, August/September. https://www.aps.org/publications/apsnews/201208/backpage.cfm/.

[2] Vijayagopal, Ram. 2016. "Comparing the Powertrain Energy and Power Densities of Electric and Gasoline Vehicles." Presentation at Powertrain Strategies for the 21st Century, University of Michigan Transportation Research Institute, July 20, 2016. http://www.umtri.umich.edu/powertrain-strategies-21st-century-1. Vijayagopal, Ram, Kevin Gallagher, Daeheung Lee, and Aymeric Rousseau. 2016. "Comparing the Powertrain Energy Densities of Electric and Gasoline Vehicles)." SAE Technical Paper 2016-01-0903. https://doi.org/10.4271/2016-01-0903/

roughly doubled, from 135 to 320 W-h/kg and 8.6 to 16 kW/kg, respectively. (See Appendix for emerging research on mass balance challenges for vehicles.)

The challenge is not just gross tonnage but also quality. For high performance end uses and applications, the quality of raw materials matters a great deal. A significant hurdle is access for development. Ownership, terms and conditions for exploitation, economic development and industrial infrastructure to support mining and minerals processing – a number of factors impact timing and cost to deliver raw and intermediate materials that we rely upon for every aspect of life.



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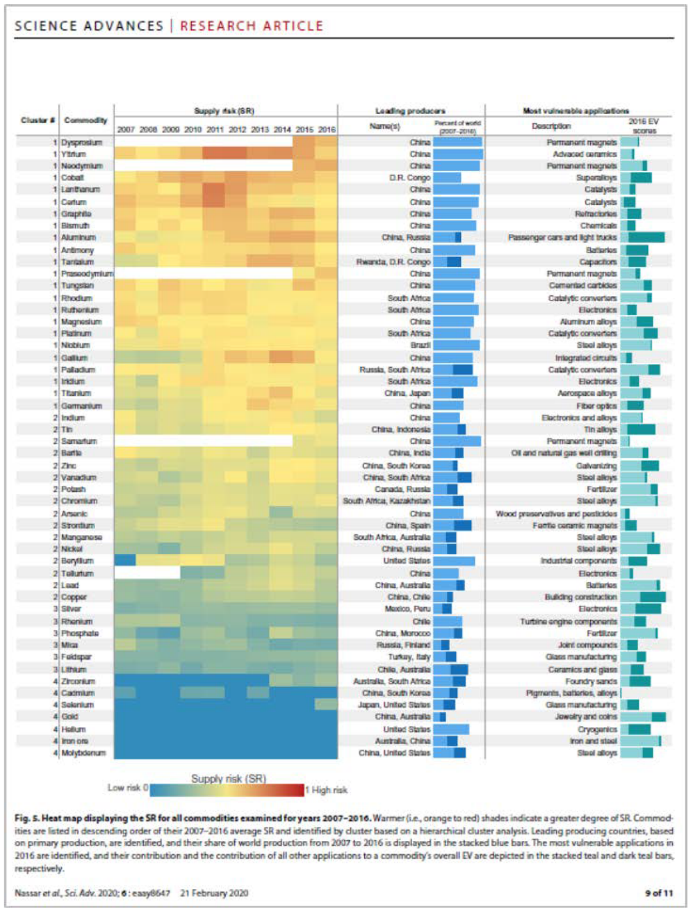
Battery Chemistries			
Element	Dominant Producer	Mkt Shr	US Risk
Iron	Australia	37%	4
Lithium	Australia	61%	3
Niobium	Brazil	90%	1
Copper	Chile	28%	2
Aluminum	China	57%	1
Cadmium	China	35%	4
Fluorspar	China	51%	
Graphite	China	60%	1
Lead	China	44%	2
Phosphorus (Phosphates)	China	40%	3
Rare Earths	China	73%	1
Silicon	China	65%	
Titanium	China	26%	1
Vanadium	China	54%	2
Zinc	China	33%	2
Cobalt	DRC	71%	1
Nickel	Indonesia	24%	2
Silver	Mexico	26%	3
Magnesium	South Africa	28%	1
Manganese	South Africa	29%	2
Potash	Canada	32%	2
Sulfur	China	22%	

Advanced Solar			
Element	**Dominant Producer**	**Mkt Shr**	**US Risk**
Copper	Chile	28%	2
Cadmium	China	35%	4
Lead	China	44%	2
Phosphorus (Phosphates)	China	40%	3
Silicon	China	65%	
Titanium	China	26%	1
Zinc	China	33%	2
Oxygen			
Sulfur	China	22%	
Arsenic	China	46%	2
Gallium	China	94%	1
Germanium	China	89%	1
Indium	China	47%	2
Tellurium	China	74%	2
Tin	China	28%	2
Bromine	Israel	43%	
Selenium	Japan/China	51%	4
Carbon			
Chlorine			
Hydrogen			
Iodine	Chile	65%	
Nitrogen			

Wind - REE group, U.S. Risk 1; Fuel Cells - PGM group, U.S. Risk 1. Not shown – gases and other elements for which supply in the appropriate quality is a risk consideration. Based on WMC and U.S. Geological Survey (USGS)/National Minerals Information Center (NMIC) for U.S. risk weighting.

Work by the USGS NMIC, published earlier this year by the American Association for the Advancement of Science (AAAS),[3] provides at least one version of criticality by devising risk factors for 52 minerals of interest. Of these, 39 rank high for supply risk and import dependence.

[3] Nassar, Nedal T., Jamie Brainard, Andrew Gulley, Ross Manley, Grecia Matos, Graham Lederer, Laurence R. Bird, et al. 2020. "Evaluating the Mineral Commodity Supply Risk of the U.S. Manufacturing Sector." Science Advances 6, no. 8 (February): eaay8647. https://doi.org/10.1126/sciadv.aay8647/



Any conversation about energy choices should include security, for our nation, energy system and economy. Again, "security" can take many meanings. How we define security and the many complex interactions can influence attention to risks, uncertainties, mitigation and solutions.

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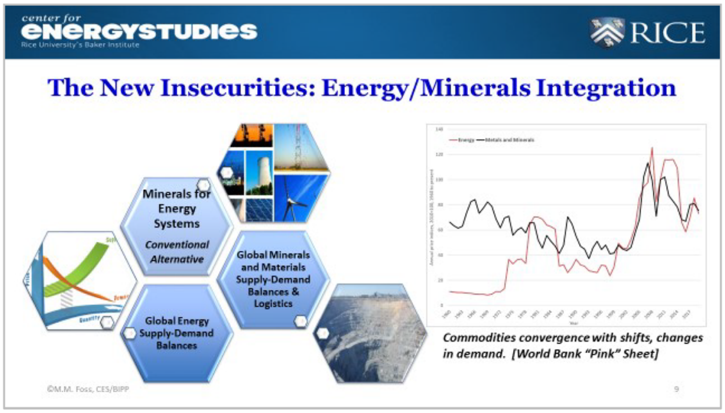
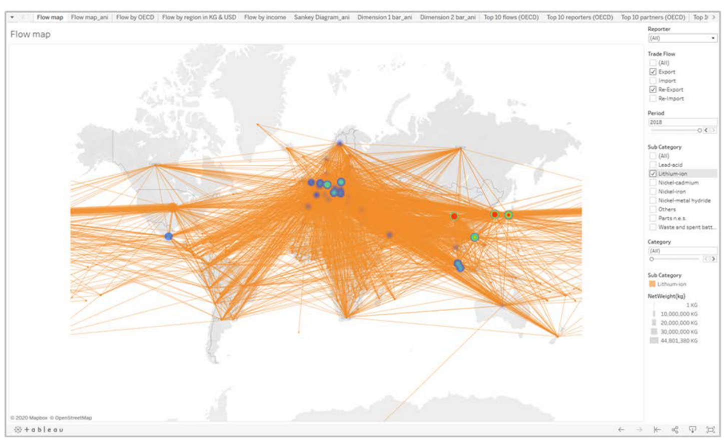


Supply chain security is subject to myriad risks and uncertainties, about which we have been learning a great deal. Any industrial activity, including the provision of consumer products, involves many linked business segments. Requirements include supply of raw materials, shipping, transformation, distribution and end use. Numerous sources of risk and uncertainty, including natural hazards and "acts of God" can create supply chain disruptions. Supply chains for energy and minerals are large and dominate bulk shipping. For example, already, global shipments of lithium battery products for all end uses rival global shipments of traditional fuels in geographic extent. Behind global shipments of lithium batteries are global shipments of all of the raw material battery inputs. Supply chains for batteries and other components will continue to grow and increase in reach and complexity.



CES lithium battery trade flows (Dr. Rachel Meidl and Elsie Hung, forthcoming).

We also are concerned about supply chains to support end of life decommissioning, recycling and disposal and all of these entail ESG risks and uncertainties. For instance, we know a great deal about waste, capture, recycling and disposal in established energy systems. We know relatively little about waste in the alternative energy streams and concerns are growing about end of life treatment of alternative energy components. We believe that we can recapture and reuse battery materials but currently less than five percent of lithium battery product is recycled. These functions and their associated supply chains are opaque and not well documented. We know that "e-waste" is growing, probably exponentially, and we know that global e-waste shipments and supply chains are expanding rapidly. (See Appendix for emerging research on waste.)

If we add "climate" to environmental security, then we introduce a great deal more complexity. All industries, businesses, governments and even households are beginning to attempt to assess emissions. Emissions associated with life cycle processes for batteries and alternative energy applications are extremely difficult to ascertain. For example, global lithium battery manufacturing, including for electric vehicles (EVs), stands at roughly 740 gigawatt hours (GWh) based on information from Wood Mackenzie. Nearly 80 percent of this capacity resides in China[4], supported by nearly 3,000 coal-fired power plants, the backbone of China's electric power grid. This means a potential output of carbon dioxide (CO2) emissions that nearly equals all of those associated with the U.S. domestic oil and gas systems, based on U.S. Environmental Protection Agency (EPA) estimates. We are starting to think about sulfur hexafluoride or SF6, an insulator for electric power switchgear. SF6 is a small contributor to global emissions but has stronger thermal properties and is expected to increase considerably with electrification.

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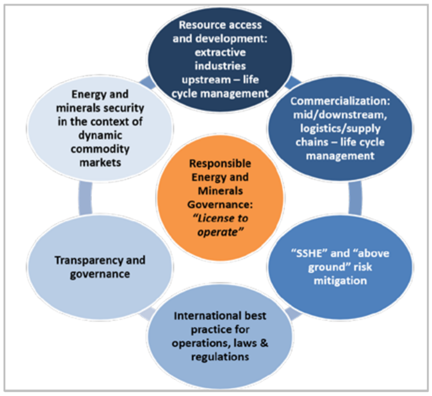
Attention is growing with respect to ESG risks specific to mining and minerals processing. Mining and minerals processing are, and can be, conducted safely and soundly with best practice and enforcement. I present a summary of what we could call the extractive industries ESG cycle below.

[4] Yergin, Daniel. 2020. "The New Geopolitics of Energy". The Wall Street Journal, September 11. https://www.wsj.com/articles/the-new-geopolitics-of-energy-11599836521?mod=searchresults&page=1&pos=1

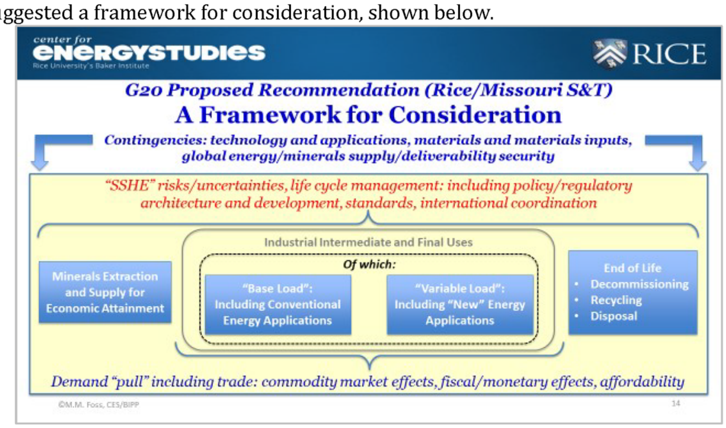


Many countries have "informal mining" sectors where best practice and safety are limited, at best. Some governments are moving to "formalize" their artisanal miners with notable examples in Chile and Democratic Republic of Congo. Exposure for multinational mining companies is yet to be determined.

International capacity for integrity and operating assurance need to expand. After the Vale tailings dam failure in Brazil, a distinct comment from a mining industry representative was that only 16 engineering groups worldwide are certified for tailings dam audits.

Communities, especially indigenous groups, are a focus for risk and uncertainty assessment and mitigation. Many existing, new and frontier minerals projects are and will be located in or proximal to indigenous lands and communities. In the U.S., we have many hard lessons from permitting and licensing that can be vetted. Achieving "social license" is demanding and even the most diligent efforts are not always successful. Experience with the World Bank's "consent" process provides many lessons on this front.

With colleagues at Missouri Science & Technology,[5] we contributed a policy brief for the upcoming G20 meeting. That brief focused on mining and minerals for energy transition. We suggested a framework for consideration, shown below.



"SSHE" refers to safety, security, health, and environment; it incorporates hazardous materials management throughout all supply chains and lifecycles. "Industrial Intermediate and Final Uses" includes energy. "Base Load" is the demand for non-fuel minerals and

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[5] Dr. Michael S. Moats, Missouri University of Science and Technology's O'Keefe Institute; Dr. Kwame Awuah-Offei, Mining & Nuclear Engineering Department, Missouri University of Science & Technology.

materials by all existing, legacy industrial systems, including conventional energy. "Variable Load" captures emerging applications, such as new energy systems, for which demand is highly uncertain. Supply chain logistics for "End of Life" are integrated for that stage.

With five recommendations that I share in closing.

- Include non-fuel minerals in G20 discussions.
- G20 members should fund research to develop a uniform mineral criticality index.
- G20 member states should commit to promote transparency of critical minerals.
- G20 members should engage relevant multilateral agencies to foster technical collaborations.
- G20 members should commit to share best practices for extraction and recovery of critical minerals (an example is the Energy Resource Governance Initiative).

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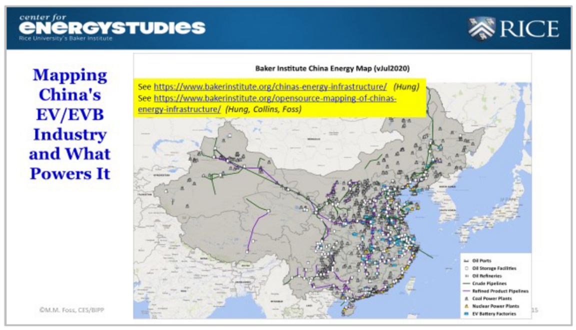
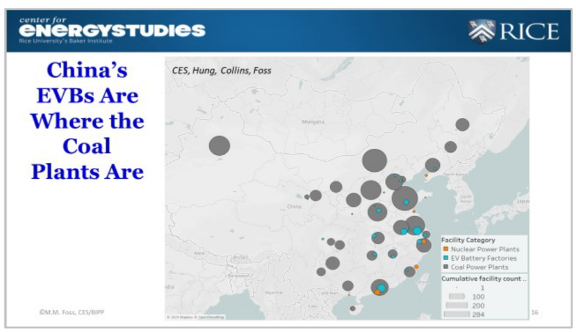
Appendix

2. Research on China's energy system, https://www.bakerinstitute.org/chinas-energy-infrastructure/, https://www.bakerinstitute.org/opensource-mapping-of-chinas-energy-infrastructure/





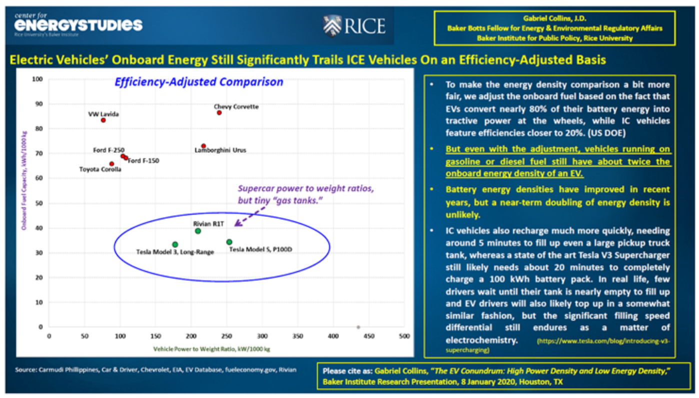
center for **ENERGYSTUDIES**
Rice University's Baker Institute
RICE

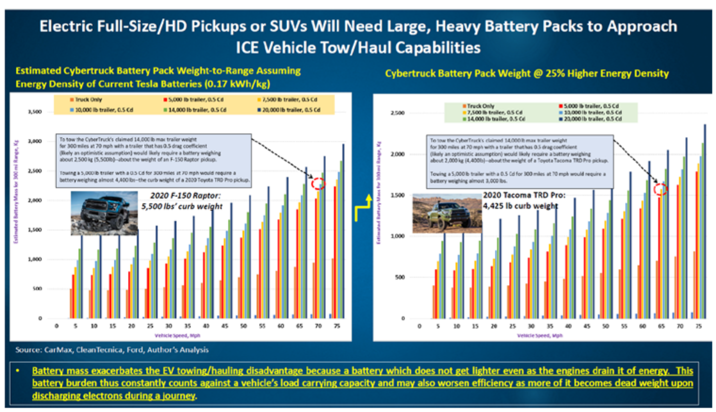
China's Inventory

	EV battery factories	Nuclear Power Plants	Coal Power Plants
In number of units			
Total units	186	114	2,956
Operating	177	47	2677
Under construction	8	14	170
Permitted			70
Announced	1	53	39
% of est. coordinates	7.6%	5.3%	1.6%
In GW			
Total capacity	89.3(GWh)*	95	1,145
Operating	85.4(GWh)*	45	997
Under construction	3.9(GWh)*	14	95
Permitted			34
Announced	0.5(GWh)*	36	20
Avg. age for operating units (yrs)	9	8	13
Capacity captured (CEC, 2020)		93%	96%

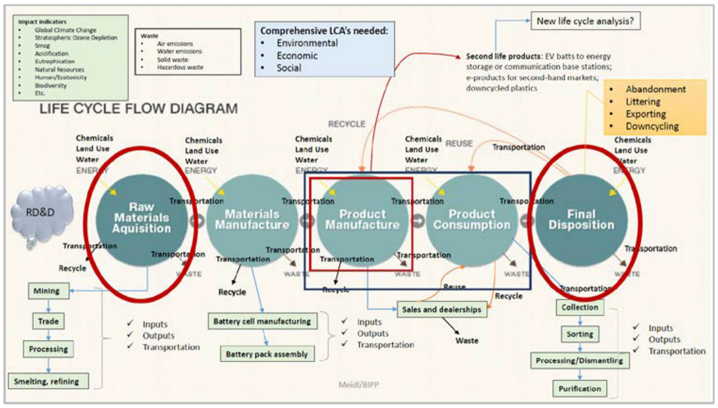
©M.M. Foss, CES/BIPP *China Electricity Council for 2019 data (http://www.cec.org.cn/guihuayutongji/gongxufenxi/dianligongxufenxi/2020-01-21/197090.html) 17

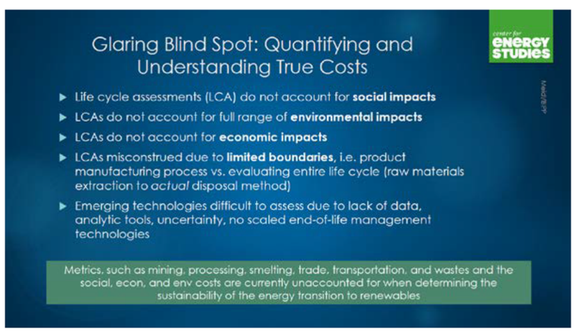
1. **Emerging research on EV mass balance challenges,** Gabriel Collins, J.D., Baker Botts Fellow in Energy & Environmental Regulatory Affairs, https://www.bakerinstitute.org/media/files/files/e315e1b0/collins-want-an-electric-pickup-to-tow-like-a-ford-f-250-you-ll-need-a-battery-that-weighs-as-much-as-an-f-150-raptor-28-january-2020.pdf, https://www.bakerinstitute.org/media/files/files/c44ec012/ces-collins-pp-ev-conundrum.pdf

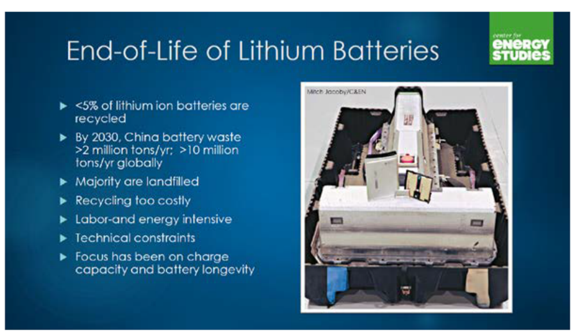


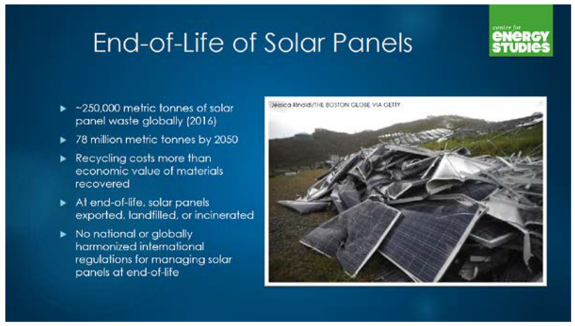


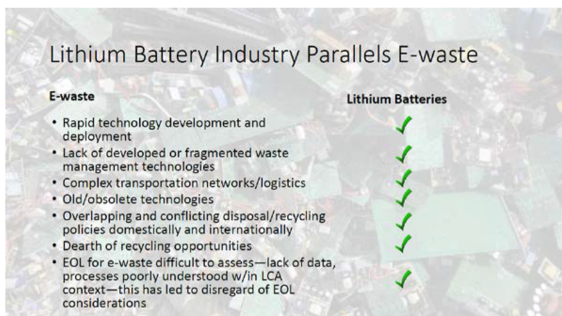
2. **Research on waste and waste management, including hazardous materials,** Dr. Rachel Meidl, Fellow in Energy & Environment, keynote speaker for the 2020 MIT Applied Energy Symposium








End-of-Life of Solar Panels
~250,000 metric tonnes of solar panel waste globally (2016)
78 million metric tonnes by 2050
Recycling costs more than economic value of materials recovered
At end-of-life, solar panels exported, landfilled, or incinerated
No national or globally harmonized international regulations for managing solar panels at end-of-life


Lithium Battery Industry Parallels E-waste
E-waste
Lithium Batteries
Rapid technology development and deployment
Lack of developed or fragmented waste management technologies
Complex transportation networks/logistics
Old/obsolete technologies
Overlapping and conflicting disposal/recycling policies domestically and internationally
Dearth of recycling opportunities
EOL for e-waste difficult to assess—lack of data, processes poorly understood w/in LCA context—this has led to disregard of EOL considerations

Mr. TONKO. Thank you, Dr. Michot Foss.

And thank you again to all of our witnesses. Thank you for sharing such great perspective and information with us. We will now move to member questions, and I will start by recognizing myself for 5 minutes.

I will start by saying I don't think anyone believes the transition to a 100-percent clean economy will be easy. If it were, we wouldn't have had all of these hearings and sought expert testimony over the past 18 months.

So I appreciate Dr. Michot Foss' testimony, and I will mention that I recently introduced a bipartisan bill to support our D&D to recycle and reuse critical materials from energy storage systems. I am happy to discuss that effort with any of my Republican colleagues because I truly believe it is critical that, when we identify a potential challenge, we must try to work together to overcome it.

But this morning I want to focus on the opportunities. Let's see if we can identify some programs ripe for Federal investment which could support well-paying jobs, transition us to a cleaner economy, and indeed lead to more equitable outcomes for all Americans.

So, Dr. Saha, are there opportunities for emissions reductions in domestic manufacturing if we support deployment of zero-emission school buses?

Dr. SAHA. Thank you.

Yes, I think in any forthcoming economic recovery stimulus packages or infrastructure bill, focusing on a few key areas can lead to not only emission reductions potential but also economic benefits in terms of, you know, creating jobs, long-term economic resilience. And earlier this year, WRI had identified five key areas. And one of them actually includes investing in public transit and transportation infrastructure, then also investing in manufacturing electric school and transit buses. They cannot only reduce operating and maintenance costs, reduce CO_2 emissions, and avoid emissions of harmful local pollution, the negative health impacts, these can also create jobs, especially manufacturing jobs, and they can position the U.S. as a leader in the growing zero-emission vehicle market. So definitely the answer is yes.

Mr. TONKO. Thank you.

And, Mr. Stephenson, if Federal investments included strong labor standards, could IBEW members find job opportunities building and maintaining the network of charging stations that would be needed to support those given buses?

Mr. STEPHENSON. Well, yes, there is no doubt there is going to have to be a huge infrastructure investment to install charging stations really across the country, not only for the buses but for other vehicles as well. And so it should provide many job opportunities, I think, hopefully for our members to install all those charging not only for along the highways but also in the homes and in the businesses and the schoolyards, wherever they have those buses. Obviously, we have to have charging stations for them to recharge.

Mr. TONKO. Thank you.

And, Dr. Fairchild, in the communities in which you work, could—would deploying new clean buses and reducing tailpipe emissions from heavy duty vehicles check all the boxes we are discussing today?

Dr. FAIRCHILD. Oh, absolutely. As you know, there are frontline communities, communities of color live close to all carbon emission land uses. And it would be substantial, particularly mobile sources of air pollution if we were able to mitigate that and—but I also think that it is important if that we make those investments, those investments must be large enough so that not only can we get our union brothers and sisters back to work, but it has got to be enough so that they open up their opportunities for and create access for lower income communities of color to also be a part of those economic opportunities.

Mr. TONKO. Great. So this isn't some unrealistic dream we are chasing. There really are Federal investments that could be made to support these three goals.

Let's try to cover a couple more examples. Dr. Saha, your testimony mentions how grid investment, such as building high-voltage transmission lines, can create jobs and other economic benefits. Is this also important infrastructure for decarbonizing our electricity sector?

Dr. SAHA. Yes. Absolutely, yes, especially when we keep in mind the context, right? We have a growing need to advance energy efficiency. We have to integrate increasing amounts of renewable energy onto the grid, and we have to keep basic new demands for electricity including from electrification of the transportation and building sectors. So definitely modernizing the electric grid infrastructure is not only an important investment opportunity but also critical for decarbonizing the power sector.

I just want to quote one stat here that transmission investment ranging between $12 billion and $16 billion annually to 2030 could stimulate about $30 billion to $40 billion in annual economic activity and create 150,000 to 200,000 full-time jobs each year.

Mr. TONKO. Thank you.

And, Mr. Stephenson, my time has run out, but if you could just maybe perhaps with us in written form back to the committee how your members would benefit from a build-out of our Nation's transmission infrastructure, I think that would be important. You might even share it with my colleagues this morning. But my time is up.

And we will now to move to recognize Mr. Shimkus, our subcommittee ranking member for 5 minutes to ask questions.

Representative.

Mr. SHIMKUS. Thank you, Mr. Chairman, and it is a great hearing.

So, Lonnie, I want to go to you first, and, you know, I appreciate your work, especially in our push to finalize Yucca Mountain and really get the Federal Government to actually comply with the law. So, my thanks to that effort. And you know the high-quality and well-paid workforce, that would continue then go to Nevada to help finish that project.

Now I understand that there is roughly 14,000 IBEW members that work at about 40 nuclear power plants around the country, and I have a, you know, a photo of the disposition of these nuclear power plants around the country. Some have closed. Some of them are planning to close. Some of them have been rolled back because of State activity. Your workers are in these plants. What are the benefits of the nuclear power across our country?

Mr. STEPHENSON. Well, thank you, Representative Shimkus. It is always good to see another Illinoisan.

Mr. SHIMKUS. And we got Dresden. In your testimony, you mentioned Dresden—

Mr. STEPHENSON. Yes.

Mr. SHIMKUS. —on the closure list now, too.

Mr. STEPHENSON. Yes, both Dresden and Byron, two very productive power plants in Illinois. It is crucial that we keep them open.

I think nuclear power is a huge piece of the puzzle, if you will. As we have talked, as we do the transition to the renewables, we still have to have strong reliable baseload and, of course, you know, nuclear zero emissions, when it comes to cleaning the emissions, and So with the current nuclear facilities that are there and the new technology, the new next generation of nuclear would be a great opportunity to make sure that we have reliable clean baseload to keep power running when the wind is not blowing, the sun is not shining. So we think there is a huge opportunity for the nuclear industry and should be into the future.

Mr. SHIMKUS. Yes. So, I would hope in our discussions we would work with the majority to try to make sure we somehow incentivize nuclear baseload because of zero-carbon emissions and the baseload, as everyone who has followed the grid, is critical. Really the whole deployment if we are going to transition, we need some solid, big numbers of electrons flowing on the grid while we move up and down the rest of the supply-and-demand chain through renewables.

Let me go to Dr. Michot Foss.

And I just, before I want to ask my questions, I want to make sure people look at page 5 and 6 of her testimony because she has, like dominant producer of battery chemistries and I am not going to go through it all but 28 of the 39 minerals that are needed in battery technology, the dominant producer is China. So, I could read this list, and know that 28 of the 39 will be coming from China. So, this is the energy security portion of this discussion that we have to have. So, I wanted to make sure people take a look at that in my short time.

Dr. Michot Foss when we talk about carbon-free emissions in these systems, are we really talking about "clean energy?" I am always having trouble with words, and how we use it - zero carbon, clean, there is a lot hidden in the way we parse out these things. In other words, when you consider the whole supply chain from the mine to the plug, how do these technologies stack up in terms of clean energy?

Dr. MICHOT FOSS. I don't know the definition of clean either. So, I will admit to that. I think everybody has got their own.

But if what we are looking at is reducing measurable quantities of certain things, gases from, you know, emissions or even other things that we are concerned about, I think it is—you are—again, Mr. Walden's comment about governance, it is easier to do this when you have got good policies, good oversight, protections for workers, and protections for the environment.

And I think the interesting thing, watching these debates in the United States, is the extent to which we know how difficult it would be to revitalize the mining industry, minerals processing in the United States or much less manufacturing for that matter, for everybody who would like to use manufacturing as a way of creating jobs and wealth around all of this. But yet we are the best positioned country to do that, us and other countries that also have difficulty dealing with public opposition to extractive businesses.

Mr. SHIMKUS. Let me stop. My time is almost expired, but let me end with this in that there have been some people, a Senator friend of mine, who says the next energy revolution would not come from a mine. And I would beg to argue in that all of these precious minerals in that are coming from a mine. So mining is still going to be part of this debate, and energy security is important.

So, with that, Mr. Chairman, I ran over my time. I appreciate it.

And I yield back.

Mr. TONKO. I thank you. The gentleman yields back.

The Chair now recognizes Chairman Pallone of the full committee.

Mr. Pallone you have 5 minutes to ask questions.

Mr. PALLONE. Thank you, Chairman Tonko.

I wanted to ask Dr. Saha a question and then—and then go to a second question with Mr. Stephenson. So try to get both of them in.

But, Dr. Saha, the transition to a low-carbon economy is more important today than ever before, and I mentioned in my opening remarks that we are facing three overlapping crises,—a pandemic, an economic collapse, and a climate emergency—and it is critical that we provide relief to communities battered by the COVID-19 pandemic and the destructive impacts of climate change.

So I wanted to start by asking you about the role of the Federal Government in transitioning to what you describe as the new climate economy, especially given the crisis that we face. The pandemic has fundamentally altered our economy. But would you agree that reaching a net-zero emissions by 2050 is still as important as ever or maybe even earlier, as some have suggested, and, if so, in the absence of Federal leadership, will this transition happen fast enough and at sufficient scale to both meet our climate goals and provide the economic benefits you describe in your testimony?

I know we could spend an hour or two on it. But if you could just take a couple of minutes, I would appreciate it.

Dr. SAHA. So, again, let me give you a little bit of context. Between 2005 and 2018, U.S. carbon emissions reduced by 12 percent, 12 percent. OK? And that is admirable. But we have to keep in mind that much of this decline came from fuel switching from coal to gas in the power sector. So this is what happened between 2005 and 2018.

And now think about where we need to go. By 2050, we have to reduce net emissions to zero if we want to be on track for 1.5 degree centigrade of warming. So this means that, from 2018 to 2030, U.S. emissions will have to decrease more than twice as fast as they did during 2005 and 2018. So that means that we cannot simply leave things to market forces or on the shoulders of subnational governments and businesses. The effort to address climate change will require leadership from the Federal Government. Period.

Mr. PALLONE. All right. Thanks so much.

Mr. Stephenson, the energy sector, like so many others, has been hit hard by the economic crisis, and I would like to hear your perspective on the role of Federal Government in revitalizing these sectors. Do you believe we can quickly recover the clean energy and energy efficiency jobs that have been lost, jobs that are vital to transitioning to a low-carbon economy? We have talked about that in previous hearings, you know, these jobs that we lost in clean energy and energy efficiency. So can we do that quickly, get them back, or are we going to need some significant Federal support and investment to accomplish that?

Mr. STEPHENSON. Well, I think there is going to have to be some Federal support to accomplish that. As you know, as some of these jobs, our members have worked in coal generation, for example. Those are very good-paying jobs with good salaries and benefits. And as those jobs—you know, we start the transition, continue the transition into the renewables, those type of jobs are hard to replace because, you know, you might have 200 people working at a coal generation plant. Then if you replace that with solar and wind, while there is a lot of job opportunities in the construction of all those, there are very few jobs really to maintain those.

And so but we really need, you know, the just transition is a word you use. You know, you hear it all the time. How do we have a just transition, you know, from workers that are currently in those jobs or they have got, you know, jobs in the future that is going to pay them, you know, similar wages and benefits.RPTR MARTINEDTR HUMKE[11:04 a.m.]

Mr. PALLONE. I believe you testified about jobs in people that are actually working on renewables, you know, windmills and solar and all of that. Don't you think we are going to need some kind of Federal help to bring those back as well because—

Mr. STEPHENSON. Absolutely. For example, there is not a solar panel that is manufactured in the United States. Why can't we bring back the manufacturing and manufacture those solar panels?

Wind generation, same thing, we are not manufacturing here in the States. Why can't we bring that back and give that a boost to our economy by encouraging and bringing the opportunity to build those, you know, the renewables and do it here, do it here in the States and provide good quality jobs in those markets to provide those services.

Mr. PALLONE. All right. Thank you so much.

Thank you, Chairman Tonko.

Mr. TONKO. The gentleman yields back.

The Chair now recognizes Representative Walden, full committee ranking member, for 5 minutes to ask questions.

Representative Walden.

Mr. WALDEN. Hey, thank you very much, Mr. Chairman, and thanks again to our witnesses today.

I have a quick yes or no question for all of our witnesses. In the Northwest, obviously, we rely on a lot of hydropower and their efforts to take out that hydropower, especially the Snake River Dams.

And I just wondered, yes or no, do you or the organizations you represent support removal of the Snake River Dams and the hydropower it provides?

I don't know who wants to answer.

Mr. STEPHENSON. I will give you a quick answer. We need to have hydro again as a clean energy source and it need to be a part of the equation.

Mr. WALDEN. All right.

Ms. Fairchild?

Dr. FAIRCHILD. Taken a position on that.

Mr. WALDEN. Has not? There is a lot of background noise, I am sorry. Has not taken a position?

Dr. FAIRCHILD. So we are a collaborative a position on that.

Mr. WALDEN. OK. All right.

Ms. Saha?

Dr. SAHA. Given that climate change is an existing shared threat, I think we need to allow the use of all possible tools, including hydropower, to emission tests as soon as possible.

Mr. WALDEN. Yes, yes.

Dr. Foss?

Dr. MICHOT FOSS. I would say that you would only take them out if you have a viable alternative.

Mr. WALDEN. Yes, thank you.

Did I get to everybody? Did I leave anybody out?

Yes, I just would say for my friends in the South, BPA provided as much generation in California as they could within their transmission capabilities. Between the 14th and 19th of August, they sold 65,000 megawatt hours of hydropower and increased their peak hydropower levels by 50 percent and its load by 25 percent in the days leading up to those power grid issues.

So, you know, what I endure out in my part of the world is a threat to the hydro system and a constant effort to try and reduce it and remove these dams. And, obviously, we have fish mitigation issues and all, enormous billion-dollar investments in trying to deal with some of that.

But, on the other hand, we do have clean zero emission hydropower that is constantly under threat of renewable. And then we watch as the nuclear facilities are getting shut down around the country, and I would tell you I am a big advocate—and I know that both chairman are—for enhancing the electric grid, but it is darn near impossible to site expansion of electric grid, especially in the West. 55 percent of my district is Federal land. They have been trying to build the Boardman to Hemingway Line for quite a while from Idaho into my district. It is very controversial. And they are doing everything they can to avoid having it touch Federal ground because it is so difficult to get it permitted and approved. And so, of course, that raises you-know-what with private land owners who see their land then under a threat.

So, expanding the grid to be able to manage the renewable energy and the grid itself is really problematic. Needs to happen, don't get me wrong. And my district is home to thousands of megawatts of wind power. And I don't know the current number on solar. But we have huge expansions going on in solar.

We actually have great opportunity to expand geothermal, too. But a lot of that, again, is on Federal land. These are very controversial issues politically when you try to do anything on the

Federal ground, but in the West, so much of our States is Federal, and it is something I think we have to address.

One other question to Dr. Michot Foss. Let's start with some facts. Here in the U.S. we are blessed with a rich diversity of these energy sources. If you look at total energy consumption in 2019, 80 percent came from fossil, eight percent from nuclear, 11 percent from renewables, and the share of energy that comes from renewables is projected to grow in the years ahead. But if we just look at electricity generation, only 7 percent came from wind and less than two percent from solar.

So, there are, obviously, efforts to ban the other fossil fuels along the way. But if we were to rapidly phase out use of fossil energy, how do we replace that 80 percent of our energy mix? Could you speak to that?

Dr. MICHOT FOSS. Not easily. It will take time, and I think that is the crux of the political conversation is the amount of time that it will take, especially if you want to repatriate manufacturing, repatriate jobs, build supply chains and do it at home as opposed to spending our dollars to acquire imported equipment and materials. You know, those are the issues, right. Worldwide, in fact, renewable energy is still only about 2 or 3 percent.

So rapid growth rates, everybody notices that, but still a very small proportion. It is hard to do. It takes a lot of infrastructure.

Mr. WALDEN. I appreciate that. Because I do think that is the challenge. We all want to use the latest innovative technology with the least emissions, but getting from here to there is, I think, where the debate is, how quickly can you do it and not risk rolling blackouts or other issues.

My time has expired. Mr. Chairman, thanks for your thoughts on my district and your continued leadership on these issues.

And I yield back.

Mr. TONKO. You are most welcome. The gentleman yields back.

The Chair now recognizes the gentleman from California, Representative Peters, for 5 minutes, please.

Mr. PETERS. Thank you, Mr. Chairman.

I would like to discuss a strategy that I haven't heard much about recently, but it is a fundamental component of any effective climate change mitigation policy, and that is the price on carbon. If we are going to save this plant, we need to change the behavior of every decision-maker throughout the economy, from the largest corporations to each of us individuals.

And one of the best ways to incentivize this collective solution is to put a price on carbon either through a cap in trade like California has or through a carbon tax. Those of us who represented the United States at the UN Climate Conference COP25 in Madrid last year heard this over and over again from economists and heads of state alike, markets need clear pricing levels to transition to a low-carbon economy.

Why? Because a price on carbon would incentivize producers and consumers of carbon intensive goods without any further government action to make better choices and to use less fossil fuel and to substitute lower carbon alternatives.

We have talked at length in Congress about an ambitious multitrillion dollar infrastructure initiative to fix our bridges and roads, expand broadband, upgrade the electrical grid, and more. Historically we funded those programs by raising the Federal gasoline tax. Now, we could raise that tax again, but at this point an upstream carbon tax makes much more sense.

We are still providing funding through an energy levy, but we also continue incentivizing conservation and innovation in a technology neutral way that will reduce the generation of greenhouse gases.

The double benefit of using a carbon tax for infrastructure is that it will fund Federal infrastructure investments and without any further government action will also induce carbon-saving infrastructure investments in the private sector, building resilient communities, providing financial support for energy efficiency retrofits, building electrical charging infrastructure, among many other priorities.

According to Senior Fellow Dallas Burtraw of Resources for the Future, quote, ″Industry has many opportunities to reduce emissions, but firms can rarely act alone. Policies like carbon pricing and performance standards are essential to coordinate this effort. Deep mid-century decarbonization goals require private sector and government partnership.″

Now, some worry that a carbon tax is regressive, and you could say the same thing about the gasoline tax, which we have used for years; but most proposals in Congress for a carbon tax contemplate the refund of a large portion of the revenues to disadvantaged communities that don't have ready alternatives and can't afford increased energy prices.

For instance, the Energy Innovation and Dividend Act, which I cosponsor, proposes a tax that protects low-income communities. But even in this divisive Congress, there are five bipartisan bills that put a price on carbon, and any one of them would be a game changer.

With respect to disadvantaged communities, let's not discount the cost of not acting. People in low-income communities today are disproportionately exposed to air pollution that is linked to asthma, cancer, and other health issues. A price on carbon that slows the rate of climate change does the most good for the communities that are most harmed by climate change today.

Now, a carbon tax is a necessary but not a sufficient solution. There are many issues that will require direct regulation. For instance, it is hard to imagine any scenario where economic incentives alone would prevent fugitive methane emissions or industrial agricultural emissions. So many of these ideas are laid out in the excellent work of the Select Committee on Climate Change.

So with that, I would like to address my question to Dr. Saha from WRI. And I wanted to say that, I meant to start out by saying people haven't been talking about this. But here is a quote from your testimony today, which is ″A carbon price is needed to embed climate change costs into economic decision-making while providing clear incentives for the development and deployment of low-carbon technologies and shifts in operations to reduce carbon emissions.

An economy-wide carbon price should be one of the central elements of a national climate policy and paired with complementary policies can be designed to help achieve net-zero emissions by mid-century.″

And that is on page 13. I certainly commend everyone to read that. But, Dr. Saha, can you talk about why it is important, in addition to these Federal investments we are talking about, to engage and incentivize the private sector in doing the right thing on climate?

Dr. SAHA. Yes, absolutely. WRI's position is that an economy-wide carbon price, whether it takes the form of cap in trade or carbon tax, has to be one of the most important tools in our toolbox and it can be designed in such a way that it can get the U.S. economy to achieve net-zero emissions by mid-century, and at the same time, it can also build a prosperous economy that offers good jobs, minimizes impacts on families, and helps address environmental justice issues.

And WRI also takes the position that while carbon pricing is necessary, it is not going to be a sufficient approach to achieve multiple climate goals and—

Mr. PETERS. My time has expired. I agree with that. I just want to put that on the table because we can't just focus on Federal investments, which are important, and Federal regulation on which we can agree. We have to incentivize the private sector to be part of this or it won't work.

Dr. SAHA. Absolutely.

Mr. PETERS. I yield back.

Mr. TONKO. Thank you, Representative Peters. The gentleman yields back.

The Chair now recognizes the gentle lady from Washington State. Representative Rodgers, you are recognized for 5 minutes, please.

Mrs. RODGERS. Thank you, Mr. Chairman.

I appreciate the majority's focus today on equitable opportunities as a part of today's hearing title. What we have seen in the past from Democrat Congresses, as well as the administration, has been more of, I think, an insistence on massive government subsidies and top-down mandates that, unfortunately, pick winners and losers.

When we think about policies to advance clean energy solutions to lower emissions, it should be technology neutral and allow private sector innovation to occur, free from the government mandates and without having to compete on unequal grounds.

I look forward to working with my colleagues on this committee, Republicans and Democrats, to really identify the solutions that are going to lower emissions but do it free from the government mandates and really make it more equitable.

As we consider policies to promote renewable energy technologies compared to other energy solutions, it is critical that we examine their entire life cycle and the impact their manufacturing components and materials have on the environment.

Dr. Michot Foss mentions in her testimony that nearly 80 percent of lithium battery manufacturing capability for electric vehicles is in China, whose grid is overwhelming powered by coal-fired plants. A similar percentage of global supply for solar panels also originates in China.

Dr. Michot Foss, how should we consider the impact of the manufacturing process on these renewable technologies and the impact that they are having on the environment when we are evaluating their efficacy for reducing emissions globally, especially coming from high emission countries like China, and how do we mitigate these issues?

Dr. MICHOT FOSS. I would have to say that one of my biggest concerns is that if you try to accelerate by any means, either market incentives or direct policy interventions, subsidies, whatever, the process of speeding up the integration of certain technologies that we don't produce ourselves, the components of which we don't produce ourselves, all we are doing effectively is shifting our emissions abroad.

Now, we have been doing this for a really long time. All of the more developed countries have been doing this for a very long time. And so the net improvements that everybody hopes to gain in terms of whatever it is that we are after, reducing greenhouse gas emissions or achieving more equitable access to energy, universal access to energy, whatever the targets are, all become diminished if that is what we end up doing.

This is a really difficult conversation with China. I think everybody has got to be honest about that. We are all hopeful, those of us who have studied the country for years, been there, that they will continue to make improvements in their own energy system. I mean, they are doing certain things. But they also have a very strong stand of self-determination and very little willingness, it seems, to engage in ways that I think others would like them to. So I think that has to be part of the conversation. It is part of the reality check on all of this.

I would point to an example over the past few days, Angela Merkel in Germany got her reality check on this because the Germans would like to be very assertive and stronger in terms of what they are doing, and they would like to be able to meet their policy goals and policy targets.

But it is meaningless if what they are doing is effectively having to rely on China for a lot of their inputs, and the Chinese are not willing to make the same types of commitments. I mean, that is where we are, I think, in the discussions.

Mrs. RODGERS. Yes, I appreciate that.

We are also seeing issues arise at the end of these technology life cycles. According to some estimates, there will be 600,000 tons of waste of lithium batteries removed from EB by 2025, 78 million tons of solar panel waste by 2050. As we continue to compete with China in critical materials and manufacturing clean energy technology, recycling can help us reduce waste and increase our ability to compete.

Dr. Michot Foss, some have said that recovering these raw materials from these devices remains impractical, especially since they are not made to come apart.

Do you agree with that view? And how clear is it whether a profitable history will be borne at times to get clean energy from adding to an already growing pile of waste?

Dr. MICHOT FOSS. Well, do you want me to answer? Talk is over. Let me just say quickly there are a lot of ideas. There is good work that is being done on recapturing recycling. I gave you all the figure that we know or that we think we know, which is five percent with recovery of lithium batteries.

I mean, it is really hard to track this stuff, very, very difficult. Lack of data, lack of information, lack of transparency, there are huge issues in tracking waste in general, but e-waste in particular.

And then, frankly, when it comes to things like—and I am sure the other panelists, Dr. Saha, for instance, would be aware of this. That when it comes to recapturing and recycling or properly disposing of waste associated with renewable energy components, there is really an unwillingness to talk about that and engage on it, probably for a whole variety of reasons.

But it is something that we have to own up to and we have to figure out. It is going to be part of the problem-solving in order to be able to move forward the right way.

So it can be done. People have to be realistic about the timing and the cost and whether it is practical or not——

Mr. TONKO. OK. The gentle lady yields back.

Mrs. RODGERS. Thank you. I yield back.

Mr. TONKO. OK. The gentle lady yields back. Thank you so much.

And now the Chair recognizes for 5 minutes the gentle lady from California. Representative Barragán, you are up for 5 minutes, please.

Ms. BARRAGÁN. Great. Thank you, Chair Tonko, for holding this important hearing.

Our country cannot afford inaction on the climate crisis, which is no longer a far off threat in the future but is affecting us today. We can see with the unprecedented wildfires in my State of California and throughout the West Coast, which are endangering the health and safety of millions of people.

We also have unprecedented opportunity to act by making a transformational green stimulus investment that delivers an economic recovery, puts people back to work, and serves as a down payment on building a more sustainable future that we can pass on to the next generation.

Dr. Fairchild, I would like to start with you and talk a little bit about equity and clean energy jobs. I want to first start by thanking you for your past work in Los Angeles on community development and job training for underserved communities, like those that I represent.

My district is the fourth poorest district in California. It is critical we center equity in any green stimulus investments we make so that the communities most in need of jobs can benefit.

Can you discuss model programs or policies at the local and State level that we can adopt alongside green investments to make sure communities of color aren't left behind? And those are policies we can adopt on a Federal level.

Dr. FAIRCHILD. Thank you very much, Congresswoman, and LA is my home, so I am going to do as much as I can to help your district.

We have a number of innovative programs. And, first, the thing that we have to recognize is that communities of color are underrepresented in the construction industry, we are underrepresented in the environmental sector, we are underrepresented in the energy sector, we are underrepresented in the water sector. And so that is a problem we have to address, but we have to address it at a number of different levels.

The first is to create awareness among the next generation about the opportunities in the clean energy future. They understand a clean energy future and a clean economy is about their generation and their future opportunities, but they don't know the current pathways that are available to them.

So ASIS, the ASIS program that we have in seven high schools in South and Southeast Los Angeles is actually training young people about, and giving them industry certified skill certificates in huge cells, in technology solid works and figuring out how to actually excite them about this career that is also a mission for them. So we really have to start from the middle school and to the high school level.

We also need to work, and we have been working closely with many of our unit partners, with the Youth Build programs. Particularly in Los Angeles, we have got about a hundred black and brown youth in the ironwork apprenticeship program and building a solar farm in Lancaster.

And then we are also working with small minority women and veteran owned contractors. We must invest in these contractors or in less than five years they will be out of business if we don't teach them about the new technologies that go with the clean energy.

There is new software. There is new equipment and new materials, new building codes, and they are still dealing with legacy issues in terms of access to capital, as well as bonding and insurance.

So this initiative really requires that level of investment.

Ms. BARRAGÁN. Great. Thank you so much, Dr. Fairchild.

Dr. Stephenson and Dr. Saha, over 490,000 clean energy workers remain jobless since the pandemic hit, including over 84,000 workers in California. Can you describe the most effective policies and investments we can enact today to bring these jobs back?

Mr. STEPHENSON. Thank you.

Obviously, we have got to get the funding and get these things back up and running again. It is unfortunate, you know, that the pandemic has slowed down a lot of opportunities for our members to continue to work in the renewable energies. However, you know, there is still a lot of work going out there.

We are still doing a lot of solar. We are still doing a lot of wind. But, you know, I just think that the drive to move into the renewables is going to move us in that direction I think naturally.

Ms. BARRAGÁN. OK.

Dr. SAHA. And I would just add that there are few areas which can actually—their investment can be helpful. So, for instance, targeted expansion of energy efficiency and energy assistance programming can provide several benefits that can put people to work immediately in quality jobs. It can contribute in the future and also find relief to struggling households by eliminating energy costs.

Similarly, investing in public transit and transportation infrastructure can create jobs, and economic growth investment in energy technologies, especially by extending the tax credits for these technologies, can be really helpful.

So there are a few areas that I think Congress should be focusing attention on.

Ms. BARRAGÁN. Great.

Mr. Stephenson, IBEW represents—oh, I apologize. I believe I am over my time.

So with that, Mr. Chairman, I—I had, of course, a lot more questions, a very important hearing. Thank you for holding it. And with that, I yield back.

Mr. TONKO. Well, thank you for participating. The gentle lady yields back.

The Chair now recognizes the gentleman from West Virginia. Representative McKinley, you are recognized for 5 minutes, please.

Mr. MCKINLEY. Thank you, Mr. Chairman.

Well, it was only a matter of time. The democratic leadership simply can't let a crisis go to waste. Now, what do I mean by that? Let's go back. I am aware of any industrialized nation, any other in the world, that has hijacked this healthcare crisis as an excuse to fundamentally transform their energy mix. But that is exactly what is happening here.

Now, even China, we talk about China, and its focus on renewables. That is true. But at the same time, they are investing—they are putting, if you look at this headline, they are talking about putting an investment in coal-fired power plants that is equal to or better than the renewables. They are going to be producing enough coal-fired prevalency equivalent of all of the Eastern European Union. So there is where we are.

Now, if we are trying to represent we are sensitive to people losing their jobs, where was that compassion over the years as the coal industry, all across America—in 26 States, we mine coal. What happened to them when they lost a very similar number of jobs with it?

What about towns like Hazard, Kentucky; Gillette, Wyoming; or Welch, West Virginia? Welch, West Virginia, is an example. It only has 1,700 people. There are no other job opportunities in Welch, West Virginia, and they are sitting there with a poverty rate of 27 percent. There are only 1,700 people living in the town. It has got a 35 percent minority population.

But, yet, if we fulfill this mission of going to a hundred percent renewables, what happens to Welch, West Virginia, or Hazard, Kentucky, or Gillette, Wyoming? I think we have a moral obligation to protect them.

But let me switch my question now to Dr. Foss because I have been listening to this diatribe from the other side on this for now for close to ten years.

Dr. Foss, can you assure the American public that if our country does indeed achieve a hundred percent renewables, once we reach that hundred percent, that we will have no more wildfires, no more hurricanes, no more droughts, and the oceans won't rise? Can you say yes or no?

Dr. MICHOT FOSS. I don't think anybody could make that claim.

Mr. MCKINLEY. Well, that is what they are doing. They are saying that we have got to do this so we can achieve, we won't have wildfires in the West. Those wildfires are horrible. But don't try to tell me as an engineer that this is the first time we have had wildfires.

Go back through your record and look at some in the past. They are horrible right now, I understand that. But the idea is being perpetrated to the American public that if we go to a hundred percent renewables, we will stop the wildfires, we will stop the hurricanes, we won't have that hurricane season on the East Coast anymore, we won't have droughts.

Thank you for your answer on that.

Let me go to a second question then. So I think you touched close to it. I want to understand, because by 2035 we are going to be—the democratic leadership is trying to go to 2035, there will be 100 percent carbon-free emissions at power plants. So my question is, that means we are going to rely on renewables, which is—eventually that is fine. We want to be at renewables eventually, but we need this bridge of using out fossil fuels to bridge to that.

So my question is, by 2035, will we have enough domestically produced—domestically, and that is the operative word—domestically produced critical minerals to produce 100 percent of our power generation with renewable resources in just the next 10 years, 15 years? Do you think that we can do that?

Dr. MICHOT FOSS. The issue, of course, is not just the raw material supply, but also the manufacturing capacity.

Mr. MCKINLEY. Can you amplify more on that, if you could, please? I have got a minute. I want people to understand that I know the goal is aspirational. But when they put it in a statute by 2035, are we going to be able to achieve that?

And the fact is, what effect is that going to have on droughts, wildfires? And there is none, as I can understand.

Dr. MICHOT FOSS. You are asking a tough one. I mean, you know, the problem is this. There is a lot of uncertainty, and I think people want to do things that they feel provide us humans with some control, and I think that is understandable. I think the political debate is what makes the most sense given the——

Mr. MCKINLEY. Or what gets them the most votes when they gin up their bases, and that is what this is all about, ginning up your liberal base to attack fossil fuels.

Dr. MICHOT FOSS. I am not privy to the strategies of——

Mr. MCKINLEY. All right. Mr. Chairman, I have ran out of time on this. I yield back the balance of my time.

Mr. TONKO. OK. Thank you for your questions.

And now the Chair will recognize the gentle lady from Delaware, the great State of Delaware as she would say. We recognize Representative Blunt Rochester, please, for 5 minutes.

Ms. BLUNT ROCHESTER. Thank you, Mr. Chairman, for calling this important hearing, and thank you to all of the witnesses for your testimony here today.

As has been said, our Nation is facing a plethora of crises right now, the COVID-19 pandemic, all-time high unemployment numbers, and climate change. On top of that, the systemic racism that is deeply woven into the fabric of our society exacerbates these crises for people of color.

Watching the wildfires in the West that my colleagues shared with us earlier and knowing that we are simultaneously bracing for the worst hurricane season in decades, the urgency to address climate change couldn't be any clearer. We don't know if we will avoid a wildfire, as was just said, but we can mitigate them. There are some things that are uncertain, but what is certain, we can and we must act, which is why I am proud of Delaware's Attorney General, Kathy Jennings.

Earlier this month she filed a suit on behalf of our State against the fossil fuel industry for its role in exacerbating climate change and the damage it has caused to Delaware's environment. We must act swiftly and boldly.

Right now we have an unprecedented opportunity to build our economy back in a cleaner, healthier, stronger, and more equitable way. And we need jobs that are not only helping us to fight climate change but also create family-sustaining wages and are accessible to all Americans.

Dr. Fairchild, in your testimony, you described the need for equity first strategies to address ongoing climate crisis, and I agree.

Can you elaborate on why it is so important for the Federal Government to prioritize investment in environmental justice communities?

Dr. FAIRCHILD. Thank you, Congresswoman, for the question.

Well, first of all, communities of color are, as you all know, the first and most impacted by climate change, and they are most impacted by the effects of COVID, are most effected by the challenges of inequities in justice.

So if we are going to—an equity first strategy basically says we support the most vulnerable, release the best first, then everybody benefits because that investment is going to have a multiplier effect. And I think there is a number of particular things that I have been hearing today that is missing the boat.

But number one, we have to have energy security defined in a different way. When we have a blackout or a brownout, what happens to folks that are in home healthcare situations, in critical facilities, people that are in public housing? We had a huge hurricane in New York City.

Folks lost—the last folks to get back on the energy grid were the public housing residents. I am talking about folks that are on the 10th, 15th, and 20th floors that couldn't even get up and down.

So we have to figure out how we invest first in critical facilities, how we invest in energy strategies for affordable multifamily housing, which is the most difficult building stock to retrofit. We have got to create community level jobs for our contractors to retrofit buildings and residential and small commercial buildings that will be left out into energy ghettos if, in fact, we don't go in there and retrofit these folks to contribute to a clean energy future and then create green and happy homes.

And I have seen a bipartisan bill on both sides of the House that really talks about retrofitting our schools where our vulnerable communities are.

So these are sort of equity first type of strategies that I would like to be considered.

Ms. BLUNT ROCHESTER. Thank you, Dr. Fairchild, and thank you also for your efforts about expanding and diversifying the building and contracting work force.

And on that, Dr. Saha, I chaired the House Bipartisan Future Work Caucus, which we just started, and I launched earlier this year. And with many industries evolving or disappearing as a result of the pandemic, it is more important than ever to create high-paying jobs with varying minimum educational requirements.

How can the clean energy industry combat educational disparities?

Dr. SAHA. Yes. So right now I think as we are sort of moving towards a low-carbon transition, we have to make sure that the jobs that are going to be created in the new climate economy are well-paying jobs, they provide access to people from all communities, and they come, you know, with benefits, and they are accessible to pretty much everyone.

So in terms of that, I think it is really incumbent on the clean energy, you know, the private sector working in partnership with policymakers and, you know, universities and education institutions to understand what are the skills that are going to be needed in this new industry, what are the gaps that need to be addressed, and work towards making sure that these challenges are being addressed.

Otherwise, I think we will perpetrate many of the inequalities and inequities that the currency has seen, and we cannot replicate those again.

Ms. BLUNT ROCHESTER. Thank you, Doctor.

And thank you, Mr. Chairman. I yield back.

Mr. TONKO. The gentle lady yields back.

The Chair now recognizes the gentleman from Ohio. Representative Johnson, you are recognized for 5 minutes, please.

Mr. JOHNSON. Well, thank you, Mr. Chairman and Ranking Member Shimkus, for holding this hearing today and to our panelists for offering their valuable perspectives.

You know, noted economist Thomas Sowell once said, "there are no solutions, only tradeoffs." So I am afraid that as the majority continues to hold hearing after hearing on their goal of replacing fossil fuels with a green economy.

My friends on the other side of the aisle do not want to admit the advantages America will have to forego in order to realize their green goals. As members of this subcommittee, it is our duty to dive deeper on these sweeping policy proposals that would fundamentally restructure America's energy economy. I would argue that it would fundamentally weaken America's energy economy.

Americans deserve to know the full scope of economic, environmental, and geopolitical costs of some of these much discussed proposals, like massively scaling up wind and solar or tremendously increasing the use of batteries. If this subcommittee won't look into it, who will?

For example, the testimony today reveals that these sweeping proposals to rapidly shift to green energy would likely result in American dependence on long, fragile supply chains moving through lands controlled by our adversaries. But I have to ask you, is this what we really want for America?

We should welcome innovation in helping America produce cleaner and more abundant energy, as we always have; but a policy change as fundamental as restructuring our energy economy and potentially seeding our energy independence must be discussed with clear eyes and a true appreciation for the costs and risks in doing so.

So, Dr. Michot Foss, we have witnessed a shell revolution in the United States, which I have seen firsthand in eastern and southeastern Ohio. And it has made America the global energy leader, strengthening our geopolitical hand, as well as spurring our economy.

Domestic demand will continue to rise for critical minerals and crucial rare metals for use in electrical components. But, unfortunately, America is dangerously dependent on these materials being mined and processed abroad.

What do we need to do, Dr. Michot Foss, what do we need to do to get America on a firm footing with these materials like we have seen with natural gas production?

Dr. MICHOT FOSS. Well, I think, first of all, what the committee could do is consider that our natural resource endowments are not unsubstantial.

The question is, are we willing to access our own resources and bring them into the market? We are still never going to be able to supply everything that everybody would want to use for any of the applications that we have been talking about today.

So we still will need trade access for those. But I think what we could do is we could look at our own backyard and see what we are willing to do and how we would be willing to do it, with what kind of guidance and what our expectations are in terms of performance of the industry.

No business is perfect. I mean, none of the things that we have talked about today are going to be completely free of problems and challenges and other things.

But in your point about our domestic oil and gas businesses, I think anybody who has studied those over time has seen what the industry can do to improve technologies, to reduce its own emissions, to be more efficient.

The mining industry and minerals processes could do the same. We would have expectations about how they perform. They need to be able to gain access to the resources for development and build the logistics in order to deliver them.

And I can tell you that in talking with any of the industries that we visit with, whether it is automakers who are trying to step up their commitments to electric vehicles, or people who are trying to plan wind and solar projects, distributor generation, think about new grid expansions and improvements, or whatever, all of those folks would like to have more domestic content in their businesses. And some of them are making major obligations to that.

So that is something you all have to think about because I think before you spend money trying to promote the application, you need to think about the inputs and how the inputs are going to be provided.

Mr. JOHNSON. OK. Well, thank you very much.

I did have a second question. I will submit it for the record, Mr. Chairman. But I will yield my time now.

Mr. TONKO. You are most welcome to do that. So thank you so much. The gentleman yields back.

The Chair now recognizes the gentle lady from Illinois who serves as Chair of the Subcommittee on Consumer Protection and Commerce, Representative Schakowsky. You are recognized, Representative, for 5 minutes, please.

Ms. SCHAKOWSKY. Thank you so much, Mr. Chairman and Ranking Member, for this important hearing.

You know, we started 2020 watching the horrifying wildfires in Australia that took millions and millions of acres, and now as we speak, of course, we are seeing that happening on the West Coast and the devastation. So let me also just give my condolences and my concern to my colleagues and, of course, their constituents that are facing so many challenges and even death right now.

And I really appreciate the effort that everyone is making right now, particularly our firefighters going into harm's way, and also the weather occurrences that are happening in the East and the multiple, you know, challenges that we have there.

And so I wanted to talk about something that is happening in Illinois. The Federal Government is investing in a program in Chicago that we call Brownfields to Brightfields, and this program converts old industrial facilities into solar brightfields, and it also creates good paying jobs and the benefits to the community around the city.

So there are so many ways that our local communities can provide good jobs, but I wanted to talk right now to President Stephenson. You know what, the subheading of this hearing today is "Opportunities for an Equitable, Low-Carbon Recovery." And I don't know that everyone would necessarily suspect that a big part of that could be talking about unions, and I wanted to explore that a little bit with you.

As a dues-paying, currently, union member myself—I have continued to pay my do you see even as I am here in Congress—it seems to me that this is a really important factor, that—in fact, I was a big supporter—I am a big supporter of the PRO Act, the Protecting the Right to Organize, if we want to rebuild a middle class even as we make our country more green.

So I wanted to ask you, how does union, in your view, really fit into this discussion about how we build a more equitable and job secure future?

Mr. STEPHENSON. Well, thank you, Representative Schakowsky, and, again as a fellow Illinoisan, it is great to see you.

You know, we think it is very important as we move forward with the renewable energies and the new technologies that are going to come out of that, that those are good paying, good quality jobs, union jobs, that can provide—that those workers can adequately work and provide for their families.

And we in the, you know, building trades and in the construction trades, we all have recognized—and we talked about the communities that have been underrepresented or been the ones that have been directly affected by climate change, and we have all across the building trades really increased our efforts to attract and get more women and people of color into our programs because we know that—and we have training programs all across the United States.

In every State we have got training programs that is already there and privately paid for between us and our contractors.

And so we have the opportunity to, as these new technologies and jobs come out is get—have the training available to train new workers to come in with the specific skills they need to be able to, you know, go out and maybe it is a wind tech.

Somebody that is taking care of those wind turbines, or, you know, in the solar. There is maintenance jobs that also, like you said, hopefully we can get back to where we are manufacturing some of those products as well, and that would provide great opportunities for jobs in areas where they really need them.

Ms. SCHAKOWSKY. So bringing jobs home and also good union jobs.

Dr. Fairchild, you heard what our president of the union has said. How important is it to make sure that there is reaching out to the communities that really need the help?

Dr. FAIRCHILD. It is essential. I think we need to rebuild the middle class if we rebuild our labor unions. But we do have to really find a better way to get people of color into unions, especially the IBEW.

And, by the way, amazing relationships with IBEW and they are opening up their apprenticeship programs, but these are hard tests for young people to pass.

So we have to have intensive boot camps to figure out how to pass these tests, and HVAC and electrical trades and other trades.

So there is a lot of work to be done, but that is the work that we need to do.

Ms. SCHAKOWSKY. Thank you.

And I yield back.

Mr. TONKO. The gentle lady yields back.

The Chair now recognizes the gentleman from Texas, I believe is next, Mr. Flores. Or do we have Representative Long with us?

Mr. LONG. Yes.

Mr. TONKO. We do?

Mr. LONG. Yes, sir.

Mr. TONKO. OK. Mr. Long, I am sorry we lost you there for a minute. You are recognized for 5 minutes, please.

Mr. LONG. Thank you, Mr. Chairman.

And, Dr. Foss, from your testimony it is clear that critical materials play a significant role in a transition to clean energy, and the U.S. is becoming more dependent on these minerals by the day.

Even though America has trillions of dollars in mineral reserves, we are 100 percent relying on importing more than a dozen key minerals. Most of these minerals come from China and other countries around the world that don't share our values and don't play by our rules.

This is especially clear with respect to environmental standards where these countries are far less concerned about environmental impact of their processes to extract these critical minerals.

I see from your testimony that you are working with Missouri Science and Technology in Rolla, Missouri, and crafted recommendations for the upcoming G20 hearing related to these topics. Can you explain the current conditions of our domestic mining industry?

Dr. MICHOT FOSS. Well, our domestic mining industry has faded just as a lot of our domestic industries have, manufacturing. And that is a consequence of both commodity markets and pressures from commodity markets, lower cost sources abroad, and partly due to governance in those exporting countries, producing in exporting countries.

And also because we, in protecting people, in protecting the environment, it made our costs higher, and that is something that is a tradeoff. We made it easier for competitors to supply raw materials who don't have the same obligations over their industries that we do.

Mr. LONG. OK. Well, we have critical materials right here at home, especially on Federal lands so the reason, why can't we produce American.

Dr. MICHOT FOSS. It takes a really long time to permit a new mining facility. It can take a really long time to open one that has already been in operation and is being recommissioned.

I think the point came up earlier, dealing with Federal lands is very difficult. Not much of what I think people would pursue would be on private lands, so we don't have, you know, a more flexible arrangement there. It is not that scrutiny is a bad thing.

Scrutiny is a good thing. If processes could be streamlined, if there was more certainty around the permitting process for new facilities, if there were ways of being able to build better consensus among different groups about access and how mining operations would be conducted in different locations, along with all of the supporting infrastructure, then I think we would be in better shape.

I often feel that what we really need to do is just revisit—if we are serious about this, we need to just revisit the entire scope of how regulation is as it pertains to the mining in the United States to see where improvements can be made in order to be able to generate more of a——

Mr. LONG. I think we are serious about it, and I would say to import 12 minerals, you know, it is not a good thing.

So the third domestic environmental permitting process hurt our international competitiveness in this area.

Dr. MICHOT FOSS. I think that certainly what it has done is it has made our industry clean and safe. It has contributed to that. I think people have learned how to adapt.

Just like every other business, the mining industry has acquired new practices. There is a lot more that can be done to make mining safe and to make it clean. I mentioned that earlier, we have got emerging ideas and emerging practices that we ought to be the leader in because we are the best place with our rules, our laws, and our transparency to be able to implement some of the things that people talk about, greener mining, climate friendly mining, you know, things that actually do a better job of protecting mineworkers.

We are deploying new technologies to reduce the human interface. I mean, this is happening in all basic industries. One way to make mining safer is to have fewer mineworkers. I mean, this is a reality in the business in terms of being able to move things forward. Better thinking, better management over permitting, licensing, compliance, and other things I think would help.

Mr. LONG. You hit on permitting there at the end, and that was going to be my next question, but I will submit it for the record since I am out of time, as far as the permitting process and fixing that to be more competitive in our global markets.

And thank you for being here today.

Mr. Chairman, I yield back.

Mr. TONKO. The gentleman yields back.

Next we recognize the gentle lady from California, Representative Matsui, you are recognized for 5 minutes, please.

Ms. MATSUI. OK. Thank you, Mr. Chairman, for holding this really very important hearing. I think it is really critical that we recognize that this is not a one-off deal. Climate change is happening, certainly in California, Oregon, and Washington State, but also throughout the country, whether it is fires or whether it is tremendous hurricanes. This is impacting the entire country, so this hearing is really quite important.

You know, I believe we need to chart a path forward that addresses not only immediacy and gravity of the climate crisis but recognize that costs to inaction are not borne equally by all Americans. Moving toward a clean energy will create new and lasting economic opportunities for helping really to alleviate some of the disproportionate impacts harming frontline communities.

Now, over the last several weeks, more than 700 wildfires have been burning throughout California. If you look at a map of California and the West Coast, you see these little icons of just fires going on all over.

This is including the second and third largest in our State's history. The fires this year are even more disruptive than last, and we have just seen just the beginning of the season. So this is not the height of the destruction right now.

The 2018 and 2019 fires cost more than $40 billion, and as the fire season goes longer and more severe, I am really concerned that the costs in terms of human life and economic damage will only grow.

So, as I said before, this is not just California and the West Coast. It is coming all throughout the country. So this is a national problem, and it has huge economic downsides.

So, Dr. Saha, can you describe what your research shows regarding the economic impacts of climate inaction in terms of the U.S. GDP?

Dr. SAHA. Thank you.

I think that is a very important question because oftentimes when we debate about the merits of climate policy, we don't take into account the costs that are already being borne on the U.S. economy. And as I said in my oral testimony, the longer we delay taking action, the longer the United States is going to be vulnerable to increasing damages from climate catastrophe and air pollution and other impacts.

And I think there is literature that says, emerging studies that have actually looked at how much climate inaction is going to shave off, you know, from U.S. GDP in case it fails to take action.

And the impact on U.S. GDP is actually going to be quite significant.

So, in that sense, I think it is really urgent that we understand the gravity of the situation and look at all technologies that can get us to a path of reducing emissions by 2050.

Ms. MATSUI. OK. Thank you.

And, you know, I am talking about wildfires and the fact that we have such significant air pollution that we can barely breathe, day is night, and it is just totally incredible; but we also have the aspects of flooding. In my district, Sacramento is the second most flooded town and urban are in this country, second to New Orleans.

And climate change exacerbates the risk of extreme weather and flooding events which makes it more common even throughout the Midwest. Modernizing our water infrastructure has significant public safety implications and presents an opportunity to minimize our carbon footprint.

Dr. Fairchild, what steps should we be taking to ensure our water infrastructure is climate resistant, resilient, and clean?

Dr. FAIRCHILD. Thank you for the question, Congresswoman.

Well, I think there are two things I would like to bring into focus. One is how do we mitigate and slow carbon emissions; and then, secondly, how do we adapt to the fact that the climate change is here and the fires are here and how do we build an infrastructure to do both.

On the one hand, our mitigation strategy in green infrastructure looks at watersheds, doing water management infrastructure, which is not the centralized water systems, but really how do we capture water.

On school sites, for example, a lot of initiatives are helping to dig up our playgrounds and making permeable pavements, and we can do this to our streets to capture the water to prevent flooding so it goes into the aquifer.

So there are a number of things, new technologies in coastal restoration and sort of ecological approaches to mitigation.

I guess the more important part is the adaptation, besides the green infrastructure, which is a job generator, by the way, from landscaping to putting up free canopies to address urban heat islands, that we really need to figure out how to adapt to rising heat waves and temperatures in our communities by making our communities cooler.

So I think that the water, energy, climate nexus is clear, and we need to recognize that these are water infrastructures, a huge energy consumer, but we also need to build an infrastructure to adapt to the floods that are taking place.

Ms. MATSUI. Well, thank you very much for all of your work.

And I see I have run out of time, so I yield back. Thank you.

Mr. TONKO. The gentle lady yields back.

The Chair now recognizes the gentleman from Texas. Representatives Flores, you are recognized for 5 minutes.

Mr. FLORES. Thank you, Mr. Chairman. I appreciate you holding the hearing today.

Dr. Michot Foss, I have a couple of questions for you, but let me start with this. The goal of this hearing is to determine how we can build a hundred percent clean economy with opportunities for a low-carbon recovery.

But let me say this, that there are no equitable opportunities for recovery for hardworking Americans if the power is out at work or if the lights out at home or school for our Nation's kids.

And California is an example of how to do this incorrectly. The California Green New Deal ignores the science of electricity physics, and it ignores market forces when setting power policy.

Today their flawed policies are causing blackouts and brownouts, and last year they caused massive fires.

California's Governor Newsom recently said that the failure to prevent blackouts was unacceptable, and he called for an investigation.

Well, he won't have to look far because their problems are caused by their failed policies. The Wall Street Journal summed up this viewpoint in an editorial recently saying that California's blackouts were a warning to the rest of America about the risk of Green New Deal policies.

In contrast, Texas is a great example about how to do it right. While oil and gas are both very important to Texas, our State is also a leader of renewable energy. In fact, renewable energy throughout Texas has helped to place our State ahead of all others in contributing to renewable energy production.

According to an article that appeared in Green Tech Media in January, Texas accounted for more than a quarter of all corporate renewable energy deals signed in 2019 around the world. This phenomenal growth is driven by the successful market-based model adapted in Texas in the 1990s when Texas began to deregulate the power industry.

The contrast between California and Texas clearly shows that policy solutions for a low-carbon economy should be based on real world strategies focused on conservation, innovation, adaptation, and market dynamics.

It is also important to realize that policymakers need to pay close attention to the importance of baseload power generation. In this context we should heed the comments of Mr. Stephenson, the President of the IBEW, where he talks about his organization's support for preserving key baseload energy services, including natural gas, coal, and nuclear power.

And as stated in his written testimony, the IBEW sees existing and advanced nuclear power as the cornerstone of low-carbon future. His testimony also states that as the United States moves toward increasing reliance on renewable energy, such as solar and wind, the need for nuclearenergy's reliability, the country's only carbon-free source that can ensure around-the-clock generation, even during inclement weather, has become greater.

Today's hearing, which explores the attributes of renewable energy, is a topic in which I have taken a keen personal interest. With regard to the moving toward carbon-neutral future, I have done more than talk about it. My residence is the largest producer of residential solar power in Brazos County, Texas, and during the hottest part of day, I will be feeding power back into our local grid.

Overall, on an annual basis, I generate 40 percent of my own power. And since 2014, by careful energy usage management and converting to 100 percent LED lighting, we have reduced our gross electricity percentage by another 37 percent.

Mr. FLORES. The point that I want to make is that finding a lasting solution to any of our economic, environmental, and energy solutions requires us to use nothing less than all of the tools in our toolbox, and our solutions again need to focus on conservation, innovation, adaptation to market dynamics.

So, again, Dr. Michot Foss, thank you for being here today and thank you for your blunt warnings regarding the severe economic security and environmental risk of relying on China to achieve our clean energy goals

We as policymakers should also heed your comments regarding the fallacy of expanding pollution sources in China in order to meet our environmental objectives. In my opening statements, I discussed the contrast between the successes of Texas energy policy, which has reduced energy emissions, and that of California, which has experienced a number of shortcomings resulting in rolling blackouts and other issues.

Can you speak to the difference in the way these two States approach incentivizing low-carbon energy production and reducing emissions while maintaining economic growth?

Dr. MICHOT FOSS. The most important difference is that we have an energy-only market, meaning electricity comes into the wholesale market on a full competitive basis. We have price caps that send price signals into the market that people respond to. Also renewable energy that has been developed, including probably yours at your household, Mr. Flores, have benefited from Federal tax supports. So there is that but one thing that we have done that—that is very difficult to do around the country is to build high-voltage transmission to carry renewable energy sources into the market. That was not easy. In fact, there is a lot to learn from that experience.

Mr. FLORES. OK. And my next question is this, and we may have to get to you answer it supplementally for me. We need to think about this beyond our borders and think globally. With respect to that, U.S. liquefied natural gas, or LNG, can ensure that global energy demand is met in a manner that minimizes greenhouse gas emissions while maximizing reliability and cost efficiency. So, based on your expertise, what are your thoughts on increasing LNG use and exports as a way to meet global energy, security, and environmental goals?

Dr. MICHOT FOSS. Mr. Chairman, should I answer?

Mr. TONKO. Please do.

Dr. MICHOT FOSS. OK.

Mr. TONKO. If you could do it quickly though.

Mr. FLORES. Thank you, Mr. Chairman.

Dr. MICHOT FOSS. To the extent that, as was already pointed out by other panelists, natural gas has a lower carbon content fuel, then what we would be helping to do through our LNG exports is reducing carbon emissions in other locations around the world the same way that we achieved carbon emission reductions here. It is low-hanging fruit. It is something to think about.

Mr. FLORES. Thank you very much.

I yield back.

Mr. Chairman, you are muted.

Mr. TONKO. Sorry about that.

The gentleman yielded back.

The Chair now recognizes the gentleman from California, Representative McNerney. You are recognized for 5 minutes, please.

Mr. MCNERNEY. Well, thank you, Chairman. I thank the ranking members, and I thank the witnesses. Interesting hearing this morning.

So watching the members' questions, I observed that we are—both sides are talking past each other, and that is unfortunate. The climate is clearly changing. It may not be impacting Ohio just yet, but it will. It is imperative to reduce carbon emissions, but energy security is also important, and everyone recognizes that. The challenge is to reduce emissions while improving energy reliability. I believe that that is possible.

And that is why I recently introduced H.R. 7975, the GREEN Workforce Act, which focuses on helping Americans train for and transition to careers in clean energy fields, providing them with the skills needed to develop and operate clean energy systems of the future.

Mr. Stephenson, thank you for your testimony. By all accounts, we will need millions of new jobs in order to fully recover from the economic impacts of the pandemic. But while the energy sector saw incredible job growth over the past decade, the distribution of that growth has not been equitable and diverse. What can be done ensure that the historically underrepresented groups are not overlooked as the clean energy jobs are created?

Mr. STEPHENSON. Yes, thank you for that question.

As I kind of alluded to earlier, within IBEW, ourselves, we have developed what we call IBEW Strong and that is designed particularly to make sure that we are reaching out to communities that haven't been part of the—particularly on our construction side—of the IBEW, that we are embracing and bringing different communities, people that maybe didn't think they have a place in the IBEW. It is part of the training and education of our local unions, of our apprenticeship programs. We just partnered with our National Electrical Contractors Association, NECA, and they are taking on the same goal, is to make sure we are increasing our diversity and inclusion within our construction industry. And so that's a vital part of it.

And as these new jobs are created, like I mentioned before, we have got training facilities all across the country. Every State, we have got training facilities. So we are in a position that we can, you know, bring these new workers into our programs, get them the training that they need to be successful, and lead the industry as these new technologies and new opportunities open up.

Mr. MCNERNEY. Thank you.

Dr. Saha, Dr. Fairchild, agriculture is the biggest economic sector in my district. In your testimony, you each highlighted the role of carbon farming in enhancing productivity, profitability, and resilience in the ag sector. Please describe the economic and climate benefits associated with improving soil health and sequestration.

Dr. Saha first.

Dr. SAHA. Hi. So, Yes, so natural carbon capture in trees and agricultural soil actually lead to emission reductions. But they also have a lot of economic benefits in terms of enhancing productivity, profitability, and resilience in U.S. farms, forests, and rural communities. So one thing, one strategy is, you know, tree restoration, whether it is happening in forests or interspersed across, you know, nonforested rural landscape. That has, you know, one of the greatest potential to sequester carbon.

Also things like improved soil management can enhance carbon storage in agriculture soils by reducing carbon losses or increasing carbon uptake, and these practices also provide other benefits, including reduced erosion or resilience to drought and in some cases increased eels (ph).

So these can open up significant opportunity for rural farming communities to economically benefit from the adoption of improved soil management practices.

Mr. MCNERNEY. Thank you.

Ms. Fairchild.

Dr. FAIRCHILD. I want to speak to the probably the distribution and processing side of this which really accounts for as much as 25, 20 percent—26 percent of energy waste appeared energy emissions and what we are doing is building—bringing the farmers closer to the markets by shortening the supply chain, working with anchor institutions, Eds and Meds, to buy sustainable foods and to buy locally.

And we are—we are building now an 800,000 square foot sustainable food factory, hiring 250 union workers in sustainable foods, and at the same time buying within the 250-mile food shed food products from farmers to—into that processing facility. So it addresses emission. It addresses jobs. It addresses business opportunities.

Mr. MCNERNEY. Thank you.

All right. Mr. Chairman, I will yield back.

Mr. TONKO. The gentleman yields back.

The Chair now recognizes the gentleman from South Carolina.

Representative Duncan, you are recognized for 5 minutes, please.

Mr. DUNCAN. Thank you, Mr. Chairman, and a very timely hearing. I want to thank all the panelists for being here. Bill Flores, great comments earlier.

I would be remiss if I didn't address the wildfires out West and really point to the failure of the folks in Western States from actively managing the Nation's forests. These are resources that the taxpayers own in many, many instances, and we are seeing over the last few years very rampant while fires out there. We have to ask ourselves: Why? If you look at the fires last year in California, many were started from faulty transition lines arcing and sparking. This year we have seen lightning strikes. We have seen terrorism, ecoterrorists, and arsonists. We have also seen a gender reveal party start one of the largest fires in California. That is well beyond any sort of climate change that you are trying to blame these fires on.

Let's look at what actually is causing the rampant wildfires to be as large and out of control as they are, and that is lack of forest management over a number of decades. That is prescribed burning.

We need to, as a Nation, realize that a little bit of nuisance during the winter and spring wet months for a prescribed burning, the smoke that is going come from prescribed burns that take that fuel out of the way is much better than the rampant smoke that we are seeing all across the West now coming from the wildfires in many, many States. And it is not just California. It is Washington. It is Montana. It is Oregon where we have not actively managed these fires.

We need to put in shading and firebreaks. We need to have prescribed burns. We need to manage the Nation's resources, and that is failure of many, many States and that is a policy, Mr. Chairman, I think we need to look at beyond climate change is look at how we manage the Nation's timber resources.

And all the experts in the field of forestry will agree with me that you have got to take the fuel away or you are going to experience this, regardless of the cause, whether it is a lightning strike or a faulty transmission line.

So, while I am talking about transmission lines, let's talk about what is going on in California this year that is pretty applicable to this hearing, and that is a 60-year failure of California energy structure to maintain and upgrade the transmission lines, the move toward renewable energy, which is intermittent. So, when you have really 100-plus days and a lot of demand, you see rolling brownouts and blackouts. That is going to happen when you go to a more renewable energy source.

Let me tell you what does work, and that is fossil fuels and nuclear power. If we want to lower our carbon footprint, we need to put more emphasis on nuclear power. In fact, let me show you this graphic. And there is a lot of windmills on that. I don't know that you can see this, but let me read this graphic. It takes 2,077 2-megawatt wind generators to produce about nine million megawatt hours of electricity, 2,000 windmills. The same energy can be produced by—one 1154-megawatt nuclear power plant produces about the same amount of energy. This—the square footage, you could put all of that—you know how much land it takes to put 2,000-something wind generators up? In less than 1 square mile footprint, you can have a nuclear power plant that is going to provide the same amount of low-carbon electricity generation. That is where we need to put our emphasis.

Ms. Fairchild, you talked earlier about hydro. I think Ms. Matsui was asking about hydropower and reservoir and clean water. This is rhetorical, but when was the last time that California built a reservoir to hold the water that is coming out of the Sierra Nevadas that is flowing into the ocean every year? Instead of holding that water to use as clean drinking water or use for hydropower, we are going to stop any sort of hydropower development in California because of a smelt order, not thinking about the need of human beings in California.

They need clean drinking water and the glaring need this year of good, stable, 24/7, 365 baseload power that is provided by nuclear power or hydro or fossil fuels that you are not going to get through renewables. And, look, I am all about renewables. I love it. I think it is groovy technology. I think it is part of the energy matrix. But we know what works, just like we know what works with active forest management of the resources that we have.

It is interesting that these wildfires aren't rampant in Canada or Mexico, a very similar topography as what we see in California. But when we see these wildfires are out of control, then we understand why. It is because we have not actively managed our forest resources, and we have got to do that. That is a policy change.

Mr. Chairman, I have 11 seconds. I want to thank you for this hearing.

And I think California and the Nation really needs to address active forest management and look at good, stable, 365, 24/7 baseload power supply generation that comes from fossil fuels, it comes from nuclear power, and upgrading our grid system to make sure that we don't have sparks that are causing a lot of fires in the past.

With that, I will yield back.

Dr. FAIRCHILD. Congressman, I wanted to correct for the record. I did not make a—take a position on water, on water power. So just wanted to correct that.

Mr. TONKO. OK. Thank you. Recognized.

So the gentleman yields back.

The Chair now recognizes the gentleman from California, Dr. Ruiz.

Representative Ruiz, you are represented for 5 minutes, please.

Mr. RUIZ. You know, as a Californian, it strikes me funny to hear a Republican from southern—South Carolina blame environmental laws for climate change and also recognizing that the vast majority of forest land in California is Federal land.

Mr. DUNCAN. Will the gentleman yield?

Mr. RUIZ. No.

I am Congressman Raul Ruiz. I represent California's 36th Congressional District, which includes 11 federally—I am sorry—got the wrong thing. I got all worked up after hearing that. One second.

You know, thank you again, Mr. Chairman, for holding this hearing. Today's hearing examines two of the most pressing issues facing Californians and my constituents right now: the massive economic toll of the COVID-19 pandemic and the devastating effects of climate change. Unemployment for my district remains above 13 percent, and small businesses from Hemet to Cathedral City have been contacting my office to share their specific hardships as a result of the pandemic.

At the same time, wildfires have torched 3.5 million acres in California, three percent of the State's total area including the 30,000-acre Apple fire, which threatened the city of Banning in my district. As climate change worsens, these fires will only get worse, more intense, and more frequent. And it is hard to imagine a worse fire season than what we have seen so far this year. That is why it is so important that we use this opportunity to invest in industries that can reduce our carbon output while also putting Americans back to work.

The daily high temperature in the Coachella Valley desert hasn't dropped below 100 degrees since June, and with more of my constituents at home during the day either because they are unemployed or working remotely, air conditioners are working overtime and requiring more energy and more costs than ever. There is no better time to invest in harnessing solar energy to lower utility bills, reduce carbon emissions, and save our environment and our health from climate change.

As of 2018, there were more than 2,300 individuals employed by solar energy companies in my district alone, and I believe that we can continue to grow this number and bring the promise of clean energy and secure unemployment to everyone. This is why I introduced H.R. 7849, the Renewable Energy Jobs Act, which would create a Federal grant to fund training programs that help people find good-paying jobs in renewable industries like wind and solar development.

Ms. Saha, in your testimony, you describe how investment in clean energy industries can help put Americans back to work. Specifically you describe how every $1 million invested in renewable energy can generate 78 full-time equivalent jobs. Can you give this committee a better sense of what that that means and how investment translates into employment?

Dr. SAHA. Absolutely.

Representative Ruiz, may I just take a few minutes to address something that—

Mr. RUIZ. We only have 1-minute and 50 seconds left. So, if you can address it in ten seconds and then answer the question, that would be wonderful.

Dr. SAHA. Absolutely.

We are hearing a lot of issues about how renewable energy is to blame for, you know, California's, you know, first rolling blackouts in 19 years. And I just want to say that that is a mischaracterization of the problem. So data shows that, right now, California's net electricity generation from one hydro renewable clean energy source is about 40 percent. Iowa has about 60 percent. So, clearly, the problem isn't the amount of renewable energy on the State's grid but what the State and its utilities are doing to balance its resources. So let's not blame renewable energy for rolling blackouts.

Mr. RUIZ. It is interesting that that argument also coincides with cuts in forest management in the budgets that we have seen over the past this administration and also the answer to this climate change is more reliance on fossil fuels.

Let me ask Mr. Stephenson a question, because I only have a few seconds. You know, we have worked closely with labor in making sure that labor has the ability to receive grant funding to train people in renewable energy jobs on-site. So how will investing in solar and wind energy development help create more job opportunities in places like the Coachella Valley where one of those large solar plants that we have been working on together help create more jobs?

Mr. STEPHENSON. As the new jobs, new technologies continue to move forward, it is going to be new training. It is going to be needed, you know, bring in more workers in, into the industry and getting them trained on the—on solar and wind, what have you. So and we are a part of that is our training programs. Like I said, we are all over the country. So we are prepared to do that and assess to get the trained people to not only do those installs, but also retrofit is also an important part of that process.

Mr. RUIZ. Thank you.

I have run out of time. So I will yield it back to the Chairman.

Mr. TONKO. OK. Thank you. The gentleman yields back.

The Chair now recognizes the gentleman from Georgia. Representative Carter.

You are recognized for 5 minutes, please.

Mr. CARTER. Thank you, Mr. Chairman.

And thank all of you for participating in this. This is certainly something that is extremely important, extremely timely. There is no question about that.

Dr. Foss, I want to start with you and ask you. When we discuss a transition to a low-carbon economy, we have to discuss the cost and the requirements that are associated with the supply chain. And certainly supply chains, as we know, are very important. I want to point out two examples of where supply chains are important.

First of all, I am old enough and I suspect there are some other members on this call who are old enough to remember the late 1970s when we realized that we were too dependent on foreign countries, particularly the Middle East, for our energy needs, and we needed to have more energy independence.

More recently, we have recognized that we are too dependent on other countries for our pharmaceutical needs. During this pandemic that we are experiencing right now, we understand that they are essential ingredients that we can't do without in order to—in order to manufacture some of our pharmaceuticals and in order to get those, we have to get them from other countries, and that is not a good position for us to be in.

So I appreciate the fact that you have pointed out that we need to look at this in detail. We need to look at the supply chain and to look at the cost and the sources of these materials.

I want to ask you, Dr. Foss. Do you believe that the energy policies that are being proposed really adequately factor in the requirements for mining for rare earth minerals, for the production of aggregates when we use—that are used in concrete and cement industries are the locations of where these minerals are mined?

Dr. MICHOT FOSS. No, sir, I don't.

Mr. CARTER. Well, I appreciate that. I appreciate you being succinct about that because it is an important point, and certainly it is an important point for us to recognize this.

You know, I live in what I consider to be one of the most beautiful areas in south Georgia. I represent the entire coast of Georgia. And if you look at that, you know, we have had a number of companies that have looked at mining, and we have got the Okefenokee Swamp, which is a great national treasure that all of us love and none of us want to see disrupted. Yet there are minerals there that could save us and help us in this country, but nobody wants it in their back yard, and I get it. I understand that, and that is one thing I think we have to take into consideration.

You also mentioned, Dr. Foss, in your testimony how the United States was ranked 12th overall in nonfuel mineral production. We know that many of these critical minerals are mined in poor conditions in areas like the Republic of the Congo, or they are used for strategic advantage by the Japanese—or by the Chinese—excuse me—and that they use them, just like I mentioned earlier, that we are witnessing right now that they are using the pharmaceuticals to their advantage. We understand that that is not a good position for us to be in, and we should not be in that position.

How important is it for us to factor into the supply chain questions when we are planning for future energy investments?

Dr. MICHOT FOSS. First of all, let me quickly correct the record. I had a cut-and-paste error in the testimony. We represent 12 percent of the global nonfuel mineral output, but we might as well be 12th when it comes to the things we don't produce sufficient amounts of.

So we have talked about—we put governance on the table, which is what you are talking about again, responsible mining and minerals production, responsible energy production from any source; it doesn't matter where it comes from, what the technology is. Best practice, that is another phrase. What is best practice? We have lots of engineering standards that are used, widely used, and indicative of best practice.

The huge difference is that, in our country, for better or worse, when projects are proposed of any sort, any type of industrial project, they undergo tremendous amounts of scrutiny. We have laws and rules to protect people, property, and the larger environment, and we have transparency. And if something happens, we know about it.

And what we would like to see is we would like to see a level playing field and see these kinds of things adopted, these kinds of values and practices adopted in other countries that are going to supply the global economy.

Mr. CARTER. Great. Well, I am out of time.

Dr. Foss, thank you very much.

And thank everyone who has participated in this today.

It has been a very good hearing, Mr. Chairman.

Mr. TONKO. I thank you. The gentleman yields back.

The Chair now recognizes the vice chair of the full committee, Representative Clarke, from my home State of New York.

Represent Clarke, you are recognized for 5 minutes.

Ms. CLARKE. Thank you so much, Mr. Chairman. And I thank our ranking member for convening today's hearing at such a critical time for our country.

As has been stated by numerous of my colleagues, we currently stand at the intersection of multiple crises: a public health crisis, an economic crisis, a crisis over longstanding racial injustice, and a climate crisis that threatens our very existence on this planet,

Now, as we look toward an economic recovery, we must address the deep-seated and interrelated issues with comprehensive solutions that put our country on the path to a more resilient and equitable future.

In my district in Brooklyn, we know the importance of resilience all too well. We have felt the impacts of climate change firsthand from Superstorm Sandy to summer heat waves that disrupt our power supply. And as our Nation experiences record fires out West and a record hurricane season down South, we know that resilience must be a primary consideration in all of our efforts to build a better future.

So I would like to begin by focusing on the idea of resilience starting with Dr. Saha.

Dr. Saha, in your testimony, you describe the importance of rebuilding a low-carbon economy that is resilient to future shocks from climate change and other crises. You also describe the importance of ensuring that decarbonization policies and technologies benefit all communities and not just those with the most resources.

Can you please expand on the need for what you refer to as climate-smart investments and how these investments in smarter, low-carbon technologies can start to build an economy that is simultaneously more resilient, competitive, and inclusive?

Dr. SAHA. Absolutely.

I think as we think about the benefits of transitioning to a low-carbon economy, we have to keep front and center issues of resiliency and equity because these are issues that are going to determine whether our climate policies are going to be effective in the long run as well.

So one of the things in terms of resiliency, let me, you know, give you an example from rural communities in this country. So plenty of research has shown that rural households suffer from a higher energy burden compared to their urban counterparts. So investments in things like energy efficiency can actually address that challenge that is being faced by rural communities, things like it can save them hundreds of dollars annually on utility bills. So, at a time when low income communities, whether in urban USA or in rural communities, are suffering from, you know, unemployment issues, thing like saving money on their utility bills is actually speaking to the whole resiliency issue.

So that is, you know, just one example that, you know, I would like to highlight.

Ms. CLARKE. Absolutely. Thank you very much, Dr. Saha.

Dr. Fairchild, your organization, Emerald Cities, works to build resilience in communities that are on the front lines of climate change, including communities in New York City who were impacted by Superstorm Sandy. You also mentioned in your testimony the importance of climate equity and how we need to bounce forward and not bounce back.

Can you please discuss the importance of building resilience in communities that you work with and how these efforts go hand in hand with investments in clean energy and climate equity?

Dr. FAIRCHILD. Thank you, Congresswoman, for the question.

And I was born and raised in Brooklyn and Queens. So I am homegirl.

The essence of resilience is that there is at least minimally issues of redundancy. If the central energy grid goes down, people still have the ability to turn on their lights, to cook, and to plug in their iPhones. The same with the food system, as in COVID, when the food central distribution system falls down, where do we get our food from? So we are doing things like, for example, just in Brooklyn, the Armory is actually—and this is what frontline communities are organized to do—putting solar on top of the Armory that would feed clean energy, renewable energy to the surrounding neighborhoods. I believe it is about 2 kilowatts, 2 megawatts of clean energy that is being produced. Folks are looking for micro grids, community energy districts that will allow them to be resilient in the case of—so we don't see a Puerto Rico, where the whole city, whole county goes black because there is no backup generation, no energy.

So how do we build these decentralized energy infrastructures, decentralized food infrastructure that allows us to be resilient in the case of extreme whether?

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

I yield back.

This is a very good hearing. Look forward to much further consideration and conversation as we move forward to advance our Nation with clean energy future. Thank you.

And I yield back.

Mr. TONKO. Thank you. I have to note that all roads lead to Brooklyn, according to—

Ms. CLARKE. Yes, they do, sir.

Mr. TONKO. So the gentle lady yields back.

And I now recognize the gentle lady from Michigan, Representative Dingell, you are represented for 5 minutes, please.

Mrs. DINGELL. Thank you, Chairman Tonko. Thanks for holding this hearing. As my other colleagues having said, it's a great hearing.

And thank you to all of the witnesses, who I know by the time you get to somebody like me, you will be glad when this is over.

But today's hearing is incredibly important as we find ourselves confronting multiple intersecting crises. No State, no community, no sector of our economy has been spared from COVID-19, and the public health and economic impacts have been devastating, and tragically this crisis is only getting worse.

But the parallels to the climate crisis are unmistakable. The human and economic toll of unmitigated climate change aren't a distant inevitably. They are here and wreaking havoc on our communities. If you just look at the headlines this week: The West is on fire. Hurricane Sally is pounding the Southern States, and scientists believe two major Antarctic glaciers are on the verge of breaking free.

This is what climate change looks like, but we have got time to work together and to act boldly. It is time to reboot our economy and create a cleaner, more inclusive future for all Americans. And I hope that all of us can work together to summon the courage to act with the urgency that we need to tackle the climate crisis and come together on a way forward.

It is always good to see my brothers and sisters in labor at the table. I think they are a very important voice. Mr. Stephenson, your testimony discusses how Congress and this committee in particular can revive American manufacturing. I think that is critical.

Can you please expand on how manufacturing policy, coupled with major public investments, can support America's middle class while addressing the climate crisis? It is not either/or but especially in the context of today's economic downturn.

Mr. STEPHENSON. Yes. Thank you.

And it is critical that all the jobs that could be created or should be created as we continue to move into a more carbon neutral or renewable energy source; there is lots of manufacturing jobs that could be out there. And that is going to not only, you know, when you go into the auto industry and converting to more electric vehicles and all the building, the manufacturing of the batteries that we have already talked about, the solar panels, the wind turbans. If we could truly manufacture that here in States, it would create hundreds of thousands of good-paying, quality jobs for Americans in this country.

Mr. DUNCAN. Thank you.

And your testimony also expressed support for a national climate bank, much like the one that I have introduced this session. That program, the Clean Energy and Sustainable Accelerator, was included in the infrastructure bill that passed the House in June and is also in the Clean Economy Jobs and Innovation Act that was introduced yesterday. With $20 billion in funding, the accelerator would finance and stimulate private investment in low and zero carbon technologies and infrastructure, creating millions of new jobs.

Mr. Stephenson, can you tell us how Federal investment and climate action would help mobilize private investment and why attaching strong labor protections to recovery spending would benefit Americans workers?

Mr. STEPHENSON. Yes. Again, you know, with the investment of the United States Government in moving this, you know, these initiatives forward, we have more people stepping up, entrepreneurs that are looking at getting involved, even small business people that could participate in this as we are, you know, continuing to build the infrastructure that is needed. Like I said, we have all the materials to provide for the services for the manufacturing. There are just multiple ways that investment would help encourage and build those companies, those employers, and their workers.

Mrs. DINGELL. Thank you.

The Clean Energy and Sustainable Accelerator also includes designated funding for one of my top priorities, which is accelerating the electrification of vehicles and fleets.

Dr. Saha, your testimony discusses the importance of electrifying vehicles and expanding EV infrastructure. Can you please elaborate on the benefits of investing in transportation electrification? What scale of investment is needed to truly move the needle on electrification to realize both its economic and climate benefits?

Dr. SAHA. Absolutely. Let me just say that transportation is now the largest source of greenhouse gas emissions in the United States. So we need a comprehensive set of policies that addresses vehicles, fuels, infrastructure, as well as mobility options. So, in terms of infrastructure, I think Congress needs to facilitate the development of an electric vehicle charging network that anticipates and enables the transition to 100 percent zero emission vehicle fleet.

Mrs. DINGELL. Thank you.

Mr. Chairman, my time is up but I would like to request unanimous consent to submit a report by the Political Economy Research Institute at the University of Massachusetts Amherst on the job creation estimates for various economic stimulus proposals, showing the benefits of a recovery based on the principles of the thrive resolution.

Mr. TONKO. Without objection.

[The information appears at the conclusion of the hearing.]

Mrs. DINGELL. Thank you, Mr. Chairman.

Mr. TONKO. I would like to—I believe that completes the list of colleagues who wanted to ask questions of our witnesses.

With that, I would certainly thank our witnesses for joining us for today's hearing. I thank you for your time, for your patience, and certainly for your input. It has been a very valuable hearing.

And I remind Members that, pursuant to committee rules, they have ten business days by which to submit additional questions for the record to be answered by our witnesses.

I ask that our witnesses please respond promptly to any such questions that you may receive.

I now have a long list of requests for unanimous consent to enter into the record. So allow me to just run through this list.

A letter from the Evangelical Environmental Network;a letter from the coalition of communities, environmental groups, and researchers regarding critical minerals;a letter from the American Lung Association and accompanying report entitled "The Road to Clean Air: Benefits of a Nationwide Transition to Electric Vehicles"; a report from Resources For the Future and the Environmental Defense Fund entitled "Environmental Remediation and Infrastructure Policies Supporting Workers and Communities in Transition"; a report from Resources for the Future and the Environmental Defense Fund entitled "Economic Development Policies to Enable Fairness For Workers and Communities in Transition";a report from World Resources Institute entitled "America's New Climate Economy: A Comprehensive Guide to the Economic Benefits of Climate Policy in the United States"; a letter from Clean Transportation Stimulus Coalition; a letter from Earthjustice and an accompanying report entitled "Equitable and Just National Climate Platform"; a report from the Political Economy Research Institute at the University of Massachusetts at Amherst entitled "Job Creation Estimates through Proposed Economic Stimulus Measures"; a letter from the Solar Energy Industries Association; a Federal registered final list of critical minerals; a May 2019 Foreign Policy article entitled "China Raises Threat of Rare-Earths Cutoff to the United States"; a December 2018 Bloomberg article entitled "China Has a Secret Weapon in the Race to Dominate Electric Cars"; a May 2020 Foreign Policy article entitled "U.S. Falters in Bid to Replace Chinese Rare-Earths"; a report from the Department of Energy entitled "Critical Materials Rare-Earth Supply Chain: A Situational White Paper"; a report from the Department of Commerce entitled "The Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals."

Mr. SHIMKUS.

Mr. TONKO. Do we have a problem with that one?

Mr. SHIMKUS. No, no, sir.

Mr. TONKO. OK. A December 2017 executive order from Donald J. Trump entitled "Presidential Executive Order on a Federal Strategy and Reliable Supplies of Critical Minerals"; a January

2020 AAAS article, AAAS article, entitled "Sustainable Minerals and Metals for a Low-Carbon Future"; and, finally, the announcement from Exelon entitled "Nuclear Plants in All Regions of the Country Have Announced Premature Retirement

With that, I now request unanimous consent to enter these items into the record.

Mr. SHIMKUS. Mr. Chairman, we reserve the right to object. I am not going to object. I want to take this time to thank the panelists. They did a great job.

It is virtually this is always challenging, but you took a lot of great questions, and I think it was a very good hearing.

So I will not object, Mr. Chairman. And thank you for having it.

Mr. TONKO. OK. I share your sentiments totally. We thank you for your participation and cooperation on the other side of the aisle.

And, without that objection to request for unanimous consent, so ordered.

[The information appears at the conclusion of the hearing.]

Mr. TONKO. And at this time, the subcommittee is adjourned.I21Thank you, everyone.

[Whereupon, at 12:51 p.m., the committee was adjourned.]

EEN EVANGELICAL ENVIRONMENTAL NETWORK

YECA YOUNG EVANGELICALS FOR CLIMATE ACTION

Rep. Nancy Pelosi, Speaker of The House
H-232 Capitol Building
Washington, DC 20515

Majority Leader Mitch McConnell
S-230 Capitol Building
Washington, DC 20510

Rep. Kevin McCarthy, Minority Leader
H-204 Capitol Building
Washington, DC 20515

Senator Charles Schumer, Minority Leader
S-221 Capitol Building
Washington, DC 20510

Dear Speaker Pelosi, Majority Leader McConnell, and the Leadership of the United States Congress:

Everyone deserves the abundant life (John 10:10) promised by Jesus. This includes the right to live in a clean, healthy, just, and fair community free from the devastating impact of fossil fuel pollution and the COVID-19 symptoms that it exacerbates.

Our belief is based in our Scriptures, which state:

> ***But let justice roll on like a river, righteousness like a never-failing stream! (Amos 5:24, NIV)***
>
> ***And what does the Lord require of you? To act justly and to love mercy and to walk humbly with your God. (Micah 6:8b, NIV)***

Today we face not one but two direct attacks on our wellbeing. First, we struggle with COVID-19 and the quickly approaching death toll of 150,000 Americans. At the same time air pollution, primarily caused by fossil fuel combustion, kills 194,000 Americans every single year, including over 5,000 newborn babies.

These twin tragedies are connected.

Air pollution in the form of smog (ground level ozone), soot ($PM_{2.5}$) and other pollutants compromises our respiratory and cardiovascular systems. This in turn exacerbates the symptoms of COVID 19, especially in communities of color where higher rates of illness or death occur due to increased exposure to harmful pollution. Even before COVID-19 reared its terrible head, we have been subsidizing the fossil fuel industry with almost 200,000 American lives each year.

God created each of us. Therefore, every human life is sacred. That is why it is so important to defend life at every stage from all that threatens its flourishing: by combating racism, by listening to medical professionals, and by acting out of concern for our most vulnerable neighbors. Defending life is our topmost concern—as such, we can no longer separate the COVID-19 and the pollution crisis in America. The good news is we can address both at the same time.

As Congress considers a new stimulus package, they would be wise to consider the demands of over 2 million pro-life Christians, dedicated to defending the lives of their children, who have called for 100% clean energy by 2030 and almost 65,000 of whom recently urged Congress to provide healthy, clean, family-supporting jobs in the next stimulus package.

We are not alone in this request. The Evangelical Environmental Network joined with the **Coalition for Clean Energy and Healthy Communities**. While we and our coalition partners do not share identical motivations or strategies, we have come together—putting our differences aside during this critical and unprecedented time in our nation's history and for our children's future—to seek a common and righteous goal: to overcome COVID-19, defend our children's lives from pollution, and rebuild a clean economy that offers hope for all while addressing the climate crisis.

The Coalition for Clean Energy and Healthy Communities (CCEHC) is a convening of 41 organizations representing millions of people across the country demanding that Congress prioritize policies that provide direct assistance to people, create good jobs for all—including in the clean energy sector—bolster policies that will grow the economy and cut pollution, correct inequities linked to environmental injustices and health disparities, address the climate crisis, and accelerate the transition to cleaner sources of energy.

As evidenced by our petition language, the Evangelical Environmental Network and almost 65,000 pro-life Christians from around our nation have the same goals:

> ***During this coronavirus crisis, I join with thousands of other pro-life Christians to ask our Senators and Representatives to continue to come together, setting partisanship aside, and to create a cleaner, brighter, and healthier future for all Americans. Our God transforms bad into good. We must do the same for our country. We ask that once it is safe to resume normal economic activity, we put people back to work in ways that support healthy lives and livelihoods by:***
>
> ***1. Making our transportation, energy, manufacturing, and building industries more efficient and less harmful to our health.***
> ***2. Helping our farmers practice good stewardship that locks carbon away in the ground while enriching the soil and providing financial support to the men and women who put food on America's table.***
> ***3. Putting millions of Americans to work to make it happen.***

We are at a critical juncture in the effort to jumpstart an economic recovery from the coronavirus crisis - a juncture that will impact the health and prosperity of Americans today and for generations to come. The Evangelical Environmental Network and CCEHC strongly urges that any COVID-19 relief package, economic stimulus package, or other legislation designed to drive economic growth include provisions that meet the criteria described below.

We need Congress to provide immediate relief to our hard-hit states and local communities, our healthcare and essential workers, and other American workers and facilities that have been devastated by the recent pandemic and its attendant health and economic impacts. As a nation, we have the historic opportunity to rebuild a stronger, more sustainable, more equitable country for ourselves and our children. And we must come together to do so. The need is urgent and we can't let this opportunity pass us by. While we, as conservatives, continue to desire accountable government that is fiscally responsible, we also understand that the people of the United States cannot endure a recession like a decade ago. Therefore, we are committed to working with Congress to pursue bipartisan legislation that seeks to immediately spur job creation by drawing on the promise of the future rather than holding tight to the answers of the past.

Specifically, we are seeking the following priorities.

Clean energy incentives: It is well documented that mature and declining industries like fossil fuels have received at least nine (9) times more U.S. government support than renewable fuels.[1] Even the *Lazard Levelized Cost of Energy 2019 Report*[2] convincingly shows how utility-scale wind and solar electric generation already provide lower cost energy than coal and, when paired with storage, are becoming competitive with natural gas in many markets. Investment in clean energy will accelerate this transition while reducing the pollution impacts on frontline communities that led to severe health impacts before the crisis, and higher mortality rates during the pandemic. Congress should support clean energy tax incentives for technologies that are truly clean and do not exacerbate pollution.

Building efficiency and bolstering electrification: During the pandemic and beyond, we need to improve building efficiency and bolster electrification to lower utility bills for families, small businesses and communities, while we reduce pollution and ensure that everyone has access to adequate heating and cooling. Specifically, Congress should provide additional assistance to the Low-Income Home Energy Assistance Program (LIHEAP), Weatherization Assistance Program (WAP), and Community Development Financial Institutions Fund (CDFI).

Clean transportation: Pollutants from fossil fuel combustion harms respiratory and cardiovascular health, exacerbating the symptoms of COVID 19. Transportation investments and policy solutions must work towards reducing pollution and providing affordable and accessible transit options for our communities. These solutions should also provide greater mobility options for transit, move toward transportation electrification for people and goods, and be based on resilient infrastructure. Specifically, Congress should invest in mass transit and the Diesel Emissions Reduction Act (DERA).

Building resilient communities: The compounding effects of COVID 19, the current hurricane season, threats from wildfires, and other hazards put local communities and emergency managers at greater risk than ever. It is time to invest in building more resilient communities, particularly frontline, vulnerable, Indigenous and communities of color that have suffered from disinvestment and been disproportionately affected by pollution and extreme weather for too long. Specifically, we support additional investment in the Community Development Block Grant Program (CDBG),

[1] Mitchell Hescox and Paul Douglas, Caring For Creation: The Evangelical's Guide to Climate Change and a Healthy Environment, Bethany House, Minneapolis, MN, 2016, p.116-117.

[2] https://www.lazard.com/perspective/lcoe2019

the Environmental Protection Agency's Environmental Justice Grant Program, and the PREPARE Act.

<u>Clean and safe water</u>: We need immediate action to ensure all individuals and families have access to clean water. We must also consider significant, long-term investments in our water programs and systems across the country to eliminate water inequities, spur economic recovery and growth, and build strong, resilient communities. Specifically, we urge that Congress enact protections to prevent water shut offs, while encouraging investments in expanding water affordability.

<u>Land and water restoration</u>: Land and water restoration will improve biodiversity for overall ecosystem health and should ease the pollution burden on communities, while related infrastructure projects will get people back to work. In the immediate term, we support the expansion of efforts to clean up orphan wells, which will boost much-needed jobs and keep our waterways and skies freer from pollution.

Now is the time for bold leadership. Our country is suffering under debilitating health and economic conditions that will require creativity, collaboration, massive resources, and the courage and determination to do all that is necessary to defend life and secure livelihoods. All actions by Congress should first provide much needed relief to the impacted communities and workers who are suffering most. Additionally, Congress should implement recovery strategies that address the causes of, and accelerate the recovery from, COVID-19 in a way that protects the long-term health and vitality of our people and our economy. We do not have to choose between a healthy environment and a healthy recovery. We can and must have both.

Thank you for your service and commitment to our country.

Sincerely,

Rev. Mitchell C. Hescox
President/CEO
Evangelical Environmental Network

Dr. Jessica Moerman
Senior Director, Science and Policy
Evangelical Environmental Network

Rev. Kyle Meyaard-Schaap
National Organizer and Spokesperson
Young Evangelicals for Climate Action

Arizona Faith Network • Arizona Trail Association • Black Hills Clean Water Alliance • Californians for Western Wilderness • Center for Biological Diversity • Conservation Northwest • Conservatives for Responsible Stewardship • Cook Inletkeeper • Dustin Mulvaney, Professor, San Jose State University • Earthworks • Earthjustice • Environmental Law & Policy Center • Environmental Protection Information Center • Harvey Young, Fishing Outfitter & Guide • Friends of the Earth • Friends of the Sonoran Desert • Gila Resources Information Project • Grand Canyon Trust • Greenpeace • HECHO • James J. A. Blair, Assistant Professor, California State Polytechnic University, Pomona • Kalmiopsis Audubon Society • Klamath Forest Alliance • Klamath-Siskiyou Wildlands Center • LEAD Agency, Inc. • League of Conservation Voters • Lynn Canal Conservation, Inc. • Malach Consulting • Mining Impact Coalition of Wisconsin • Montana Environmental Information Center • National Parks Conservation Association • Native Fish Society • Natural Resources Defense Council • Nevada Conservation League • NM Environmental Law Center • Northeastern Minnesotans for Wilderness • Ocean Conservation Research • Oregon Wild • Patagonia Area Resource Alliance • Physicians for Social Responsibility, AZ Chapter • Portneuf Resource Council • PWYP-US • Rock Creek Alliance • Rogue Valley Citizens for Clean Air • Save Our Cabinets • Save Our Sky Blue Waters • Seven Circles Foundation • Sierra Club • Smith River Alliance • Soda Mountain Wilderness Council • Southern Utah Wilderness Alliance • The Lands Council • The Wilderness Society • Thea Riofrancos, Assistant Professor, Providence College • Upper Peninsula Environmental Coalition • WaterLegacy • WaterWatch of Oregon • Western Environmental Law Center • Western Organization of Resource Councils • Western Values Project • WildEarth Guardians

September 15, 2020

The Honorable Frank Pallone
Chairman
House Committee on Energy & Commerce
United States House of Representatives
Washington, DC 20515

The Honorable Greg Walden
Ranking Member
House Committee on Energy & Commerce
United States House of Representatives
Washington, DC 20515

Dear Chairman Pallone and Ranking Member Walden:

The undersigned mining-impacted communities, academic experts, and organizations representing millions of members and supporters urge you to oppose any language or legislation that curtails the mining review and permitting processes, or increases domestic mining without appropriate safeguards and reform of the 1872 Mining Act. In recent months, we have seen an increase in misleading arguments from certain members of Congress that are attempting to use national security and child welfare concerns to legitimize their efforts to make it easier and cheaper for mining companies to operate on U.S. soil. In order to have a secure *and* responsible mineral supply chain, we must first update our antiquated mining laws that put our public lands, drinking water, and indigenous lands at risk each day. We reject the need for legislation such as S. 1317, the American Mineral Security Act, to be included within COVID-19 stimulus legislation or other legislative vehicles.

We first want to address a number of fallacies that have become more popular since the pandemic put a spotlight on supply chain issues. The first is the falsehood that our supply of so-called "critical minerals" is low. U.S. mining interests articulate a future of scarcity for various minerals that are listed by the current administration as critical for national security -- such as uranium -- in order to get financial and regulatory support. This vision of a scarce future is as unlikely as it is dishonest for the majority of these critical minerals. The Strategic and Critical Materials Stockpiling Act, as well as several other existing statutes, already mandates that the U.S. maintain a sufficient supply of critical mineral reserves[1]. Additionally, we get a huge percentage of our critical mineral imports from allies with strong labor laws. For example, Australia and Canada, both U.S. allies, have the largest and most economically recoverable uranium resources in the world[2]. The U.S., which only contains 1% of the global uranium resource, can easily source uranium from these uranium-abundant countries. For defense purposes, the United States has decades' worth of uranium supplies.

As a practical matter, minerals are internationally traded commodities on world markets often owned by foreign companies. The best way to ensure a reliable supply of these critical minerals is to maintain our alliances with nations that source these minerals, while promoting public and private sector investment in research, conservation, recycling, and substitution. Ultimately, securing our supply of critical minerals has little to do with domestic mining. Global supply, refining, and product manufacturing chains allow for greater efficiency, creating lower costs for consumers, including the U.S. Military. This supply chain diversity lowers disruption risks. Even in the event of a disruption, both the free market and free trade principles help regulate the behavior of market participants. For example, in 2010, when China restricted the export of certain minerals[3], markets and the international community responded precisely how they should. Savvy investors provided capital for new critical minerals projects. The Mountain Pass rare earth and molybdenum mine in California re-opened for business. Australia opened the Mount Weld mine. Critical mineral manufacturers and consumers diversified their supply chains, researched alternatives, and increased recycling.

An additional falsehood propagated by the mining industry is that U.S. regulations keep mining companies from competing globally. The U.S. has some of the most pro-mining policies in the world[4], essentially allowing unfettered access for mining on public lands via a mining law from 1872 that has never been updated. The U.S. has a competitive market for minerals that is aided by policy that ensures permitting is efficient and revenues are unhampered. Opening a new mine takes on average two years, which is on par with other modern democracies with robust mining industries, such as Australia, Canada, and Norway[5]. States such as Arizona, Alaska and Nevada were identified by a global survey[6] as among the top 10 most attractive jurisdictions in the world for mining investment.

The U.S.'s pro-mining policy effectively allows multinational mining corporations to send their profits to CEO's in foreign countries while they pollute our public lands and waters for free, without paying any royalties for the minerals they take from American public lands. Communities across the

[1] https://www.dla.mil/HQ/Acquisition/StrategicMaterials/About.aspx
[2] https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production.aspx
[3] https://www.heritage.org/asia/report/china-paper-tiger-rare-earth-minerals
[4] https://www.fraserinstitute.org/sites/default/files/annual-survey-of-mining-companies-2019.pdf
[5] https://www.gao.gov/assets/680/674752.pdf
[6] https://www.fraserinstitute.org/sites/default/files/annual-survey-of-mining-companies-2019.pdf

country are living with pollution from mining accidents, and taxpayers -- not the polluters -- are often paying for a cleanup bill which has reached $50 billion dollars across an estimated 500,000 abandoned hardrock mines[7]. We need to hold mining companies accountable for their pollution, in order to protect communities and save taxpayer dollars. American taxpayers already shoulder an enormous financial burden from hardrock mining. The EPA estimates the backlog of cleanup costs for these mines is between $20 to $54 billion dollars[8] -- vastly more than the entire annual Superfund budget, which the Trump Administration has proposed to cut further.

And again, unlike other extractive industries, such as the coal industry, under the 1872 law, mining companies pay no royalties nor a reclamation fee. Whoever stakes a claim and discovers valuable minerals on public lands claims those riches -- more than $300 billion dollars and counting since 1872 -- without giving taxpayers a dime. We are seeing a massive increase in threats to public lands and communities from mining, including in some of our country's most iconic places: uranium mining near the Grand Canyon; copper-nickel mining near the Boundary Waters Canoe Area Wilderness; uranium exploration in Bears Ears; lithium mining in the Black Rock Desert; and copper and gold mining in Bristol Bay. It is irresponsible to talk about weakening standards and increasing domestic mining when our national treasures are being divvied up in backroom deals, without public input. The needed reform is not that which further guts process and review, but rather that which protects and better balances the needs of communities, tribes, and future generations so they are not left bearing the environmental and public health costs domestic mining has regularly left in its wake.

We must reform our mining laws in order to protect communities and the environment by balancing industrial scale mining with other important land uses, such as conservation, recreation and tourism, municipal water supplies, and renewable energy development. EPA reports that metal mining is the nation's largest toxic polluter[9], and that 40% of the headwaters of western watersheds are polluted by mining. Every day 50 million gallons of contaminated wastewater stream from abandoned hardrock mines— 20 million gallons of which run untreated into our drinking water systems[10]. These new and abandoned mines disproportionately impact tribes and Tribal Land, polluting land and water that many tribes depend on for subsistence.

There are better ways to meet our growing mineral demand than to bailout multinational mining companies or remove regulations on domestic mining that protect, among other things, public health. Public and private sector investment all over the world has spurred innovations in recycling and reuse of critical minerals. In addition to improvements in efficiency, there is tremendous opportunity in "re-mining" the wastes left behind from 150 years of manufacturing, particularly for minerals such as copper, nickel, and aluminum. Our focus and funding should be going towards finally reforming our mining law by passing H.R. 2579, the Hardrock Leasing and Reclamation Act of 2019, and scaling up

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[7] https://earthworks.org/cms/assets/uploads/2017/12/EPA-542-R-04-015-Cleaning-up-the-nations-waste-sites.pdf
[8] https://earthworks.org/cms/assets/uploads/2017/12/EPA-542-R-04-015-Cleaning-up-the-nations-waste-sites.pdf
[9] https://www.epa.gov/sites/production/files/2020-02/documents/industry_sectors.pdf
[10] https://www.pbs.org/newshour/nation/u-s-mining-sites-dump-50-million-gallons-of-fouled-wastewater-daily

innovations around recycling, reuse and re-mining, rather than proposals like S. 1317 being proposed for the most recent stimulus legislation.

We oppose S. 1317, and any similar legislation that would undermine environmental safeguards to push reckless mining projects, including the improper use of "byproducts" language to effectively make any mine a "critical mineral mine" with less environmental review as a consequence; broad secretarial discretion on what is considered a "critical mineral," such as uranium fuel; and the establishment of certain timelines for environmental review that restrict public input. By directing the Secretaries of Interior and Agriculture to accelerate the permitting of hardrock mining across our public lands, this provision in the "HEALS Act" puts a strong finger on the scale in favor of limiting environmental review, short-changing public input and ultimately approving large destructive mining projects, which will have substantially negative impacts for our clean water, air quality, wildlife, and communities. The Pebble Mine in Bristol Bay, Alaska is a prime example of why environmental review for large-scale mines should not be rushed. The Pebble Mine is a massive project that jeopardizes the world's largest and most productive wild salmon fishery, yet the Army Corps of Engineers has fast-tracked the environmental review process by ignoring important data and analysis and dismissing the input and concerns of Alaska Native Tribes, respected independent scientists, and other state and federal agencies. This resulted in a grossly deficient Environmental Impact Statement. Congress should fight to keep this from becoming the new normal.

Hardrock mining is considered to be the most toxic industry in the U.S. to our communities and natural resources and, therefore, development of "critical minerals" should not mean limiting environmental review under the National Environmental Policy Act and/or reducing public input in mining decisions on public lands. Rather, these decisions must protect communities and cultural resources, safeguard our air and water, and protect wildlife, wildlands, and national parks. For decades, the mining lobby has blocked much-needed 1872 Mining Law reform that would fairly treat both public land owners -- all Americans -- and mining companies. They are now using a public health emergency to help remove the few community safeguards that remain on mining projects.

If we want to obtain critical mineral security, we must focus on safe forms of reuse and recycling, and update our mining laws to protect communities, land, and water; not reduce or remove necessary community and public lands safety regulations. We ask you to reject the inclusion of S. 1317, the American Mineral Security Act, in any stimulus legislation, and ask you to oppose any legislation that suggests we must rush to strip our lands of resources, and the public of its voices for the false promise of enhanced national security.

Thank you for your consideration.

Arizona Faith Network
Arizona Trail Association
Black Hills Clean Water Alliance

Californians for Western Wilderness
Center for Biological Diversity
Conservation Northwest
Conservatives for Responsible Stewardship
Cook Inletkeeper
Dr. James J. A. Blair, Assistant Professor, California State Polytechnic University, Pomona
Dustin Mulvaney, Professor, San Jose State University
Earthworks
Earthjustice
Environmental Law & Policy Center
Environmental Protection Information Center
Harvey Young, Fishing Outfitter & Guide
Friends of the Earth
Friends of the Sonoran Desert
Gila Resources Information Project
Grand Canyon Trust
Greenpeace
HECHO
Kalmiopsis Audubon Society
Klamath Forest Alliance
Klamath-Siskiyou Wildlands Center
LEAD Agency, Inc.
League of Conservation Voters
Lynn Canal Conservation, Inc.
Malach Consulting
Mining Impact Coalition of Wisconsin
Montana Environmental Information Center
National Parks Conservation Association
Native Fish Society
Natural Resources Defense Council
Nevada Conservation League
NM Environmental Law Center
Northeastern Minnesotans for Wilderness
Ocean Conservation Research
Oregon Wild
Patagonia Area Resource Alliance
Physicians for Social Responsibility, AZ Chapter
Portneuf Resource Council, non-profit
PWYP-US
Rock Creek Alliance
Rogue Valley Citizens for Clean Air
Save Our Cabinets
Save Our Sky Blue Waters
Seven Circles Foundation
Sierra Club
Smith River Alliance
Soda Mountain Wilderness Council
Southern Utah Wilderness Alliance

The Lands Council
The Wilderness Society
Thea Riofrancos, Assistant Professor, Providence College
Upper Peninsula Environmental Coalition
WaterLegacy
WaterWatch of Oregon
Western Environmental Law Center
Western Organization of Resource Councils
Western Values Project
WildEarth Guardians

September 15, 2020

Chairman Frank Pallone, Jr.,
House Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515

Ranking Member Greg Walden
House Committee on Energy and Commerce
2322 Rayburn House Office Building
Washington, DC 20515

The Honorable Nancy Pelosi
Speaker
US House of Representatives
H-232, The Capitol
Washington, DC 20515

The Honorable Kevin McCarthy
Minority Leader
US House of Representatives
H-204, The Capitol
Washington, DC 20515

Dear Speaker Pelosi, Minority Leader McCarthy,Chairman Pallone, and Ranking Member Walden:

On behalf of our tens of millions of members and supporters nationwide, we thank you for your strong efforts to combat COVID-19 and safeguard Americans during this crisis. We urge you to continue your work to prioritize public health and frontline workers. **As Congress looks to rebuild and stimulate the economy, we also urge you to invest in a major clean transportation stimulus package that will go a long way in putting Americans back to work, increasing American competitiveness, and protecting our health and climate. This includes relief and stimulus investment in electrifying the entire transportation sector and supporting public transit. We specifically recommend that a stimulus program accelerate clean transportation manufacturing, invest in electric vehicle infrastructure, deploy electric buses in transit and school bus fleets, and make electric cars and trucks more affordable to consumers and businesses.**

Growing electric vehicle related manufacturing and deployment will accelerate job growth. In 2019, in the vehicle sector alone, there were more than 250,000 people employed in jobs related to hybrid and electric vehicles, and nearly 500,000 working in jobs focused on fuel efficient components. Tens of thousands of them have already lost their jobs due to the COVID-19 crisis. Creating strong incentives for clean transportation will help put these and other Americans back to work.

Investing in electrifying the transportation sector will help the most vulnerable among us. According to recent analysis, being chronically exposed to slightly elevated air pollution is linked to notably higher rates of death in people with COVID-19. The transportation sector is a significant and dangerous source of particulate matter (PM) and nitrogen oxide (NOx) pollution. Additionally, studies show that low-income neighborhoods and communities of color breathe in the dirtiest sources of pollution, causing higher rates of asthma, cancer, and respiratory issues. The transportation sector is also the leading source of climate-damaging pollution. Climate change fuels dangerous storms, droughts, and wildfires that put American lives and our nation's economy and security at risk.

Electric vehicles (EVs) are much cleaner than their conventional gasoline and diesel counterparts, even when accounting for power plant emissions associated with charging EVs. These vehicles are also unique in their ability to become even cleaner as the electricity grid is increasingly powered by low- and zero-emissions power. EVs also do not emit PM or NOx from tailpipes, directly impacting local air quality. What's more, countries worldwide are moving rapidly to capture this growing market, and the U.S. risks being left behind.

We urge you to consider the following pro-worker, pro-economy, pro-public health, and pro-climate transportation electrification and transit investments as top-tier priorities that should be included in forthcoming COVID-19 stimulus packages:

1. Invest at least $20 billion in domestic clean vehicle and parts manufacturing

Due to the pandemic and the economic crisis associated with it, American manufacturing is at risk, particularly in the vehicle sector. The automotive industry accounts for a major portion of U.S. manufacturing and a disproportionate amount of U.S. GDP and research and development. The industry employs more than a million manufacturing workers directly and millions more indirectly. At least 40 manufacturers in the U.S. offer more than 100 different models of electric trucks, school and transit buses, and passenger vehicles, but other nations worldwide are moving even faster to capture this rapidly growing global market. A smart and robust stimulus investment in the manufacturing of zero emission vehicles, batteries, battery cells, and other advanced vehicle technology in the U.S. can bring back jobs to communities across the nation and help U.S. companies compete in a global marketplace that is rapidly moving toward electrified transportation.

Congress can leverage several existing programs to expand American clean light-, medium-, and heavy-duty vehicle manufacturing:

- **Expand and update the Advanced Technology Vehicles Manufacturing Program (ATVM) for today's economic landscape** by allowing medium- and heavy-duty electric vehicle manufacturers and suppliers to apply for this revolving loan program, which will accelerate scale for this nascent industry. Expanding the criteria will encourage new applicants, particularly in this economic downturn. There are provisions to do this in the No EXHAUST Act (H.R. 5545) as well as in the ATVM Program Reform Act (H.R. 5860).
- **Fund the Manufacturing Conversion Grants authorized in section 132 of the Energy Independence and Security Act** - These grants would provide direct funding to manufacturers to retool plants that are closed or are at risk closing to help accelerate the manufacture of EVs and critical components.
- **Robustly fund the 48C tax credit** that supports small and medium sized business to retool to build clean energy and vehicle technology, and make this tax credit refundable.

2. Invest $20 billion in electric vehicle charging infrastructure

Building out public EV charging infrastructure will dramatically increase the number of people who are willing to purchase an EV. Using electricity to fuel vehicles is cleaner, can make the grid more efficient, and will save consumers money. EVs also provide savings in fuel and maintenance costs for drivers, and installing EV charging stations provide good paying electrical jobs. A recent analysis of publicly available data estimates that this level of investment would support between 120,000 and 300,000 full-time jobs for a year. In addition, federal and state governments should encourage the use of domestically manufactured equipment, which will result in more domestic manufacturing jobs. Additionally, significant EV charging infrastructure is needed for transit buses, port vehicles, ride-share vehicles, and corporate and government fleets of light-, medium-, and heavy-duty vehicles.

There are several ways to smartly invest in charging infrastructure:

- **Ensure that there is adequate charging along highways** to enable longer distance travel for EV drivers and to address congestion-related emissions due to concentrated regional freight commerce. This can be accomplished through bills such as the Clean Corridors Act (S. 674/H.R. 2616) or the EV Freedom Act (H.R. 5770).
- **Make charging equitably available** to people who do not have access to a driveway or garage, which is particularly important for people who live in apartments. Ensuring that communities that bear disproportionate pollution burdens, such as low-income communities and communities of color, have access to charging so that clean vehicles can be deployed in their communities is also important and can be addressed through bills such as through the Electric Vehicles for Underserved Communities Act (H.R. 5751).
- **Support infrastructure necessary for the deployment of electric freight trucks** operating to and from ports, warehouses, and other logistic hubs with heavy-duty vehicle charging infrastructure grants. Provisions for this are included in the No Exhaust Act (H.R. 5545) and Section 1402 of America's Transportation Infrastructure Act of 2019 (S. 2302).
- **Use existing DOT programs to further deploy charging infrastructure**, including the Congestion Mitigation and Air Quality (CMAQ) and Surface Transportation Block Grants (STBG) programs.
- **Provide long-term certainty that federal incentives for EV infrastructure will exist.** Manufacturers and installers of charging equipment need certainty that incentives will be available, such as the alternative fuel infrastructure tax credit (30C). Ensuring that each charging unit is eligible will also be helpful for larger installations with multiple pieces of equipment for charging depots and when there are more EVs on the roads.

3. Invest $20 billion in the adoption of electric buses for transit & school bus fleets

Electrifying transit and school buses will not only boost the nascent electric bus industry, it will eliminate air pollution from these vehicles along their fixed routes, thus protecting the health of the drivers, riders, and people who live along the routes. There are about 475,000 school buses in the United States that transport 23 million children every school day racking up 3.4 billion miles per year. Additionally, there are 66,000 public transit buses in the United States that collectively travel more than 2 billion miles and emit about 6 million tons of $CO2$ per year. Low-income residents and communities of color disproportionately rely on public transit buses and live in neighborhoods where dirty exhaust worsens public health. An electric transit bus will save about 47 kg of NOx per year compared to a diesel bus and will emit 78 metric tons less of GHG per year than a conventional diesel bus. Additionally, an electric transit bus can achieve the equivalent of 25 mpg, as compared to 5 mpg for a conventional diesel hybrid bus, which can save up to $50,000 annually in fuel and maintenance costs. There is abundant interest in purchasing electric transit buses as public transit agencies in at least 45 states have begun adding electric buses for their fleets, and several U.S. cities as well as the state of California have committed to a 100% transition to electric transit buses. Meanwhile, according to a recent study, U.S. investment in electric transit buses alone could lead to upwards of nearly 8,000 job-years through 2030 with an economic output increase of $2.5 billion over a 15 year period. However, this young industry requires public investment to accelerate its growth and reach economies of scale.

A switch to zero emission school and transit buses presents a critical opportunity to create jobs, slash pollution harmful to our health, reduce oil use, and reduce greenhouse gases to mitigate climate change. We recommend Congress:

- **Provide additional funding for the Low-No competitive grant program** administered by the Federal Transit Administration for the purchase of low or zero emission transit buses. In recent years, demand for grant funding has far exceeded available funding. In 2018, states and cities applied for grants totaling $558 million, but only $85 million of funding was available (FTA 2019).
- **Provide additional funding for the Clean School Bus Program in EPA's Diesel Emissions Reductions Act (DERA) specifically for the purchase of electric school buses.** In 2019, EPA awarded $11.5 million in grants to 157 school districts to aid in new cleaner school buses for their fleets. However, there were 260 school districts who were not selected in the lottery system that the program uses to give out grants. We recommend significantly increasing the amount of money that is available for electric school buses, increasing the per bus award limit, and funding infrastructure investments for electric school buses.

4. Invest in the adoption of electric trucks

One of the things the COVID-19 crisis has made clear is how heavily Americans depend on the shipping industry. Heavy-duty vehicles make up only 5 percent of all vehicles on the road in the United States but emit 45 percent of the U.S. transportation sector's nitrogen oxide (NOx) pollution, 57 percent of its fine particulate matter pollution, and 25 percent of global warming emissions in the transportation sector. This exhaust disproportionately affects the health of people of color and low-income communities due to proximity to heavy vehicular and port traffic as well as trucking corridors. Electric trucks do not emit any NOx, PM2.5, or GHG pollution during vehicle operation. Meanwhile, sales of electric-drive medium and heavy-duty vehicles globally (excluding China) are expected to increase by a compound annual growth rate of nearly 17% between 2018 and 2030. U.S. companies and workers can benefit greatly in this market, and we can significantly improve public health with the adoption of these vehicles in our communities, but only with early market assistance.

We recommend that a purchase incentive be put in place for medium- and heavy-duty vehicles to speed the transition to adoption and manufacturing of cleaner trucks. The point of sale voucher model at the state and local levels has been shown to be successful in efficiently deploying zero-emission trucks and buses among fleet operators, purchasers, and dealers.

- **Provide a purchase incentive for medium- and heavy-duty zero emission vehicles to accelerate deployment** - this could take many forms, such as:
  - A rebate at the point of sale for electric trucks;
  - A 10 percent tax credit as proposed in the Green VAN Act (H.R. 5162); or
  - Exempt zero emission medium- and heavy-duty truck purchasers from paying the current 12% excise tax on the purchase of heavy-duty vehicles.

5. Extend the purchase incentives for passenger cars and trucks

Sales of light-duty EVs have been on the rise as more models become available and consumers gain experience with these vehicles. However, due to the downturn in the economy, manufacturers are delaying the introduction of new vehicles, and plants are idling around the country. A robust return to vehicle sales - and to advanced vehicle sales - will be critical to restart and sustain domestic manufacturing investment and secure the industry's global competitiveness coming out of this crisis.

To promote jobs and health benefits of electric cars and trucks, Congress should:

- **Extend the tax credit for light duty electric vehicles**, such as proposed in the Driving America Forward Act (S. 1094/H.R. 2256). Congress should also consider making this a point of sale rebate for more immediate stimulative effects.
- **Ensure any demand stimulus to support automobile manufacturers is invested to spur the sale and manufacture of highly efficient and electric vehicles, maintain and increase domestic manufacturing, protect and create good jobs, and strengthen the industry's global leadership on clean vehicles**. Manufacturers must also ensure worker safety and remain compliant with conditions in the CARES Act.

6. Invest at least $20 billion in immediate operational assistance and prioritize funding capital improvements for public transit

While $25 billion for transit and $1 billion for passenger rail was a good initial response through the CARES Act (and the $15.75 billion for transit in the HEROES Act introduced in the House on May 12), estimated COVID-19-related losses to transit agencies already tally between $26 and $40 billion, and are likely to keep growing the longer this pandemic goes on. Many essential workers rely on public transit to get to work at locations such as hospitals and grocery stores. Meanwhile, these transit riders and transit workers themselves are risking their lives during the pandemic. Additionally, public transit needs a long-term significant boost to support our communities and economy. Transit provides affordable mobility for millions of households to get to medical appointments, educational opportunities, and other services critical for economic development and well-being. Investment in transit pays big dividends in employment as well; every $1 billion invested in public transit creates more than 50,000 jobs and economic returns of $3.7 billion over 20 years. Additionally, recent analysis found that public investment spent on public transportation produced 70 percent more job hours than funds spent on highways.

This kind of stimulus will lead to significant job increases. To keep public transit operating cleanly and safely, both now and into the future, we recommend these investments in transit:

- **Provide at least an additional $20 billion in immediate relief funding to U.S. transit agencies** to ensure that safety and data-driven public health measures are in place**,** the continuation of frequent and reliable service, and temporary agency ability to make up for COVID-19-related lost revenues from increased telecommuting and decreased travel.
- **Waive the prohibition on using capital funds for operational expenses and local cost share for future capital investments for at least a year.**
- **Address the $99 billion "state of good repair" backlog for U.S. public transit.** According to industry analysis, $18 billion/year is needed for maintenance alone, and significant new funding for expansion.
- **If a stimulus investment includes the highway trust fund, public transit should receive at least 50% of the guaranteed borrowed or granted funds,** the current 20% cap is from an outdated 1982 agreement.

Thank you for your ongoing work, in the face of the COVID-19 crisis, to ensure both immediate relief and long-term recovery and stimulus. Major investment in clean, family-sustaining, 21st century transportation jobs will benefit our safety, health, climate, mobility, economy, and American competitiveness for generations to come.

Sincerely,
350 Bay Area
350 Seattle
350 Silicon Valley
Acadia Center
Ballard Fuel Cell Systems
CalETC
California Business Alliance for a Clean Economy
CALSTART
Center for Biological Diversity
Center for Neighborhood Technology
Central California Asthma Collaborative
Ceres
CHARGE ACROSS TOWN
Citizens Utility Board - Illinois
Clean Energy Economy for the Region
Clean Water Action
Clean Water Action (NJ)
Climate Solutions
Coalition for a Safe Environment
Coalition for Clean Air
Coltura
Conservation Law Foundation
Consumer Federation of America
Consumer Reports
Cool the Earth / Drive Clean Bay Area
CT League of Conservation Voters
E2 (Environmental Entrepreneurs)
Earth Day Austin
Earthjustice
Earthworks
East Coast Greenway Alliance
Easton Energy and Environment Task Force
Ecology Center (Michigan)
Elders Climate Action
Electric Auto Association
Endangered Species Coalition

Environmental Defense Fund
Environmental Health Coalition
Environmental Law & Policy Center
Environmental Working Group
Forth
Fresh Energy
Green For All
GRID Alternatives
Jobs to Move America
League of Conservation Voters
Madison Area Bus Advocates
Marin School For Environmental Leadership
Minnesota Center for Environmental Advocacy
Mothers Out Front
Move Minnesota
National Consumer Law Center, on behalf of our low-income clients
Natural Resources Council of Maine
Natural Resources Defense Council
New Jersey Sustainable Business Council
NW Energy Coalition
Oregon Environmental Council
Plug In America
Protect Our Winters
Public Citizen
RE Sources for Sustainable Communities
RENEW Wisconsin
Respiratory Health Association
ReVision Energy
Safe Climate Campaign
Sierra Club
Solar United Neighbors
Southeast Energy Efficiency Alliance
Southern Alliance for Clean Energy
Southwest Energy Efficiency Project
Sunrise Tacoma
The Alliance for Business Leadership
The Climate Center
The Climate Group
The Illinois Environmental Council
Transport Hartford Academy at the Center for Latino Progress
Union of Concerned Scientists
Voices for Progress
West Oakland Environmental Indicators Project
Windsor Climate Action

CC:
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Minority Leader Chuck Schumer
Chairman Richard Shelby, Senate Committee on Appropriations
Vice Chairman Patrick Leahy, Senate Committee on Appropriations
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Ranking Member Sherrod Brown, Senate Committee on Banking, Housing, and Urban Affairs
Chairman Lisa Murkowski, Senate Committee on Energy and Natural Resources
Ranking Member Joe Manchin, Senate Committee on Energy and Natural Resources
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Ranking Member Sam Graves, House Committee on Transportation & Infrastructure
Chairman Richard Neal, House Committee on Ways and Means
Ranking Member Brady, House Committee on Ways and Means
Chairman Kathy Castor, House Select Committee on the Climate Crisis
Ranking Member Garret Graves, House Select Committee on the Climate Crisis
Members of the Senate
Members of the House

September 16, 2020

Chairman Paul Tonko
Subcommittee on Energy and Climate Change
2125 Rayburn House Office Building
Washington, DC 20515

Ranking Member John Shimkus
Subcommittee on Energy and Climate Change
2217 Rayburn House Office Building
Washington, DC 20515

RE: Hearing on "Building a 100 Percent Clean Economy: Opportunities for an Equitable, Low-Carbon Recovery."

Dear Chairman Tonko and Ranking Member Shimkus,

On behalf of the Solar Energy Industries Association (SEIA), I want to thank you for your leadership and the aggressive work you have undertaken for the American people during the 116th Congress to create a 100 percent clean economy by 2050. As the House Energy and Commerce Subcommittee on Environment and Climate Change prepares to discuss various policy solutions at today's hearing, I want to share with you the many ways the solar industry is coping with the COVID-19 pandemic and how, despite setbacks, our industry's workforce is continuing to build aggressively towards the 100 percent clean energy future the nation desperately needs.

The Solar+ Decade

The 2020s will be the decade where the solar industry, alongside partners in storage, grid modernization and other technologies work to make solar energy account for 20% of U.S. electricity generation by 2030. The Solar+ Decade represents not just the immense amount of solar installations that must be deployed in order to prevent the irreversible effects of climate change, but also an opportunity to create hundreds of thousands of jobs and equitably distribute the benefits of the clean energy economy to communities that have too often been left behind. If we meet these goals, 600,000 Americans could have a career in the solar industry, and we could add $345 billion to the economy. These benefits can and must reach communities that have been disproportionately harmed by both climate change and the pandemic.

While the solar industry is still on target to reach our 2030 goals, the COVID crisis has dramatically impacted our industry. Prior to this crisis, the solar workforce was expected to grow to 294,000 Americans this year. Analysis from SEIA shows that instead of adding more than 50,000 jobs during the first half of the year as we originally projected, the industry lost more than 72,000 workers. Tens of thousands of solar projects have been cancelled or postponed, putting billions of dollars of economic investment on hold. In addition, companies continue to see constraints on tax equity markets, a major component to financing solar projects.

SEIA also knows that addressing diversity, equity, inclusion, and justice issues must be a priority as we navigate the clean energy transformation. SEIA is working with its members and board of directors to ensure this important work is incorporated into all aspects of our industry. We continue to develop best practices and research in this area, and environmental justice and equity are increasingly becoming a focal point for our policy priorities. Any federal policy aiming to address climate change must simultaneously address the socioeconomic and systemic challenges faced by communities of color and other marginalized groups. As the nation endures the pandemic and some of its biggest impacts of climate change to date, the solar industry is ready to play a leading role in the development of these policies.

September 16, 2020

Smart policies can put us on the path to 20% solar by 2030 while also making solar electricity cost savings accessible to every family and small business; enabling the United States to completely decarbonize the electricity sector.

SEIA has identified the following policy areas as beneficial drivers for creating a strong, equitable recovery:

- Adjust the Investment Tax Credit: In order for solar companies to lift us from this economic nosedive, we must make changes to the solar investment tax credit (ITC). In the immediate term, we should establish a temporary 100% direct pay program for the ITC, which will ensure steady financing in the midst of the crisis and provide much needed certainty. In addition, we should delay the current phase down schedule of the ITC and push out critical deadlines associated with construction start dates and placed-in-service dates.
- Modernize the grid and invest in transmission: Electricity infrastructure investments are a critical component of the long-term growth prospects of clean energy. To do this, we can direct FERC to evaluate interregional transmission planning to account for the power market's move toward renewables and allocate federal funding for microgrid projects in remote or underserved communities. In addition, federal investments in transmission projects that transport clean renewable energy to load centers, upgrades to existing interregional transmission lines, tax credits for regionally significant transmission lines, and streamlining the interconnection process for large-scale solar will accelerate clean energy deployment.
- Expand access to solar for all Americans: Ensuring low-cost electricity access for all communities, especially those hit hardest by the COVID-19 pandemic, should be a key focus of any long-term infrastructure or stimulus effort. SEIA supports the creation of federal grant programs for installing distributed solar energy systems, including small community solar projects, and expanding federal funding for rural energy projects, including modernization and investment on tribal lands, among other possible solutions.
- Streamline permitting and inspection for clean energy: Streamlining the permitting and inspection process for solar projects could save homeowners and businesses thousands of dollars. For example, expanding federal support and funding for the Solar Automated Permit Processing (SolarAPP) program and providing additional infrastructure project permitting proposals, such as FAST 41, can help accelerate growth in the clean energy sector.
- Train the next generation of a diverse solar workforce: It is imperative that the solar workforce reflects the diversity of our nation and that solar job opportunities are available in all communities. SEIA supports expanding U.S. Department of Energy funded training programs, including initiatives that recruit women and people of color to careers in the clean energy sector, as well as federal grants to support on-the-job training or apprenticeship programs. We also support continued support for programs, such as Solar Ready Vets, that assist military veterans and transitioning service members find careers in the solar industry.
- Bringing clean, affordable power to public schools and non-profits.

SEIA also supports the development of a number of other policies to stimulate the solar economy such as:

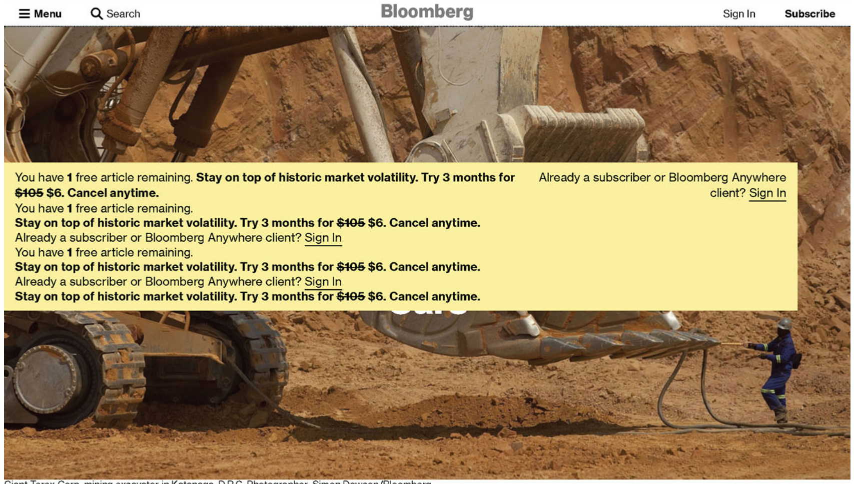
- Authorizing federal agencies to enter into long-term contracts for energy from renewables and cogeneration facilities;
- Tax credits for investments in advanced energy manufacturing;
- Tax incentives based on emissions output profiles of energy technologies;
- Clean Renewable Energy Bonds for renewable energy projects, including solar; establishing a federal Green Bank;
- DOE funding earmarked for research, development, and demonstration projects;

September 16, 2020

- Funding for energy generation, transmission, and energy efficiency projects on military facilities; and funding to build, repair and renovate federal buildings to increase energy efficiency, including installation of solar energy.

SEIA is proud of the contribution the solar industry has made towards decarbonizing our electricity system. With the right policy support, we are confident that the Solar+ Decade will be fruitful for the American economy, and American workers and small businesses in every community. Thank you for your consideration of these policies and continued dialogue with the solar industry.
Sincerely,

Abigail Ross Hopper, Esq.
President & CEO



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Giant Terex Corp. mining excavator in Katanaga, D.R.C. Photographer: Simon Dawson/Bloomberg

By Jack Farchy and Hayley Warren
December 2, 2018

Over the past two years, cobalt has emerged as one of the hottest commodities of the electric-vehicle revolution. The silvery-blue metal, an important component in lithium-ion batteries, has more than doubled in price, making carmakers and tech giants fret about securing their future needs.

The focus on the metal has turned a spotlight on the obscure supply chain that takes cobalt produced in mines in the Democratic Republic of Congo, Canada or Morocco, and ultimately delivers cobalt-containing batteries to companies from Samsung Electronics Co. to Volkswagen AG. That supply chain is dominated by Chinese companies.

Many of the leading companies that mine cobalt, such as Glencore Plc and Vale SA, are well known. So too, at the other end of the spectrum, are the tech companies and carmakers that buy batteries.

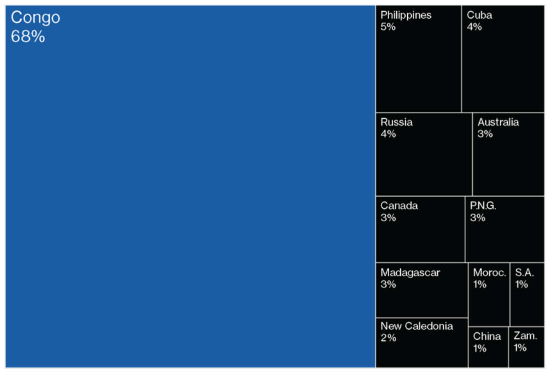
In between them sit companies that refine cobalt ore to make chemicals like cobalt sulphate; companies that combine these chemicals with other metals like nickel and manganese to make the cathode element of a lithium-ion battery; and companies that assemble the cathodes with the other components to make battery cells, and ultimately batteries.

Copper and cobalt mine operated by Katanga Mining Ltd. Photographer: Simon Dawson/Bloomberg

While there's little cobalt mining in China itself (1 percent of the world's total output in 2017), Chinese companies have snapped up cobalt mines abroad in recent years, particularly in the Democratic Republic of Congo, the largest source of the metal.

Cobalt Origins

More than two-thirds of cobalt mined in 2017 came from the Congo



Sources: Darton Commodities Ltd.

One key concern for cobalt buyers is that more than half of the world's supply of the metal originates from a country where there has never been a peaceful transition of power. Reports of child labor at some small-scale mines in Congo has prompted some end users to trace the supply chain for the cobalt in the batteries they buy.

Eight of the 14 largest cobalt miners in Congo are now Chinese-owned, accounting for almost half of the country's output.

Mining Stronghold

Share of 2017 output in Democratic Republic of Congo

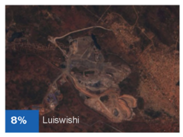
Chinese-owned

2km
2mi

Mutanda Mining
Glencore, Switzerland

Tenke Fungurume
CMOC, China

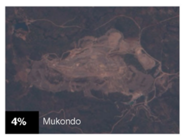
Other D.R.C.
including artisanal mining



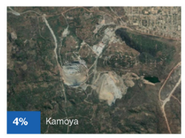
Congo Dongfang Mining
Zhejiang Huayou Cobalt, China

Ruashi Mining
Jinchuan Group, China

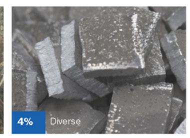
Etoile/Usoke
Shalina Resources/Chemaf, U.A.E.



Boss Mining
ERG, Luxembourg

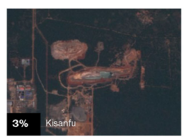


Kamoya
Wanbao Mining Ltd. (Comika), China



Metal Mines
Nanjing Hanrui Cobalt, China

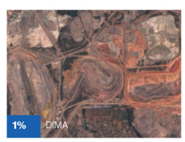
Big Hill
GTL, Belgium/D.R.C.



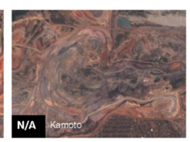
Somika
Somika SPRL, D.R.C.

MJM
Jiana Energy, China

MKM
CREC, China



Sicomines
CREC, China



Glencore
Katanga Mining/KCC, Switzerland

Katanga Mining Ltd. production was suspended in 2015, and restarted in 2018.
Sources: Darton Commodities, EO Browser/Sinergise Ltd., USGS Mineral Resources

After the cobalt has been mined, it is sold-sometimes via traders-to refiners. They produce cobalt metal and powder, which are mostly used to make superalloys used in jet engines, or chemicals like cobalt sulphate, which are used to make batteries.


Photographer: Jasper Juinen/Bloomberg

China is even more dominant in the production of cobalt chemicals needed to make batteries than Congo is in cobalt mining. According to data from Darton Commodities Ltd., China accounts for more than 80 percent of the production of cobalt chemicals.

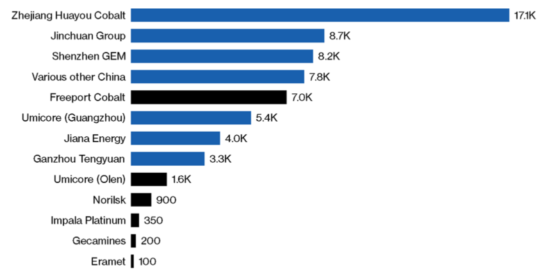
“China controls a massive proportion of the world’s cobalt sulphate,” says George Heppel, an analyst at consultancy CRU Group in London. “Aside from one chemical refinery in Finland, they control pretty much the entire world’s cobalt chemical refining capacity.”

Chemical Strength

Cobalt refined in 2017, in metric tons

China-based company

Chemical | Powder | Metal



Chemical refers to refined cobalt excluding metals and coarse powders.
Source: Darton Commodities Ltd.

In the next stage of processing, the cobalt chemicals are put together with other metals, such as manganese or aluminum, to make cathodes–the positively charged part of a battery.

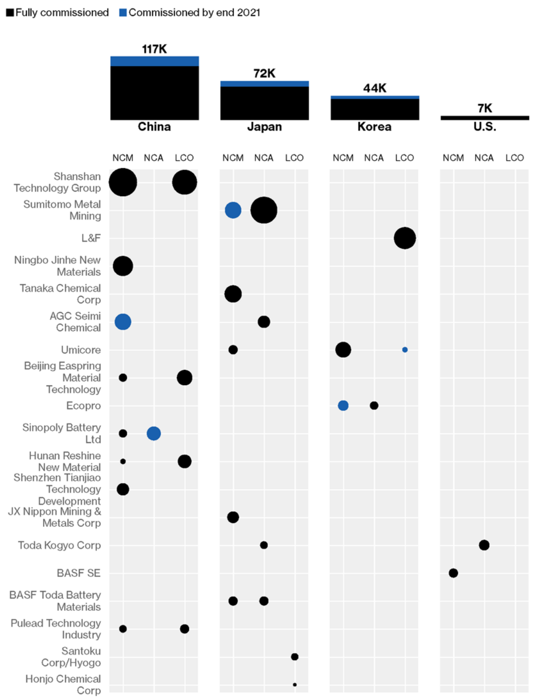
Photographer: Jasper Juinen/Bloomberg

There's a wide range of different chemical makeups of lithium-ion batteries. Not all of them use cobalt, but many of the most popular do. Following the surge in cobalt prices, most batterymakers are researching ways to reduce the proportion of cobalt in their batteries.

Currently in the ascendancy in the electric-vehicle industry are nickel–manganese–cobalt oxide (NMC) batteries, used in most electric cars, and 57 percent of the production capacity for this type of cathode is in China. Tesla Inc., however, uses nickel–cobalt–aluminium oxide (NCA) batteries, which have a lower proportion of cobalt. Cathodes of this type are largely made in Japan. The consumer electronics industry largely uses lithium–cobalt–oxide (LCO) batteries, which contain the highest proportion of cobalt.

Positive Charge

Battery cathode capacity, in tons



Source: Bloomberg NEF

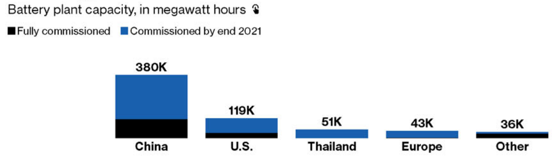
Finally, the cathodes are brought together with the other components of a battery to make battery cells and then whole batteries in so-called "megafactories."

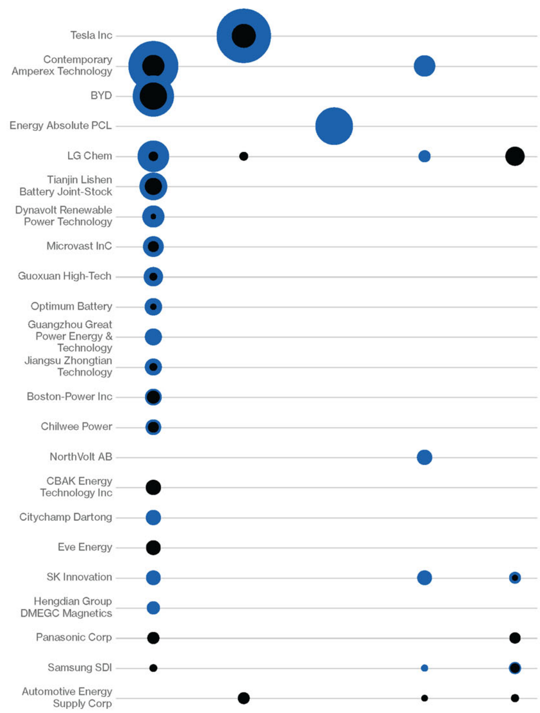
LG Chem battery packs at Korea's Hyundai plant. Photographer: SeongJoon Cho/Bloomberg

After Tesla pioneered the concept of a gigafactory in Nevada, there are now dozens of similar plants springing up across China. Chinese companies, like Contemporary Amperex Technology Co., are rapidly expanding. "We are going to increasingly see a lot of battery manufacturing migrating to China because the materials involved in manufacturing it are so readily available," says Heppel.

Power Hungry

Battery plant capacity, in megawatt hours





Only manufacturers with combined capacity exceeding 5,000MWh are broken out
Source: Bloomberg NEF

"There's not going to be enough cobalt for everyone to avoid China," says Heppel. "No matter how clever people try to be, there's always going to be more readily available materials in China, which gives them a significant advantage."

Correction: A previous version mislabelled the joint venture countries for the Big Hill mine.

Editor: Dylan Griffiths
Photo Editor: Gina Turner

REPORT

U.S. Falters in Bid to Replace Chinese Rare Earths

Despite new legislation, Washington won't be delivering critical minerals needed for defense, high tech, and energy.

BY KEITH JOHNSON, ROBBIE GRAMER | MAY 25, 2020, 7:00 AM

Rising tensions with China and the race to repatriate supply chains in the wake of the COVID-19 pandemic have given fresh impetus to U.S. efforts to launch a renaissance in rare earths, the critical minerals at the heart of high technology, clean energy, and especially high-end U.S. defense platforms.

But it's not going well, despite a slew of new bills and government initiatives aimed at rebuilding a soup-to-nuts rare-earth supply chain in the United States that would, after decades of growing reliance on China and other foreign suppliers, restore U.S. self-reliance in a vital sector.

"I think the light bulb has gone on, but we are still in a muddle about exactly what to do about it," said David Hammond, an expert on rare earths at Hammond International Group, a consultancy.

The problem is that, despite years of steadily increasing efforts under the Trump administration, the United States—both the public and private sectors—has yet to figure out how to redress the fundamental vulnerabilities in its critical materials supply chain, and America still seems years away from developing the full gamut of rare-earth mining, processing, and refining capabilities it needs if it seeks to wean itself off foreign suppliers.

This month, Texas Republican Sen. Ted Cruz became the latest lawmaker to introduce legislation meant to jump-start a domestic rare-earth industry by offering juicy tax breaks for new projects—and especially large tax incentives for end consumers who source finished products from American suppliers. Other lawmakers, like Sen. Lisa Murkowski of Alaska, have pushed legislation of their own meant to spur U.S. development of rare earths.

The U.S. Defense Department, meanwhile, is trying to throw money at the problem, putting rare earths at the center of the annual defense acquisition bill three years in a row, with plans this year to massively increase existing Pentagon funding for rare-earth projects. All that comes after a drumbeat of Trump administration moves, from a 2017 executive order seeking to ensure supplies of critical minerals to a 2019 Commerce Department report suggesting ways to do so.

"It's ripe for legislation," said an advisor to Cruz, who says that kick-starting domestic demand for finished rare-earth products will percolate back up the supply chain and rejuvenate a U.S. industry that has basically evaporated since its world-leading days three decades ago.

Mining The Future: A special report by FP Analytics details China's control and influence in critical metals and minerals vital to global high-tech industry. Read here.

The drive to decouple from China has been thrown into overdrive by the coronavirus pandemic and new calls from hawks in Washington to take a tougher approach to confronting Beijing's rise as a global rival. Sen. Josh Hawley, a Missouri Republican, took to the Senate floor this week to rail against China's economic imperialism and called for the United States to leave the World Trade Organization and create a brand-new global economic order.

Other lawmakers and Trump administration officials, starting with the president, are also increasingly leery of maintaining the kind of deep economic integration with China that has marked the last two decades.

"There's this confluence of factors that really provided added momentum to the discussions on the Hill concerning security of supply [of rare earths]," said Jane Nakano, a scholar at the Center for Strategic and International Studies. "It went on before COVID, but certainly there's added momentum because of COVID."

Gaining independence on rare earths has been the subject of on-again, off-again debates in U.S. defense circles since 2010, when China, the world's leading supplier, briefly halted rare-earth exports during a dispute with Japan. If there's so much urgency about building a U.S. supply chain, it's not to make the materials needed for the next generation of smartphones, electric car batteries, or wind turbines—though all those things need high-end rare-earth products.

Rather, the Pentagon's front-line weapons are all heavily reliant on precision-crafted rare-earth products and materials whose manufacture now is largely in the hands of China. Each F-35 fighter, for instance, needs 920 pounds of rare earths; each *Virginia*-class nuclear submarine requires 9,200 pounds. Tomahawk missiles, guidance systems, and jet engines all need different combinations of alloys and specialized products using some of the 17 different rare-earth elements.

If lawmakers, the Pentagon, and the White House are all now taking the rare-earth challenge seriously, why do they seem to be making little progress in tackling the issue?

Part of the problem is that a lot of the efforts so far, both in private sector and those with government funding, have focused simply on getting more rare-earth ores out of the ground in the United States. There are new rare-earth mines in different stages of early development in Alaska, Wyoming, and Texas, in addition to expansion underway at the one existing mine at Mountain Pass, California.

Another potential factor is the growing realization that China can't continue to dominate the rare-earth market in perpetuity. This is not because of any legislation coming out of Washington that outmaneuvers Beijing but simply because China is taking steps to limit its breakneck production of the minerals, the mining of which leads to massive environmental damage.

"China has in its campaign to dominate the world splurged all its rare earths at bargain basement prices and has now ended up as a net importer of heavy rare earths," said Christopher Eccleston, a mining strategist at the London-based financial advisory firm Hallgarten & Company. "It's really quite a turnaround."

In a 2019 study, Hallgarten projected that China would mine less than 50 percent of the world's rare earths, compared with about 75 percent today, by the mid-2020s as it tightens restrictions on extracting its diminishing supplies.

Still, the critical bottleneck for the United States, and especially the defense sector, isn't access to rare-earth ores, which are available from many countries all over the world, including deposits in Vietnam, Brazil, India, Australia, Canada, and Greenland. Rather, it's that the rest of the value chain—processing those ores, refining them into metals, and turning that metal into advanced products like permanent magnets—is dominated by China.

"People get caught up on the resource end, and they don't realize that China owns the metals and will continue to own that space," said James Kennedy, the founder of ThREE Consulting, a rare-earth consultancy focused on security implications.

Some of the latest initiatives do seek to address part of those vulnerabilities, though even those measures have been ill-starred. The Pentagon said last month it would provide funding to both the project at Mountain Pass and for Australian firm Lynas to build processing facilities. But now both those programs appear to be on hold: *Reuters* reported that the Pentagon is halting the funding of those rare earth projects pending further investigation. It's not clear if the holdup is due to the realization that Mountain Pass has minority Chinese ownership (and a Chinese monopoly on the mine's output) or if the retreat is due to the realization that neither U.S. project is rich in the particular kind of heavy rare earths the military needs.

So far, all the steps taken fall short of rebuilding the full, mine-to-magnet kind of value chain that would be needed to ensure U.S. self-reliance of the critical materials.

"In the end, it does not matter how many rare-earth mines the United States opens. It does not matter if they are upgraded to produce mixed or separated oxides," Kennedy said. "Nothing matters until we figure out how to overcome China's control over metal production."

Some of the latest plans—like Cruz's new bill—do try to nudge the development of more domestic capacity at the high end of the value chain, by incentivizing manufacturers to use magnets and other advanced products made in the United States. But using traditional tools like tax credits to fix a problem caused by China's state-mandated dominance of an entire industry is likely doomed to fail, Kennedy said.

"Tax incentives are only good if you see profitability," he said, a rare event in an industry plagued by high costs, razor-thin margins, and serial bankruptcies. U.S. lawmakers' proposals, he said, have "a market solution for a non-market problem."

That's a point that Kennedy, Hammond, and many other rare-earth experts repeatedly make: Given China's state-mandated dominance of the niche rare-earth industry, it basically controls pricing and ensures that normal economic rules don't apply. That makes it hard to respond to China's current dominance by turning to market-based solutions, like urging mining companies to pour hundreds of millions of dollars into big upfront investments that could be rendered uneconomical with a single decision in Beijing.

"Let's see: uncertain demand, uncertain price, uncertain technology—yeah, let me get my checkbook out," Hammond said.

To make sure the United States can rebuild the full range of rare-earth capabilities—from mining to processing to making the advanced final products—Hammond and others think it's time for the Trump administration to turn its penchant for state capitalism to one sector that could actually use it. That would entail bypassing the dicey market economics of rare-earth mining and processing altogether and doing something like creating a government entity that could just underwrite the entire process in the name of national security.

"This is a critical defense issue, like the shipyards in the Second World War," Hammond said. "Rare earths lends itself to a state capitalist solution more than just about anything."

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TAGS: CHINA, COMMODITIES, CONGRESS, NATIONAL SECURITY, RARE EARTHS, REPORT

VIEW COMMENTS

EXECUTIVE ORDERS

Presidential Executive Order on a Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals

ENERGY & ENVIRONMENT | Issued on: December 20, 2017

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

Section 1. Findings. The United States is heavily reliant on imports of certain mineral commodities that are vital to the Nation's security and economic prosperity. This dependency of the United States on foreign sources creates a strategic vulnerability for both its economy and military to adverse foreign government action, natural disaster, and other events that can disrupt supply of these key minerals. Despite the presence of significant deposits of some of these minerals across the United States, our miners and producers are currently limited by a lack of comprehensive, machine-readable data concerning topographical, geological, and geophysical surveys; permitting delays; and the potential for protracted litigation regarding permits that are issued. An increase in private-sector domestic exploration, production, recycling, and reprocessing of critical minerals, and support for efforts to identify more commonly available technological alternatives to these minerals, will reduce our dependence on imports, preserve our leadership in technological innovation, support job creation, improve our national security and balance of trade, and enhance the technological superiority and readiness of our Armed Forces, which are among the Nation's most significant consumers of critical minerals.

Sec. 2. Definition. (a) A "critical mineral" is a mineral identified by the Secretary of the Interior pursuant to subsection (b) of this section to be (i) a non-fuel mineral or mineral material essential to the economic and national security of the United States, (ii) the supply chain of which is vulnerable to disruption, and (iii) that serves an essential function in the manufacturing of a product, the absence of which would have significant consequences for our economy or our national security.

(b) The Secretary of the Interior, in coordination with the Secretary of Defense and in consultation with the heads of other relevant executive departments and agencies (agencies), shall publish a list of critical minerals in the Federal Register not later than 60 days after the date of this order, and disseminate such list to the appropriate agencies.

Sec. 3. Policy. It shall be the policy of the Federal Government to reduce the Nation's vulnerability to disruptions in the supply of critical minerals, which constitutes a strategic vulnerability for the security and prosperity of the United States. The United States will further this policy for the benefit of the American people and in a safe and environmentally responsible manner, by:

(a) identifying new sources of critical minerals;

(b) increasing activity at all levels of the supply chain, including exploration, mining, concentration, separation, alloying, recycling, and reprocessing critical minerals;
(c) ensuring that our miners and producers have electronic access to the most advanced topographic, geologic, and geophysical data within U.S. territory to the extent permitted by law and subject to appropriate limitations for purposes of privacy and security, including appropriate limitations to protect critical infrastructure data such as those related to national security areas; and

(d) streamlining leasing and permitting processes to expedite exploration, production, processing, reprocessing, recycling, and domestic refining of critical minerals.

Sec. 4. Implementation. (a) Within 180 days of the date that the Secretary of the Interior publishes a list of critical minerals under section 2 of this order, the Secretary of Commerce, in coordination with the Secretaries of Defense, the Interior, Agriculture, and Energy, and the United States Trade Representative, shall submit a report to the President through the Assistant to the President for Economic Policy, the Assistant to the President for National Security Affairs, the Director of the Office of Management and Budget, and the Director of the Office of Science and Technology Policy. The report shall include:

(i) a strategy to reduce the Nation's reliance on critical minerals;

(ii) an assessment of progress toward developing critical minerals recycling and reprocessing technologies, and technological alternatives to critical minerals;

(iii) options for accessing and developing critical minerals through investment and trade with our allies and partners;

(iv) a plan to improve the topographic, geologic, and geophysical mapping of the United States and make the resulting data and metadata electronically accessible, to the extent permitted by law and subject to appropriate limitations for purposes of privacy and security, to support private sector mineral exploration of critical minerals; and

(v) recommendations to streamline permitting and review processes related to developing leases; enhancing access to critical mineral resources; and increasing discovery, production, and domestic refining of critical minerals.

(b) Agencies shall implement subsection (a) of this section in a manner consistent with, and when possible complementary to, implementation of Executive Order 13771 of January 30, 2017 (Reducing Regulation and Controlling Regulatory Costs), Executive Order 13783 of March 28, 2017 (Promoting Energy Independence and Economic Growth), Executive Order 13807 of August 15, 2017 (Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects), and Executive Order 12866 of

September 30, 1993 (Regulatory Planning and Review).

Sec. 5. General Provisions.

(a) Nothing in this order shall be construed to impair or otherwise affect:

(i) the authority granted by law to an executive department or agency, or the head thereof;

(ii) the functions of the Director of the Office of Management and Budget relating to budgetary, administrative, or legislative proposals; or

(iii) existing treaties or international agreements relating to mineral production, imports, or exports.

(b) This order shall be implemented consistent with applicable law and subject to the availability of appropriations.

(c) This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

DONALD J. TRUMP

THE WHITE HOUSE,

December 20, 2017.

POLICY FORUM

ENERGY

Sustainable minerals and metals for a low-carbon future

Policy coordination is needed for global supply chains

By **Benjamin K. Sovacool[1], Saleem H. Ali[2,3,4], Morgan Bazilian[5], Ben Radley[6], Benoit Nemery[7], Julia Okatz[8], Dustin Mulvaney[9]**

Climate change mitigation will create new natural resource and supply chain opportunities and dilemmas, because substantial amounts of raw materials will be required to build new low-carbon energy devices and infrastructure (*1*). However, despite attempts at improved governance and better corporate management, procurement of many mineral and metal resources occurs in areas generally acknowledged for mismanagement, remains environmentally capricious, and, in some cases, is a source of conflict at the sites of resource extraction (*2*). These extractive and smelting industries have thus left a legacy in many parts of the world of environmental degradation, adverse impacts to public health, marginalized communities and workers, and biodiversity damage. We identify key sustainability challenges with practices used in industries that will supply the metals and minerals—including cobalt, copper, lithium, cadmium, and rare earth elements (REEs)—needed for technologies such as solar photovoltaics, batteries, electric vehicle (EV) motors, wind turbines, fuel cells, and nuclear reactors. We then propose four holistic recommendations to make mining and metal processing more sustainable and just and to make the mining and extractive industries more efficient and resilient.

Between 2015 and 2050, the global EV stock needs to jump from 1.2 million light-duty passenger cars to 965 million passenger cars, battery storage capacity needs to climb from 0.5 gigawatt-hour (GWh) to 12,380 GWh, and the amount of installed solar photovoltaic capacity must rise from 223 GW to more than 7100 GW (*3*). The materials and metals demanded by a low-carbon economy will be immense (*4*). One recent assessment concluded that expected demand for 14 metals—such as copper, cobalt, nickel, and lithium—central to the manufacturing of renewable energy, EV, fuel cell, and storage technologies will grow substantially in the next few decades (*5*). Another study projected increases in demand for materials between 2015 and 2060 of 87,000% for EV batteries, 1000% for wind power, and 3000% for solar cells and photovoltaics (*6*). Although they are only projections and subject to uncertainty, the World Bank put it concisely that "the clean energy transition will be significantly mineral intensive" (*7*) (see the figure).

Many of the minerals and metals needed for low-carbon technologies are considered "critical raw materials" or "technologically critical elements," terms meant to capture the fact that they are not only of strategic or economic importance but also at higher risk of supply shortage or price volatility (*8*). But their mining can produce grave social risks. A majority of the world's cobalt, used in the most common battery chemistries for EVs and stationary electricity storage, is mined in the Democratic Republic of Congo (DRC) (see the map), a country struggling to recover from years of armed conflict. There, women and sometimes children often work in or around mines for less pay or status than their male and adult counterparts, without basic safety equipment (see the photo). Owing to a lack of preventative strategies and measures such as drilling with water and proper exhaust ventilation, many cobalt miners have extremely high levels of toxic metals in their body and are at risk of developing respiratory illness, heart disease, or cancer.

In addition, mining frequently results in severe environmental impacts and community dislocation. Moreover, metal production itself is energy intensive and difficult to decarbonize. Mining for copper, needed for electric wires and circuits and thin-film solar cells, and mining for lithium, used in batteries, has been criticized in Chile for depleting local groundwater resources across the Atacama Desert, destroying fragile ecosystems, and converting meadows and lagoons into salt flats. The extraction, crushing, refining, and processing of cadmium, a by-product of zinc mining, into compounds for rechargeable nickel cadmium batteries and thin-film photovoltaic modules that use cadmium telluride (CdTe) or cadmium sulfide semiconductors can pose risks such as groundwater or food contamination or worker exposure to hazardous chemicals, especially in the supply chains where elemental cadmium exposures are greatest. REEs, such as neodymium and the less common dysprosium, are needed for magnets in electric generators in wind turbines and motors in EVs, control rods for nuclear reactors, and the fluid catalysts for shale gas fracking. But REE extraction in China has resulted in chemical pollution from ammonium sulfate and ammonium chloride and tailings pollution that now threaten rural groundwater aquifers as well as rivers and streams. Several metals for green technologies are found as "companions" to other ores with differential value and unsustainable supply chains (*9*).

POLICY RECOMMENDATIONS

With these sobering social and environmental aspects of current mineral extraction in mind, we suggest four policy recommendations.

Diversify mining enterprises for local ownership and livelihood dividends

Although large-scale mining is often economically efficient, it has limited employment potential, only set to worsen with the recent arrival of fully automated mines. Mining can concentrate occupational hazards as well as environmental risk, as demonstrated most severely by tailings pond disasters and mining wastewater contamination. Even where there is relative political stability and stricter regulatory regimes in place, there can still be serious environmental failures, as exemplified by the recent global rise in dam failures at settling ponds for mine tailings. The level of distrust of extractive industries has even led to countrywide moratoria on all new mining projects, such as in El Salvador and the Philippines.

Traditional labor-intensive mechanisms of mining that are possible to undertake with less mechanization and without major capital investments are called artisanal and small-scale mining (ASM). Although ASM is not immune from poor governance or environmental harm, it provides livelihood potential for at least 40 million people worldwide, with an additional three to five times more people indirectly supported by the sector (*10*). It is also usually more strongly embedded in local and national economies than foreign-owned, large-scale mining, with a greater level of

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value retained and distributed within the country. Diversifying mineral supply chains to allow for greater coexistence of small- and large-scale operations is needed. Yet, efforts to incorporate artisanal miners into the formal economy have often resulted in a scarcity of permits awarded, exorbitant costs for miners to legalize their operations, and extremely lengthy and bureaucratic processes for registration.

Development donors need to focus on bottom-up formalization efforts rather than merely facilitating government efforts to better regulate the sector for increased tax revenues. There needs to be a focus on policies that recognize its livelihood potential in areas of extreme poverty. Moreover, formalization of the sector should focus on creating stronger, more accountable arrangements to drive greater value of resource revenues down the supply chain to ASM miners to ensure better environmental and safety mechanisms and expand their access to markets. The recent decision of the London Metals Exchange to have a policy of "nondiscrimination" toward ASM is a positive sign in this regard. Certain industry actors have demonstrated a commitment to, and the benefits of, this type of approach, such as Fairphone's sourcing of the mineral columbite-tantalite (coltan) used in mobile phones. At the level of government policy, ASM has demonstrated its ability to increase productivity and mechanize production, even in hostile regulatory and governance environments. More space for and support to ASM to pursue this trajectory would enhance its capacity to meet the increased demand for minerals required in the move toward a low-carbon future. One place to begin is with the redistribution of dormant mining concessions previously granted to (but unused by) mining companies so that local ASM operators can legally work in these locations, as has been taking place recently in Tanzania.

A creuseur, or digger, descends into a Congolese copper and cobalt mine in Kawama. Wages are low, and working conditions are dangerous, often with no safety equipment or structural support for the tunnels.

PHOTO: MICHAEL ROBINSON CHAVEZ/*THE WASHINGTON POST* VIA GETTY IMAGES

Acknowledge the limits of traceability

A great deal of attention has focused on fostering transparency and accountability of mineral mining by means of voluntary traceability or even "ethical minerals" schemes. International groups, including Amnesty International, the United Nations, and the Organisation for Economic Co-operation and Development, have all called on mining companies to ensure that supply chains are not sourced from mines that involve illegal labor and/or child labor. In concert, Eurasian Resources Group (ERG) launched their Clean Cobalt Framework in 2018, First Cobalt has their Responsible Cobalt Initiative, RCS Global has its Better Cobalt program, Amnesty International is working on an Ethical Battery framework, and the World Economic Forum launched a Global Battery Alliance committed to "responsible sourcing" of raw materials for batteries.

Traceability schemes, however, may be impossible to fully enforce in practice and could, in the extreme, merely become an exercise in public relations rather than improved governance and outcomes for miners. In the eastern DRC, for example, cassiterite, the mineral that tin is extracted from, is exported through a traceability system yet can nonetheless have contributed to conflict financing or labor and human rights abuses while simultaneously introducing heavy financial costs onto local workers for the right to participate in the system (*11*). Nonetheless, traceability is not without promise, and examples from Blockchain technology show how the use of artificial intelligence algorithms for data processing has the potential for greater assurance but ultimately relies on the accuracy of data being fed into the supply chain.

Transparency of supply chains is a means to an end and will only be effective if consumers or regulators start to differentiate between products being provided. There are effective lessons on traceability and transparency arising from the Kimberley Process for conflict diamonds; the Extractive Industries Transparency Initiative for oil, gas, and mineral resources; and the Fairmined Standard for gold that could be applied to the mineral supply chains needed for decarbonization. Paramount among these is an acknowledgment that traceability schemes offer a largely technical solution to profoundly political problems and that these political issues cannot be circumvented or ignored if meaningful solutions for workers are to be found. Traceability schemes ultimately will have value if the market and consumers trust their authenticity and there are few potential opportunities for leakage in the system.

Explore new resource streams

Although primary emphasis must be placed on resource efficiency (higher output or usage of product per unit of resource input) and recycling, there will likely be a need for primary resource extraction as well owing to clean-energy infrastructure demand. New resource streams—including metal availability in seawater (desalination) and groundwater (geothermal brines), material substitution or material intensity reductions, and materials recovery and recycling—also hold promise for diversifying supply chains, as long as they maintain environmental sustainability and protect worker safety.

Although mining in terrestrial areas is likely to continue to meet the demands of low-carbon technologies in the nearer term, we need to carefully consider mineral sources beneath the oceans in the longer term. The

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International Seabed Authority, set up under the United Nations (UN) Convention on the Law of the Sea, is in the process of issuing regulations related to oceanic mineral extraction. This process is a rare opportunity to be proactive in setting forth science-based environmental safeguards for mineral extraction. For metals such as cobalt and nickel, ocean minerals hold important prospects on the continental shelf within states' exclusive economic zones as well as the outer continental shelf regions. Within international waters, metallic nodules found in the vast Clarion-Clipperton Zone of the Pacific as well as in cobalt and tellurium crusts, which are found in seamounts worldwide, provide some of the richest deposits of metals for green technologies. Difficult extraction and declining reserves of some terrestrial minerals, as well as social resistance against terrestrial mining, may lead to oceanic mineral reserves becoming more plausible sources. Minerals near hydrothermal vents are in more pristine and distinctive ecosystems and should likely remain off-limits for mineral extraction for the foreseeable future.

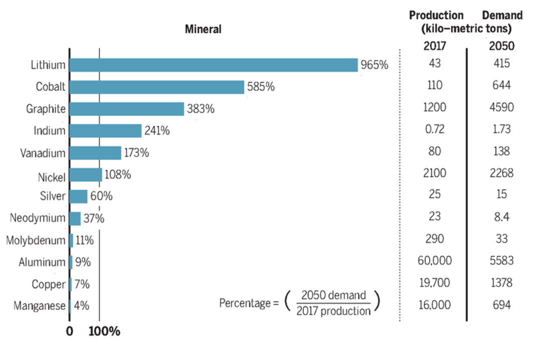
Technological substitution can play an important role as well. Copper offers an illustrative example. Higher copper prices in recent years have incentivized replacement in new applications in the automotive industry, such as wire harnesses and replacing copper with aluminum winding in motors. However, substitution to other primary metals or even synthetics could merely shift resource demand to another material that may be more abundant initially but can become more challenging to procure over time. Moreover, substitution may be limited to particular innovations or niches. Alternatives to lithium-ion batteries, such as sodium-ion batteries, are becoming more practical and feasible. But finding substitutes for metals like platinum group metals in key technologies such as fuel cells has become increasingly difficult, and reserves are dwindling.

Recycling and better resource efficiency can play a part at extending and enhancing the lifetimes of products and also stretching out mineral reserves. Closed-loop supply chains based on circular economy ideas in addition to advancements in metallurgy, reverse logistics, waste separation, materials science, waste processing, and advanced recycling can all enhance the longevity and continual reuse of minerals and metals. Researchers at the U.S. National Renewable Energy Laboratory estimate that 65% of the U.S. domestic cobalt demand in 2040 could be supplied by end-of-life lithium-ion batteries, provided a robust take-back and recycling infrastructure is in place.

Extended producer responsibility (EPR) is a framework that stipulates that producers are responsible for the entire lifespan of a product, including at the end of its usefulness. EPR would, in particular, shift responsibility for collecting the valuable resource streams and materials inside used electronics from users or waste managers to the companies that produce the devices. EPR holds producers responsible for their products at the end of their useful life and encourages durability, extended product lifetimes, and designs that are easy to reuse, repair, or recover materials from. A successful EPR program known as PV Cycle has been in place in Europe for photovoltaics for about a decade and has helped drive a new market in used photovoltaics that has seen 30,000 metric tons of material recycled. To date, EPR has mainly shaped collection, recycling, and waste management to ensure safe and responsible disposal of specific classes of products like e-waste, paint, and pharmaceuticals, but, in concept, it is also meant to help drive more sustainable design as well as options for reuse and repair. There is evidence of EPR's influence on green design in the global solar industry. For example, thin-film manufacturer First Solar screens new materials to ensure that they will not negatively influence their recycling process, through which they currently recover 90% of their CdTe semiconductor material and 90% of their glass. To more easily recycle the plastics and copper from photovoltaics, some manufacturers are seeking out halogen-free components.

Space mining, although potentially useful for developing lunar and planetary bases farther into the future, has less potential for meeting the demand for minerals for immediate decarbonization on Earth. A possible exception to this may be platinum group metals from asteroids, but here, too, the time frame and quantity of production would preclude its use in meeting immediate technology needs for climate mitigation.

Growth in mineral needs for low-carbon energy technology



All production and demand data reflect annual values. 2017 data reflect annual production for all uses. 2050 data reflect estimated demand for only low-carbon energy technology uses. Data from (7).

Incorporate minerals into climate and energy planning

Given the centrality of minerals and metals to the future diffusion of low-carbon technologies, materials security should be actively incorporated into formal climate planning. This could be connected to ongoing planning as part of the nationally determined contributions (NDCs) under the Paris Accord, the European Commission's National Energy and Climate Plans (NECPs), or even energy policy-making at the national scale. Climate planners could begin by mapping out their NDC contributions alongside a list of "critical minerals" for energy security (see supplementary materials).

Although care must be taken to ensure that the NDC process does not become too broad or research intensive, we believe the NDCs are the most tangible international policy consensus mechanism on this matter. The NDCs can incorporate some of the mineral sourcing challenges through efforts at resource efficiency. The Group of Seven (G7) has taken on this linkage, and policies to motivate resource efficiency can be a means of keeping track of material

GRAPHIC: X. LIU/SCIENCE

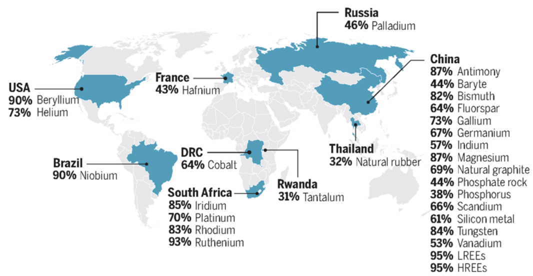
and mineral supply chains. For example, a materials assessment for particular infrastructure options for climate change mitigation or adaptation could be included in cost-benefit analyses. Recent work has suggested that the social acceptability of tying resource-efficient products to climate change mitigation efforts is strong (*12*).

Having each country create a list of critical minerals within its NDC process and show possible trade-offs and shortfalls could lead to several benefits. More efforts on national critical material analysis could result in improved mapping of mineral supply chains, for which there is already a notable gap across many developing countries and regions. The analytical efforts would enhance our understanding of supply constraints and demand patterns, which in turn could lead to a better understanding of future prices and drivers, especially those beyond the control of governments and policy as agents of change. The process of mapping mineral demands for NDCs, NECPs, and national energy policies could lead to new linkages and networks and a raising of awareness, connecting the traditional minerals and metals community to other research and social communities, especially in climate policy and energy studies. In this way, climate mitigation could be twinned with minerals security and industrial strategy as a way to meet broad sets of goals (environmental, political, and economic) in one stroke.

AN ETHICAL CONUNDRUM

Mineral and metal supplies are geologically determined, yet socially mediated. Even if supplies are enhanced through coproducts of other industries, new resource streams, and considerable expansion of recycling and increased recovery rates, there are likely to be bottlenecks across metal supply chains (*13*). This is exacerbated by poorly functioning markets, as least for the minor metals. Hence, trade policy will need to become more deftly aligned with mineral supply in ways which are both economically and ecologically more efficient. Furthermore, more robust reporting and emissions data will be required across the supply chain. For example, although the U.S. government strategy for mineral supply security released in June 2019 highlights the importance of trade with allies and partners, it does not consider where it is most ecologically efficient to source minerals. Pursuing decarbonization simultaneously with principles of a circular economy, coupled with increased market transparency mechanisms and full life-cycle reporting, could yield important social and environmental benefits.

Countries accounting for the largest share of critical raw materials



DRC, Democratic Republic of Congo; LREEs, light rare earth elements; HREEs, heavy rare earth elements. Figure modified from European Commission, "Third list of critical raw materials for the EU of 2017" (European Commission, 2017); https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en.

Consideration should also be given to where mining is most likely to have a positive development footprint while also having more manageable environmental impacts (*14*). Utilizing tools such as the Responsible Mining Index and platforms such as the Responsible Minerals Initiative or the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development may be a way forward. Although there may be treaty fatigue among policy-makers, an intertreaty protocol on mineral supply chains to ensure that the goals of existing treaties are met could enhance effective governance. Conversations in this vein should be attempted among the parties to the UN Framework Convention on Climate Change, through the UN Environment Assembly, as well as more focused mechanisms such as the U.S. government's recently launched Energy Resource Governance Initiative, the World Bank's Climate-Smart Mining Facility, or the European Institute of Innovation and Technology for Raw Materials.

Having just marked the 150th anniversary of the formulation of the periodic table, it is high time we realize that the elements, and the minerals in which they are embedded, are essential to our attainment of low-carbon goals. There is an ethical conundrum to addressing climate change only by aggravating other social and ecological problems related to unsustainable mineral and metal supply chains. But done sustainably, an impending mining boom could help lift communities out of poverty, accelerate technical innovation for decarbonization, and further the realization of energy and climate targets. Which direction it takes will depend considerably on how metal and mineral supply chains are governed over the next few critical years. ■

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SUPPLEMENTARY MATERIALS

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Science

Sustainable minerals and metals for a low-carbon future

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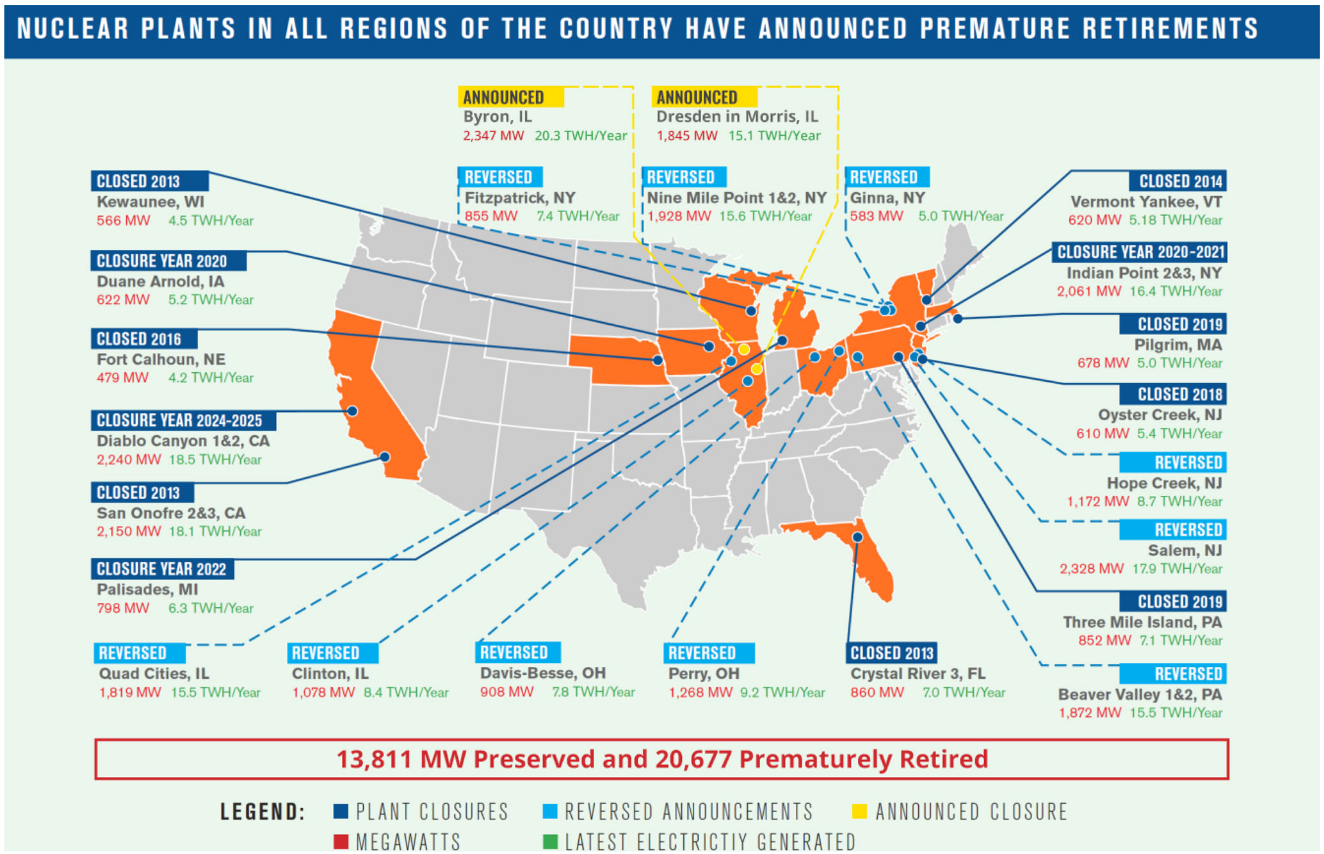
NUCLEAR PLANTS IN ALL REGIONS OF THE COUNTRY HAVE ANNOUNCED PREMATURE RETIREMENTS
ANNOUNCED
Byron, IL
2,347 MW 20.3 TWH/Year
ANNOUNCED
Dresden in Morris, IL
1,845 MW 15.1 TWH/Year
CLOSED 2013
Kewaunee, WI
566 MW 4.5 TWH/Year
REVERSED
Fitzpatrick, NY
855 MW 7.4 TWH/Year
REVERSED
Nine Mile Point 1&2, NY
1,928 MW 15.6 TWH/Year
REVERSED
Ginna, NY
583 MW 5.0 TWH/Year
CLOSED 2014
Vermont Yankee, VT
620 MW 5.18 TWH/Year
CLOSURE YEAR 2020
Duane Arnold, IA
622 MW 5.2 TWH/Year
CLOSURE YEAR 2020-2021
Indian Point 2&3, NY
2,061 MW 16.4 TWH/Year
CLOSED 2016
Fort Calhoun, NE
479 MW 4.2 TWH/Year
CLOSED 2019
Pilgrim, MA
678 MW 5.0 TWH/Year
CLOSURE YEAR 2024-2025
Diablo Canyon 1&2, CA
2,240 MW 18.5 TWH/Year
CLOSED 2018
Oyster Creek, NJ
610 MW 5.4 TWH/Year
REVERSED
Hope Creek, NJ
1,172 MW 8.7 TWH/Year
CLOSED 2013
San Onofre 2&3, CA
2,150 MW 18.1 TWH/Year
REVERSED
Salem, NJ
2,328 MW 17.9 TWH/Year
CLOSURE YEAR 2022
Palisades, MI
798 MW 6.3 TWH/Year
CLOSED 2019
Three Mile Island, PA
852 MW 7.1 TWH/Year
REVERSED
Quad Cities, IL
1,819 MW 15.5 TWH/Year
REVERSED
Clinton, IL
1,078 MW 8.4 TWH/Year
REVERSED
Davis-Besse, OH
908 MW 7.8 TWH/Year
REVERSED
Perry, OH
1,268 MW 9.2 TWH/Year
CLOSED 2013
Crystal River 3, FL
860 MW 7.0 TWH/Year
REVERSED
Beaver Valley 1&2, PA
1,872 MW 15.5 TWH/Year
13,811 MW Preserved and 20,677 Prematurely Retired
LEGEND:
PLANT CLOSURES
REVERSED ANNOUNCEMENTS
ANNOUNCED CLOSURE
MEGAWATTS
LATEST ELECTRICTIY GENERATED

116th Congress
2d Session

H. Res. __

H.R. 4447 - Clean Economy Jobs and Innovation Act
H.R. 6270 - Uyghur Forced Labor Disclosure Act of 2020
H.R. 8319 - Continuing Appropriations Act, 2021 and Other Extensions Act

1. Structured rule for H.R. 4447.
2. Provides 90 minutes of general debate equally divided among and controlled by the chair and ranking minority member of the Committee on Energy and Commerce and the chair and ranking minority member of the Committee on Science, Space, and Technology.
3. Waives all points of order against consideration of the bill.
4. Provides that an amendment in the nature of a substitute consisting of the text of Rules Committee Print 116-63, modified by the amendment printed in Part A of the Rules Committee report, shall be considered as adopted and the bill, as amended, shall be considered as read.
5. Waives all points of order against provisions in the bill, as amended.
6. Section 2 provides that following debate, each further amendment printed in part B of the Rules Committee report not earlier considered as part of amendments en bloc pursuant to section 3 shall be considered only in the order printed in the report, may be offered only by a Member designated in the report, shall be considered as read, shall be debatable for the time specified in the report equally divided and controlled by the proponent and an opponent, may be withdrawn by the proponent at any time before the question is put thereon, shall not be subject to amendment, and shall not be subject to a demand for division of the question.
7. Section 3 provides that at any time after debate the chair of the Committee on Energy and Commerce or his designee may offer amendments en bloc consisting of further amendments printed in part B of the Rules Committee report not earlier disposed of. Amendments en bloc shall be considered as read, shall be debatable for 20 minutes equally divided and controlled by the chair and ranking minority member of the Committee on Energy and Commerce or their designees, shall not be

subject to amendment, and shall not be subject to a demand for division of the question.

8. Waives all points of order against the amendments printed in part B of the Rules Committee report and amendments en bloc described in section 3.
9. Provides one motion to recommit with or without instructions.
10. Closed rule for H.R. 6270.
11. Provides one hour of general debate equally divided and controlled by the chair and ranking minority member of the Committee on Financial Services.
12. Waives all points of order against consideration of the bill.
13. Provides that an amendment in the nature of a substitute consisting of the text of Rules Committee Print 116-64 shall be considered as adopted and the bill, as amended, shall be considered as read.
14. Waives all points of order against provisions in the bill, as amended.
15. Provides one motion to recommit with or without instructions.
16. Closed rule for H.R. 8319.
17. Provides one hour of general debate equally divided and controlled by the chair and ranking minority member of the Committee on Appropriations.
18. Waives all points of order against consideration of the bill and provides that the bill shall not be subject to a question of consideration.
19. Provides that the bill shall be considered as read.
20. Waives all points of order against provisions in the bill.
21. Provides that clause 2(e) of Rule XXI shall not apply during consideration of the bill.
22. Provides one motion to recommit.

RESOLUTION

Resolved, That upon adoption of this resolution it shall be in order to consider in the House the bill (H.R. 4447) to establish an energy storage and microgrid grant and technical assistance program. All points of order against consideration of the bill are waived. In lieu of the amendment in the nature of a substitute recommended by the Committee on Energy and Commerce now printed in the bill, an amendment in the nature of a substitute consisting of the text of Rules Committee Print 116–63, modified by the amendment printed in part A of the report of the Committee on Rules accompanying this resolution, shall be considered as adopted. The bill, as amended, shall be considered as read. All points of order against provisions in the bill, as amended, are waived.

The previous question shall be considered as ordered on the bill, as amended, and on any further amendment thereto, to final passage without intervening motion except: (1) 90 minutes of debate equally divided among and controlled by the chair and ranking minority member of the Committee on Energy and Commerce and the chair and ranking minority member of the Committee on Science, Space, and Technology; (2) the further amendments described in section 2 of this resolution; (3) the amendments en bloc described in section 3 of this resolution; and (4) one motion to recommit with or without instructions.

Sec. 2. After debate pursuant to the first section of this resolution, each further amendment printed in part B of the report of the Committee on Rules not earlier considered as part of amendments en bloc pursuant to section 3 of this resolution shall be considered only in the order printed in the report, may be offered only by a Member designated in the report, shall be considered as read, shall be debatable for the time specified in the report equally divided and controlled by the proponent and an opponent, may be withdrawn by the proponent at any time before the question is put thereon, shall not be subject to amendment, and shall not be subject to a demand for division of the question.

Sec. 3. It shall be in order at any time after debate pursuant to the first section of this resolution for the chair of the Committee on Energy and Commerce or his designee to offer amendments en bloc consisting of further amendments printed in part B of the report of the Committee on Rules accompanying this resolution not earlier disposed of. Amendments en bloc offered pursuant to this section shall be considered as read, shall be debatable for 20 minutes equally divided and controlled by the chair and ranking minority member of the Committee on Energy and Commerce or their respective designees, shall not be subject to amendment, and shall not be subject to a demand for division of the question.

Sec. 4. All points of order against the further amendments printed in part B of the report of the Committee on Rules or amendments en bloc described in section 3 of this resolution are waived.

Sec. 5. Upon adoption of this resolution it shall be in order to consider in the House the bill (H.R. 6270) to amend the Securities Exchange Act of 1934 to require issuers to make certain disclosures relating to the Xinjiang Uyghur Autonomous Region, and for other purposes. All points of order against consideration of the bill are waived. An amendment in the nature of a substitute consisting of the text of Rules Committee Print 116-64 shall be considered as adopted. The bill, as amended, shall be considered as read. All points of order against provisions in the bill, as amended, are waived. The previous question shall be considered as ordered on the bill, as amended, and on any further amendment thereto, to final passage without intervening motion except: (1) one hour of debate equally divided and controlled by the chair and ranking minority member of the Committee on Financial Services; and (2) one motion to recommit with or without instructions.

Sec. 6. Upon adoption of this resolution it shall be in order to consider in the House without intervention of any question of consideration the bill (H.R. 8319) making continuing appropriations for fiscal year 2021, and for other purposes. All points of order against consideration of the bill are waived. The bill shall be considered as read. All points of order against provisions in the bill are waived. Clause 2(e) of rule XXI shall not apply during consideration of the bill. The previous question shall be considered as ordered on the bill and on any amendment thereto to final passage without intervening motion except: (1) one hour of debate equally divided and controlled by the chair and ranking minority member of the Committee on Appropriations; and (2) one motion to recommit.

SUMMARY OF AMENDMENT TO H.R. 4447 IN PART A PROPOSED TO BE CONSIDERED AS ADOPTED

Sponsor	#	Description
1. Pallone (NJ)	#170	**(LATE) (MANAGER'S)** Makes several technical and conforming changes to the bill; adds findings and a report related to energy and water efficiency measures and energy savings performance contracts; amends prevailing wage and wage rate requirements in several sections of the bill; removes certain spending provisions related to public lands renewable energy development; clarifies that the focus of the methane hydrate research program is on risk assessment and mitigation of environmental impacts; clarifies the timing and application of eminent domain for pipeline projects; codifies a recent Department of Commerce agreement limiting importation of uranium from Russia into the United States; defers collection of fees and expands eligibility criteria for the DOE Title XVII Loan Program; adds a new requirement for EPA to establish a protocol for assessing and addressing the cumulative impacts of

environmental stressors; and establishes a uniform definition of "apprenticeship" and "pre-apprenticeship" for the act.

SUMMARY OF AMENDMENTS TO H.R. 4447 IN PART B PROPOSED TO BE MADE IN ORDER

(summaries derived from information provided by sponsors)

Sponsor	#	Description	Debate Time
1. Axne (IA), Bustos (IL)	#107	**(REVISED)** Adds biofuels facilities as eligible for funding under the Carbon Capture Program.	(10 minutes)
2. Barragán (CA), Beyer (VA), Lee, Barbara (CA), Raskin (MD), Velázquez (NY), Bonamici (OR), Huffman (CA), Lowenthal (CA), Clarke, Yvette (NY), Khanna (CA), Hastings (FL), Kennedy (MA)	#57	Establishes a $1 billion dollar a year Climate Smart Ports program at EPA to provide grants for ports and port users to invest in zero emissions technology for cargo handling equipment, drayage trucks, and harbor craft. The program also supports the development of shore power and clean energy microgrids at ports.	(10 minutes)
3. Barragán (CA)	#59	Increases the authorized appropriation by $40,000,000 for FY 2021-2030 for the EPA's Environmental Justice Small Grants Program, Environmental Justice Collaborative Problem-Solving Cooperative Agreement Program, and Community Action for a Renewed Environment grant programs I and II.	(10 minutes)
4. Barragán (CA)	#61	Increases authorized appropriation levels by $100,000,000 for the Weatherization Assistance Program for Fiscal Year 2021-2025.	(10 minutes)

5. Barragán (CA)	#130	**(LATE)** Establishes a climate justice grants program, administered by EPA, to provide local government and community non-profit grants to environmental justice communities for climate mitigation and climate adaptation projects. The authorized appropriation is $1 billion a year for FY 2021-2025.	(10 minutes)
6. Barragán (CA), Cárdenas (CA), McEachin (VA)	#142	**(LATE)** Increases the authorized appropriation by $50 million a year for FY 2021-2025 for the low-income solar grant program in Subtitle D.	(10 minutes)
7. Blunt Rochester (DE)	#44	**(REVISED)** Funds clean energy and energy efficiency upgrades to critical infrastructure, like schools and hospitals.	(10 minutes)
8. Brown (MD)	#88	Prohibits the use of certain hazardous substances linked to respiratory sensitization and asthma in thermal insulating materials for low income housing weatherization.	(10 minutes)
9. Burgess (TX)	#5	Requires the Secretary of Energy to certify that this legislation will not reduce the United States' energy security or energy independence.	(10 minutes)
10. Burgess (TX)	#6	Requires the Secretary of Energy to certify that this legislation will not increase electric rates or gasoline prices.	(10 minutes)
11. Burgess (TX)	#68	Requires the Secretary of Interior to report to Congress on the use of forced labor practices to extract critical minerals from foreign sources for export to the United States.	(10 minutes)
12. Burgess (TX)	#80	Requires the Secretary of Energy to report to Congress on the effect of variable and distributed energy resources on the reliability of the electric grid, specifically pertaining to natural disasters and physical or cyber attacks on the grid infrastructure.	(10 minutes)
13. Burgess (TX)	#87	Requires the Secretary of Energy to report to Congress on the potential duplication of research efforts in the Department of Energy's applied energy programs, evaluate	(10 minutes)

		the opportunity costs associated with such efforts, and examine the impact of combining duplicated projects. Also requires recommendations on streamlining research grant process.	
14. Castor (FL)	#150	**(LATE)** Adds emissions reduction and climate change mitigation to DOE's R&D mission.	(10 minutes)
15. Castor (FL)	#151	**(LATE)** Directs the Secretary of Energy to engage the National Academies for a study to identify barriers to equitable distribution of the benefits of clean energy to frontline communities.	(10 minutes)
16. Clarke, Yvette (NY)	#2	Establishes a pilot program within the Environmental Protection Agency to award funds in the form of grants, rebates and low-cost revolving loans to projects that either (1) replace an existing diesel-powered transport refrigeration unit in a heavy-duty vehicle with an electric unit; or (2) purchase and install shore power infrastructure or related equipment that enables electric transport refrigeration units to operate on grid electricity at places where refrigerated heavy-duty vehicles congregate, such as distribution centers.	(10 minutes)
17. Cleaver (MO), McKinley (WV)	#8	Directs the Secretary of Energy to establish a grant program for tree planting to reduce residential energy consumption. The Secretary should award sufficient grants each year to plant not less than 300,000 trees a year until 2025.	(10 minutes)
18. Cox (CA)	#27	Adds agricultural applications, such as solar powered smart agricultural monitoring and irrigation systems, as an eligible solar energy research subject area.	(10 minutes)
19. DeGette (CO), Perlmutter (CO)	#124	**(LATE) (REVISED)** Requires EPA to identify 100 environmental justice communities overburdened by pollution violations and implement strategies for ending the violations.	(10 minutes)
20. Delgado	#123	**(LATE)** Requires the Department of Labor	(10

(NY)		and the Department of Energy to project the current and future workforce needs and shortages within the clean energy technology industry.	minutes)
21. DeSaulnier (CA)	#16	**(REVISED)** Establishes a Department of Energy, in coordination with the Department of Labor, grant program for local communities to develop transition plans for their fossil fuel workforce to more sustainable jobs or sectors.	(10 minutes)
22. Dingell (MI), Walberg (MI)	#75	Amends the Energy Policy and Conservation Act to modify and make technical changes to the definition of water heater under energy conservation standards.	(10 minutes)
23. Doggett (TX), Raskin (MD), Cisneros (CA), Beyer (VA), Huffman (CA), Porter (CA), Pocan (WI), Barragán (CA), Casten (IL)	#94	**(REVISED)** Direct the National Academy of Sciences to conduct a study to evaluate the efficacy of carbon capture technology and to identify industries where energy efficiency is most enhanced by the addition of carbon capture technology.	(10 minutes)
24. Escobar (TX)	#77	Requires the Department of Energy to give special consideration to minority-serving institutions, or a multi-institutional consortium which includes a minority-serving institution, when awarding grants, contracts, or cooperative agreements for solar energy research and development programs.	(10 minutes)
25. Finkenauer (IA)	#131	**(LATE) (REVISED)** Provides labor standards for clean energy projects being funded in whole or in part by provisions of this bill.	(10 minutes)
26. Garamendi (CA), Lowenthal (CA)	#33	Clarifies that offshore wind projects on the Outer Continental Shelf are indeed subject to jurisdiction of the U.S. Constitution and applicable federal laws, as offshore oil/gas rigs are currently. House passed this language by voice vote in 112th Congress (see H.R. 2360).	(10 minutes)

27. Golden (ME)	#129	**(LATE)** Incorporates biomass systems into the Distributed Renewable Energy section of the bill, as well as the energy workforce development and grant program sections.	(10 minutes)
28. Graves, Garret (LA)	#156	**(LATE)** Requires the Secretary of Energy to identify the ability to source necessary critical minerals necessary for solar energy production.	(10 minutes)
29. Graves, Garret (LA)	#158	**(LATE)** Requires actions under emissions reduction road map to be cost-competitive in developing countries as well.	(10 minutes)
30. Graves, Garret (LA)	#160	**(LATE)** Requires a report on the increase or decrease in net imports of critical minerals as a result of actions taken in section 5302.	(10 minutes)
31. Haaland (NM), Gallego (AZ)	#137	**(LATE)** Ensures that the HA-LEU program created in the bill will not negatively impact the natural or cultural resources of Tribal communities or Native Nations or degrade ground or surface water quality as a result of uranium mining.	(10 minutes)
32. Haaland (NM), Tlaib (MI), Ocasio-Cortez (NY)	#169	**(LATE)** Increases authorizations for renewable energy R&D accounts by 50% and adds an authorization for total funding for research, development, demonstration and commercialization activities for EERE.	(10 minutes)
33. Harder (CA)	#78	**(REVISED)** Directs the Secretary of Energy to generate a map that maps wildfire risk around utilities to allow for better planning for grid hardening, vegetation management, and emergency access points, among other things.	(10 minutes)
34. Harder (CA)	#135	**(LATE)** Requires the Centers of Excellence to consider the public health effects of wildfire smoke on outdoor workers, strengthens research and outreach, requires collaboration between centers and grantees, and sets a standard for determining Centers.	(10 minutes)
35. Hayes (CT), Cárdenas (CA)	#71	Amends Section 6201, the Reauthorization of the Clean School Bus Program. Reserves $100 million of $130 million per fiscal year between 2021-2025 for awards to eligible	(10 minutes)

		recipients proposing to replace school buses with zero-emission school buses.	
36. Hayes (CT), Trahan (MA)	#147	**(LATE) (REVISED)** Ensures nothing in this bill would affect the safety and well being of children in carrying out the projects, programs, and other applicable items in this Act or affect the enforcement of child labor and forced labor laws.	(10 minutes)
37. Huffman (CA)	#46	Ensures that harmed Indian Tribes have an opportunity to address the Klamath Hydroelectric Project's historic and ongoing damages to tribal and fishery resources, and that any annual license includes comprehensive studies of the facility's impacts.	(10 minutes)
38. Kuster (NH)	#17	Doubles funding to $40,000,000 for the Energy Workforce Development program, which will help schools and workforce programs train the next generation of energy workers.	(10 minutes)
39. Lamb (PA), Trahan (MA)	#139	**(LATE)** Authorizes fusion research program.	(10 minutes)
40. Lamb (PA)	#140	**(LATE)** Authorizes milestone-based nuclear demonstration projects.	(10 minutes)
41. Lamb (PA)	#148	**(LATE)** Authorizes produced water research, development, and demonstration program.	(10 minutes)
42. Larsen, Rick (WA)	#175	**(LATE)** Directs the U.S. Department of Transportation to catalog climate change mitigation efforts in U.S. aviation and aerospace, identify barriers to adoption and serve as a roadmap for U.S. aviation to meet emission reduction goals.	(10 minutes)
43. Lee, Susie (NV), Tonko (NY)	#126	**(LATE)** Amends subtitle C of Title II to facilitate a streamlined process for the local permitting of distributed energy systems.	(10 minutes)
44. Levin, Andy (MI), Ocasio-Cortez (NY)	#97	Amends various programs under subtitle E – EV Infrastructure by expanding on the definition of “underserved or disadvantaged community” used under this subtitle; ensuring EV supply equipment listed as eligible for the rebate program is ADA	(10 minutes)

		compliant; requiring identification of nearby existing publicly available EV supply equipment in the EV infrastructure rebate program application; requiring the Secretary of Energy in developing standards for an electric vehicle charging network to provide considerations for addressing range anxiety and the need for a nationwide network of EV charging infrastructure; and ensuring State Energy Transportation Plans include considerations for statewide networks of EV charging infrastructure and modernization to electric grids to be powered by renewable energy sources.	
45. Levin, Andy (MI)	#100	Directs the Secretary of Labor, in consultation with the Secretary of Energy, and acting through the Bureau of Labor statistics to collect and analyze labor market data to track workforce trends resulting from renewable energy and energy efficiency technology initiatives. Authorizes appropriations of $10,000,000 for each fiscal years 2021 through 2025 to carry out this section.	(10 minutes)
46. Levin, Mike (CA), Bonamici (OR), Neguse (CO)	#37	**(REVISED)** Establishes a program to improve wildfire smoke emissions modeling and to develop smoke forecasts. Directs the Environmental Protection Agency to collect data and coordinate research on the impacts of acute air pollution exposure from wildfires.	(10 minutes)
47. Lipinski (IL)	#10	**(REVISED)** Requires the Secretary of Energy to carry out a research program on effects of exposure to low-dose radiation.	(10 minutes)
48. Loebsack (IA), Velázquez (NY)	#132	**(LATE)** Establishes a grant program within DOE for the purpose of making energy efficiency and renewable energy improvements at public school facilities.	(10 minutes)
49. Lowenthal (CA)	#38	**(REVISED)** Requires the Department of Interior to create an online database to annually report the type of energy and emissions produced on federal public lands.	(10 minutes)
50. Lucas (OK)	#14	Expresses the sense of Congress that in	(10

		order to reduce emissions and meet 100 percent of the power demand in the United States through clean, renewable, or zero emission energy sources while maintaining U.S. leadership in science and technology, the Secretary of Energy must prioritize funding for fundamental research, and research and development infrastructure.	minutes)
51. Lucas (OK)	#15	Expresses the sense of Congress that in order to reduce emissions and meet 100 percent of the power demand in the United States through clean, renewable, or zero emission energy sources while maintaining U.S. competitiveness in science and technology, the U.S. must prioritize investment in domestic energy sources and supply chains, as well as investment in the research and development of exportable next-generation energy technologies.	(10 minutes)
52. Lujan (NM), Castor (FL)	#110	Supports the growth of local solar energy by making community solar more accessible to all consumers and ratepayers, including lower-income consumers, by requiring states to consider enacting policies to allow community solar projects.	(10 minutes)
53. McNerney (CA), Bonamici (OR)	#136	**(LATE)** Directs the National Institute of Standards and Technology (NIST) to collect data following wildfires in the wildland-urban interface related to the influence of building materials on structural fires and how wind, terrain, and moisture affect wildland fires. NIST would also be required to conduct research on and develop metrics for economic outcomes associated with wildland-urban interface fire mitigation.	(10 minutes)
54. Mucarsel-Powell (FL)	#19	Directs the Secretary to support research and development of underground transmission and distribution lines to lower costs and improve reliability and safety.	(10 minutes)
55. Norcross (NJ), McKinley (WV)	#22	Creates a rebate program for energy efficient electrotechnologies upgrades.	(10 minutes)
56. Norcross	#23	Allows grant funds for Building efficiency	(10

(NJ)		and resiliency to be used to make an addition or alteration to, or to install, replace, or provide maintenance to, an air filtration and purification system of an HVAC system to help prevent the spread of COVID-19. All laborers and mechanics employed in the process of the project must be paid prevailing wages.	minutes)
57. Ocasio-Cortez (NY)	#84	Strikes section 3109 on methane hydrates.	(10 minutes)
58. O'Halleran (AZ)	#47	Reauthorizes and increases funding for Section 609 "Rural and Remote Communities Electrification Grants" under the Public Utility Regulatory Policies Act (PURPA) to assist the economic transition of rural and distressed communities impacted by the downturn of coal-fired power generation. Grants available under this section may be used to increase energy efficiency, upgrade transmission or distribution lines, or modernize electric generation facilities in rural and distressed communities, with an emphasis on renewable energy.	(10 minutes)
59. O'Halleran (AZ)	#55	Directs the Department of Energy to establish a "Coal Community Resource Clearinghouse" for the purpose of increasing awareness of Federal and State programs, grants, loans, and technical assistance resources DOE determines could assist economic development and transition activities in communities impacted by the downturn of coal-fired power generation.	(10 minutes)
60. Omar (MN)	#171	**(LATE)** Requires the Administrator to establish and carry out a program to award grants, on a competitive basis, to eligible entities for projects that are consistent with zero-waste practices.	(10 minutes)
61. Omar (MN)	#172	**(LATE)** States that the Secretary of the Treasury, shall submit to Congress a report that contains— (1) an identification of any existing fossil fuel production subsidies not eliminated by this Act, or the amendments	(10 minutes)

		made by this Act; and (2) a quantification of the economic costs of such subsidies.	
62. Panetta (CA), LaMalfa (CA), Costa (CA), Garamendi (CA), Harder (CA), Carbajal (CA)	#28	**(REVISED)** Directs the Secretary of Energy to establish a critical infrastructure and microgrid research program.	(10 minutes)
63. Panetta (CA), LaMalfa (CA), Costa (CA), Garamendi (CA), Carbajal (CA)	#64	Expands financial assistance for weatherization enhancement and innovation to cover the use of materials that are resistant to high heat and fire in dwellings occupied by low-income persons in areas at risk from drought and wildfires.	(10 minutes)
64. Perlmutter (CO)	#25	Modifies the definition of energy storage to broaden its scope.	(10 minutes)
65. Peters (CA)	#73	**(REVISED)** Establishes an interagency task force to create an action plan to reduce super pollutants based on policy recommendations provided by the Intergovernmental Panel on Climate Change, U.S. Climate Alliance, and other relevant agencies.	(10 minutes)
66. Peters (CA)	#76	**(REVISED)** Directs EPA, DOE and other relevant agencies to develop a comprehensive plan to reduce black carbon emissions from the international shipping industry through its membership in the International Maritime Organization (IMO), including binding limits on black carbon as part of the Polar Code.	(10 minutes)
67. Peters (CA)	#133	**(LATE)** Requires the DOE to release the Interconnections Seams Study, which may support efforts to increase renewable energy transmission, and has reportedly been held and/or altered for political reasons.	(10 minutes)
68. Pingree (ME), Spanberger	#29	Includes agricultural and grazing practices and forest management and afforestation as priorities in the Department of Energy's	(10 minutes)

(VA)		carbon removal program.	
69. Pingree (ME)	#67	Includes research and development that reduces impacts on existing ocean uses and increases coordination between offshore wind and existing users, including the commercial fishing industry, as purposes of the Department of Energy's wind energy research and development grant program.	(10 minutes)
70. Plaskett (VI), Lieu (CA), San Nicolas (GU)	#125	**(LATE)** Establishes a Department of Energy grant program for investments in renewable energy systems, energy efficiency activities, energy storage, smart grids, or microgrids in territories of the United States, as well as for training local residents. Grants would be awarded to non-profit organizations and the Department of Energy's National Laboratories may provide technical assistance.	(10 minutes)
71. Pocan (WI)	#62	**(REVISED)** Reauthorizes the EPA State Indoor Radon Grant (SIRG) Program.	(10 minutes)
72. Quigley (IL)	#13	Directs GSA to incorporate, to the extent practicable, features, practices, and strategies to reduce bird fatality resulting from collisions with public buildings.	(10 minutes)
73. Quigley (IL)	#32	Establishes an Advanced Energy Technology Research Initiative at FERC to reform power system modeling and update grid services and grid operator software, and authorizes studies on advanced energy and electric grid efficiency.	(10 minutes)
74. Rouda (CA)	#11	Suspends preemption for federal appliance and equipment efficiency standards when DOE misses deadlines to update such standards.	(10 minutes)
75. Rush (IL)	#39	Requires the Secretary of Energy to establish an energy jobs council. The council shall conduct a survey of energy employers and produce annually an energy and employment report.	(10 minutes)
76. Schrader (OR)	#50	Establishes the Home Wildfire Risk Reduction Rebate program, to provide rebates to homeowners to defray the costs of	(10 minutes)

		retrofitting an existing home to be wildfire-resistant.	
77. Schweikert (AZ)	#108	Requires the Secretary of Energy to conduct a study on the benefits of blue hydrogen technology and how that can further enhance the deployment and adoption of carbon capture and storage.	(10 minutes)
78. Scott, Bobby (VA), Murphy, Stephanie (FL)	#106	**(REVISED)** Supports the use of modeling and simulation tools to more efficiently design, site, permit, manufacture, construct, operate, maintain, and decommission wind energy systems.	(10 minutes)
79. Scott, Bobby (VA)	#141	**(LATE)** Supports research on the recovery of critical materials used in wind energy systems.	(10 minutes)
80. Sherrill (NJ)	#168	**(LATE)** Provides explicit direction for DOE to conduct RD&D on ways to reduce siting and permitting issues associated with potential impacts of wind power systems on air traffic control, air defense, and weather radar systems	(10 minutes)
81. Stevens (MI), Dingell (MI)	#111	Directs the Secretary to establish a program of research, development, and demonstration activities on more efficient and sustainable materials, technologies, and processes for the manufacture, development, and use of the passenger and commercial vehicles.	(10 minutes)
82. Thompson, Mike (CA), Huffman (CA), Garamendi (CA), Panetta (CA)	#72	Establishes a reliability standard, within the Federal Power Act, regarding extreme weather events. Directs the Department of Energy (DOE) to create a program and publish a report for states and local utilities on ways to improve the resiliency of their electrical grids.	(10 minutes)
83. Thompson, Mike (CA), Horsford (NV), Horn (OK)	#79	Clarifies that energy use avoided through the use of geothermal pump technology is considered renewable energy produced for the purposes of this bill.	(10 minutes)
84. Tlaib (MI)	#167	**(LATE)** Requires the EPA to conduct a study to evaluate the disparate health impacts of emissions from fossil fuel	(10 minutes)

		facilities on minority and low and moderate income communities. Requires EPA to report to congress a summary of the study conducted.	
85. Tonko (NY)	#120	Requires the EPA Administrator to enter into an agreement with the National Academy of Sciences to assess methods for life cycle greenhouse gas emissions analyses for low-carbon transportation fuels.	(10 minutes)
86. Waters (CA)	#83	Requires the Secretary of Transportation's report on electric vehicle (EV) charging station infrastructure in underserved communities to identify the potential for, and obstacles to, recruiting and entering into contracts with locally-owned small and disadvantaged businesses, including women- and minority-owned businesses, to deploy EV charging infrastructure in these communities.	(10 minutes)
87. Waters (CA)	#95	Encourages institutions of higher education that receive grants for the construction of training and assessment centers to identify and consider qualified diverse candidates during the procurement process.	(10 minutes)
88. Waters (CA)	#103	Requires the Secretary of Energy to evaluate, on state applications for "State Leadership Grants," which support the implementation of smart manufacturing technology, whether proposed projects will benefit diverse communities.	(10 minutes)
89. Waters (CA)	#146	**(LATE)** Expands the Home Energy Savings Retrofit Rebate Program to include multifamily housing.	(10 minutes)
90. Wild (PA), Jeffries (NY)	#112	**(REVISED)** Requires the Secretary of Energy, in consultation with the Secretary of Labor, to establish a program to provide competitive grants to eligible entities to pay for pre-apprenticeship training for individuals or on-the-job training of a new or existing employee.	(10 minutes)
91. Wilson, Joe (SC)	#40	Evaluates potential demonstration sites across the Department of Energy complex	(10 minutes)

		under Advanced Nuclear Reactor Research, Development, Demonstration, and Commercial Application Program.	
92. Bera (CA)	#96	**(REVISED)** Directs the Secretary of Energy to support R&D on tools and technologies for improving electric grid and energy sector safety and resilience during concurrent or co-located severe weather events.	(10 minutes)
93. Blumenauer (OR)	#152	**(LATE) (REVISED)** Requires the Secretary of Energy to file a report to the committees of jurisdiction documenting funds spent under the Light Water Reactor Sustainability program, and creates an advisory committee to submit an annual report to the relevant committees outlining the progress of the this program.	(10 minutes)
94. DeGette (CO)	#122	**(LATE) (REVISED)** Updates the methane waste prevention rules of the Bureau of Land Management.	(10 minutes)
95. Krishnamoorthi (IL)	#91	**(REVISED)** Requires the public awareness campaign to include projected environmental impact, and information on how to find more information on the grant.	(10 minutes)
96. Clark, Katherine (MA)	#115	**(REVISED)** Creates a task force led by the Secretary of Energy, which would be tasked with creating a report identifying tools that the Federal Government can use to advance the deployment of carbon dioxide removal projects.	(10 minutes)
97. Blunt Rochester (DE)	#45	**(REVISED)** Creates a competitive grant program at EPA to incentivize ports to create and implement climate action plans.	(10 minutes)
98. Lujan (NM), Wilson, Joe (SC), Casten (IL), Torres Small, Xochitl (NM)	#99	**(REVISED)** Creates a congressionally-authorized Department of Energy foundation to support the Department's energy missions and to increase collaboration to accelerate the commercialization of energy technologies.	(10 minutes)

Subcommittee on Environment and Climate Change
Hearing on
"Building a 100 Percent Clean Economy: Opportunities for an Equitable, Low-Carbon Recovery"
September 16, 2020

Devashree Saha, Ph.D.
Senior Associate
World Resources Institute

The Honorable Nanette Diaz Barragán (D-CA):

1. Over 490,000 clean energy workers remain jobless since the pandemic hit, including over 84,000 workers in California. Can you describe the most effective policies and investments we can enact today to bring these jobs back?

   RESPONSE: As the United States begins its recovery from the health and economic impacts of COVID-19, it is imperative that we address the next big global challenge: Climate change. While the pandemic has led to a high level of unemployment in the country, including in the clean energy sector, targeted policies and investments to address climate change can also create an opportunity to create jobs in the low-carbon sector and stimulate economic activity.

   Specifically, WRI has identified five priority areas where Congress can take immediate action that can help create jobs and boost economic recovery:

   1. **Building Energy Efficiency and Energy Assistance:** A targeted expansion of energy efficiency and energy assistance programming can provide three core benefits: it can put people to work immediately in quality jobs, contributes to a clean energy future, and provides relief to struggling households by alleviating energy costs. For more details, see Building Energy Efficiency and Energy Assistance: Creating Jobs and Providing Relief to States Across the Country.
   - Increase the funding allocated to the Low-Income Home Energy Assistance Program (LIHEAP) to $20 billion.
   - Increase the funding allocated to the DOE Weatherization Assistance Program to $5 billion annually.
   - Increase grant funding to states by $100 billion across the State Energy Program, the Energy Efficiency and Conservation Block Grant, and Community Development Block Grant to support upgrades of hospitals, schools, and public buildings to make these high-performance buildings, improve energy efficiency, improve indoor air quality, and lower capital, operating, and maintenance costs of these buildings.

- Increase consumer incentives for appliance replacement, including the Nonbusiness Energy Property Credit and the State Energy Efficient Appliance Rebate Program.

2. **Public Transit and Transportation Infrastructure:** Investing in public transit and transportation infrastructure can create jobs and economic growth (every $1 billion invested in public transportation creates nearly 50,000 jobs and returns $5 billion in economic activity), while supporting financially stressed state and local governments. For more details, see Public Transit and Transportation Infrastructure: Creating Jobs and Supporting Transit Across the United States.

- Increase funding to $25 billion annually to fill the budget gaps of local transit agencies and support their ongoing operating costs.
- Reorient transportation funding toward "fix-it-first" principles that focus on maintaining and repairing existing roads, bridges, and transit systems over the expansion of new roads and highways, and "complete streets" infrastructure projects that offer space for biking, walking, driving, and public transit
- Invest in electric vehicle (EV) charging infrastructure in every state across the country.
- Establish 'Buy Clean' incentives for the concrete used in transportation infrastructure projects.

3. **Manufacturing Electric School and Transit Buses:** Investing in manufacturing electric school and transit buses can reduce operating and maintenance costs, reduce CO2 emissions, and avoid emissions of harmful local pollution with negative health impacts, all while creating jobs in the near-term and positioning the U.S. as a leader in the growing zero-emission vehicle market. For more details, see Manufacturing Electric School and Transit Buses: Creating Jobs and Economic Growth.

- Scale up the Clean Cities, Clean School Buses and Low and No Emissions Vehicle programs to provide $20 billion in grants to school districts and transit systems—enough to replace 60,000 school and transit buses, or about 10 percent of the national fleet.

4. **Grid Modernization:** Investments in modernizing the U.S. electric grid infrastructure will be critical to unlocking the renewable energy investment required for a clean energy future, it provides consumers with cost savings and a more reliable/resilient grid. Transmission investment ranging between $12 billion and $16 billion annually through 2030 could stimulate $30 billion to $40 billion in annual economic activity and create 150,000 to 200,000 full-time jobs each year. For more details, see Grid Modernization: Creating Jobs, Cutting Electric Bills, and Improving Resiliency.

- Make existing renewable energy tax credits refundable.
- Extend the federal renewable energy tax incentives for five years and make energy storage systems and transmission projects eligible for the Investment Tax Credit.

- Reauthorize DOE's Smart Grid Investment Grant program and fund it at $20 billion to promote investments in smart grid technologies, tools, and techniques.
- Expand low-cost loans and grants to rural electric co-ops to expand electricity transmission and broadband access through USDA's Rural Utilities Service (RUS).
- Authorize the Department of Transportation to provide $5 billion annually over 10 years in Transportation Infrastructure Finance and Innovation Act (TIFIA) loans to transmission projects that emphasize the integration of renewable energy.
- Leverage the DOE's Loan Guarantee Program to incentivize investment in transmission infrastructure.
- Make strategic investments in energy storage deployment.

5. **Restoring Trees to the Landscape:** Jobs on tree planting crews, in nurseries, and as foresters are literally "shovel-ready," and support the single largest near-term opportunity for carbon dioxide removal at scale in the United States. An annual federal investment of $4–4.5 billion could create more than 150,000 jobs and $6-12 billion per year in economic activity. For more details, see Restoring Trees to the Landscape: Creating "Shovel-Ready" Jobs Across the United States.

- Add new dedicated funding for tree restoration to the Environmental Quality Incentives Program (EQIP).
- Expand incentives for tree restoration projects on historically forested lands through the Conservation Reserve Program (CRP).
- Issue grants to state and local governments to boost tree restoration using their own policy tools.
- In total, across these programs Congress could dedicate $4–4.5 billion per year for tree restoration

2. We are going to need record levels of investment in clean energy to reach 100% clean energy. Are there financing strategies you recommend Congress support that can leverage private sector dollars to help us build the clean energy economy as fast as possible?

   RESPONSE: Congress can look to the experience of several subnational governments across the nation that have created green banks to drive investments in clean energy. These subnational green banks have generated $5.3 billion in clean energy investment since 2011, with $1.5 billion in 2019 alone. But to address climate change effectively, we need to invest many billions more.

   The idea of a similar entity at the federal level is catching on in Congress. A federal green bank can use a range of financial tools to address barriers that currently prevent private sector investment from going into the low-carbon sector. If the private sector sees these types of investments as risky, it would be unwilling to provide capital at rates that are feasible for a project to move forward. The federal green bank can provide credit enhancements, such as loan loss reserves and loan guarantees, to de-risk private sector investments.

Some important considerations should be kept in mind when designing a federal green bank. First, it should prioritize and incentivize investments in projects that significantly reduce carbon emissions across the entire economy. That means solutions like transit-oriented-development, including equitable, dense housing near reliable trains and buses will be as eligible for green bank as projects that fund improved insulation, windows and other energy use reduction measures in buildings. Second, the bank should be a nonpartisan nonprofit operating with complete public transparency. Once established and funded, all its investment decisions should be made by experts and should be insulated from political interference. Third, the green bank should have a unique focus on equity and community engagement. To that end, a federal green bank should enable low-income and minority communities to benefit from and afford projects and investments that reduce emissions, create jobs, and stimulate economic activity.

3. Strong and effective partnerships between federal agencies and state and local governments will be critical for effectively implementing many clean energy investment programs. Can you describe best practices that can ensure a green stimulus is well coordinated and respects the diversity of strengths and needs different areas of the country have?

RESPONSE: Experience from the American Recovery and Reinvestment Act of 2009 (ARRA) provides some guidelines on how a future green stimulus can be well coordinated between federal agencies and state and local governments. One lesson is to rely on established programs and implementation networks to provide rapid assistance rather than standing up new organizations or procedures. Some of the most successful elements of ARRA expanded upon existing programs and funding streams to the states. This enabled federal money to get out of the door rapidly and spent quickly and effectively by states and local governments.

Second, the federal government will need to adopt strategies for speedy and effective implementation of stimulus program. The Obama administration created the Recovery Implementation Office (RIO) within the Office of Management and Budget (OMB) to facilitate communication among federal agencies, states, and other funding recipients. RIO provided guidance and technical assistance, and helped states meet spending targets. In this manner, RIO served as a focal point for governmentwide problem solving and coordination. Creating a similar, high-level focal point for overseeing and implementing future stimulus programs will be important.

Third, the federal government has to strike the right balance between accountability and speedy implementation. One the one hand, there will be an emphasis on rapid program implementation that can lead to job creation and economic activity. On the other hand, there will oversight of these programs with clear expectation of accountability and transparency from state and local governments. The latter can slow implementation of programs as state and local officials and funding recipients wait for new rules, clear guidance, and risk-reduction strategies. The more quickly such accountability rules and procedures can be issued and the simpler they are, the greater the likelihood that accountability requirements can be successfully implemented.

The Honorable Diana DeGette (D-CO):

1. Dr. Saha told us that promoting the deployment of clean energy technology can be a major boon to the US economy. I recently introduced legislation that will both invest millions toward the innovation of new clean-energy technologies and create the nation's first federal clean energy standard.

    a. Does the technology we need to provide Americans with 100% reliable, affordable, emissions-free electricity exist today?

    RESPONSE: At present, we do not have every single tool we need to get to net-zero emissions in the power sector. It can be useful to think of decarbonization in chapters. Variable renewable energy is available and relatively cheap now. Short-duration energy storage is quickly becoming economic. Those solutions are scalable now and can make a significant contribution to power sector decarbonization in the short term. However, we also need other technologies, such as advanced nuclear, CCUS, and long-duration storage, each of which faces differing challenges along the innovation curve. For instance, for carbon capture and storage, some technologies have reached the demonstration phase, but none of them have low costs for them to commercially deployed at scale. For long duration storage technologies, the high costs of demonstration are a significant obstacle. Therefore, rapid innovation is needed for these three technologies and for other emerging low-carbon technologies to be able to provide Americans with 100% reliable, affordable, emissions-free electricity.

    b. Would a federal clean energy standard, combined with the type of investment you've discussed -- both of which are included in my bill -- drive innovation of the technologies we need to solve the climate crisis?

    RESPONSE: Rapid decarbonization of the electricity sector is critical for addressing the climate crisis. While an economy-wide price on carbon should be enacted as soon as possible, a well-designed Clean Energy Standard (CES) could jumpstart decarbonization of electricity, and might provide a useful complement to a broader carbon price if it were designed to provide targeted incentives to speed the development and deployment of technologies and practices that may be needed as the electric sector approaches zero emissions, such as electricity storage, demand response, electrolysis to create hydrogen fuel, and carbon capture and storage (CCS).

In terms of design CES should be technology neutral to encourage competition and innovation in the electric power industry. It can thereby increase demand for clean energy technologies, provide investment certainty for those technologies, drive forward commercialization, cost reductions, and innovation for zero emission technology.

Congress should also look at ways to account for the full emissions impact of any particular technology, such as methane leakage and the climate impacts of different biomass resources rather than assume that all biomass is carbon-neutral. Congress should allow states to pursue a more ambitious policy than the federal CES and preserve the benefits of their stronger standards. This might be achieved by allowing states to set their own more ambitious standards under the program, by allowing states to opt out of the federal CES if they have a stronger standard in place, or by allowing states to not issue clean energy credits to generators in excess of what they would receive based on the state standards, or by other means.

c. By driving innovation, will this combination also benefit our economy?

RESPONSE: A well-designed clean energy standard will help push out the dirtiest generation while directing greater investments in the zero-emission clean energy we all want to see. It will deliver clean energy to American consumers, while enhancing the reliability and resilience of the nation's power grid, creating jobs domestically, and increasing American economic competitiveness globally.

2. Most states have enacted either a renewable energy standard or a clean energy standard.

a. Have clean and renewable energy standards been successful at the state level, and do you feel they offer a useful model for federal action?

RESPONSE: Yes, clean and renewable energy standards have been successful at the state level, and they offer a useful model for federal action. The details of state renewable portfolio standards vary from state to state, with different levels of ambition and differing qualified technologies. In addition, state RPS exist amidst a broad array of market and policy drivers for renewable energy growth, as a result of which separating out the incremental impact of any one driver can be challenging. Having said that, a number of studies have come to the conclusion that state RPS policies have been successful in driving U.S. renewable energy growth. Many states have exceeded their original standards ahead of schedule and have responded by setting increasingly aggressive requirements. Researchers at the Lawrence Berkeley National Laboratory observed that more than 60% of renewables deployment since 2000 has occurred in states with an RPS in place. Furthermore, studies estimating the costs and benefits of RPS policies have found that the benefits tend to outweigh the costs by significant amounts. Another study found that the national costs of RPS compliance in 2013 were approximately $1 billion, while benefits from reduced carbon emissions totaled $2.2 billion and public health benefits came to an impressive $5.2 billion. In short, RPS policies appear to foster renewables deployment, and their benefits exceed their costs. A federal clean energy standard can build on the successful experience of those states that have implemented renewable and alternative energy portfolio standard.

3. The Clean Energy Standard in my bill is designed to account for the fact that we can't predict the pace of clean energy innovation. I think of my bill as having three speeds. If technology doesn't develop quickly enough, my bill will offset any carbon emissions in 2050 with verified carbon reductions outside the power sector. If technology moves much more quickly as a result of the support we're providing for innovation, we could accelerate to zero emissions as soon as 2037. Finally, any power company ready to replace all emitting technologies with non-emitting technologies before 2037 will receive funding assistance to do so. This will be available upon enactment.

    a. Do you think it makes sense to design a Clean Energy Standard to adjust to the pace of technology innovation, while ensuring adequate federal investment to ensure that that innovation occurs?

    RESPONSE: While in the past, technology innovation has often happened at a faster speed than was previously anticipated, as of now we do not possess all the technologies we need to fully decarbonize the power sector. A federal CES should, therefore, not only require power companies to ramp up their use of existing clean energy technologies such as solar, wind, and hydro, but also spur the innovation of new technologies that will be required to fully decarbonize the power sector. In designing a federal clean energy standard, one thing that will need to be kept in mind is its interaction with other policies such as existing federal tax credits such as the production tax credit and a possible technology neutral tax credits policy in future.

Subcommittee on Environment and Climate Change
Hearing on
"Building a 100 Percent Clean Economy: Opportunities for an Equitable, Low-Carbon Recovery"
September 16, 2020

Lonnie R. Stephenson
International President
International Brotherhood of Electrical Workers (IBEW)

The Honorable Nanette Diaz Barragán (D-CA):

1. Over 490,000 clean energy workers remain jobless since the pandemic hit, including over 84,000 workers in California. Can you describe the most effective policies and investments we can enact today to bring these jobs back?

   RESPONSE:

2. IBEW represents workers in both the clean energy industry and the fossil fuel industry. Can you talk about the opportunity and the challenges we face in putting a just transition in place as energy industry shifts towards cleaner sources, and do you have any recommendations on policies we can enact to make sure workers aren't left behind during this transition?

   RESPONSE:

The Honorable Diana DeGette (D-CO):

1. I appreciate the work of the IBEW and other unions on the Labor Energy Partnership Mr. Stephenson mentioned in his written testimony. While developing my legislation, I have tried to incorporate the four main principles of the Partnership. Specifically, I wanted to make sure my bill provided a "just transition" for energy workers, so as to not leave them outside of this power sector transformation.

   a. Do you agree that in whatever plan we move forward with, existing energy workers must be protected and helped to transition into new jobs in clean energy, should that be necessary?

      RESPONSE:

   b. For the jobs and employees new to the energy sector, will it be important that those workers be given an opportunity to organize?

RESPONSE:

c. Do you believe that the transition to a clean energy economy can be "just" without giving the workers an opportunity to organize?

RESPONSE:

Subcommittee on Environment and Climate Change
Hearing on
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September 16, 2020

Denise Fairchild, Ph.D.
President & CEO
Emerald Cities Collaborative

The Honorable Nanette Diaz Barragán (D-CA):

1. Dr. Fairchild, first I want to thank you your past work in Los Angeles on community development and job training for underserved communities, like those that I represent. My district is the fourth poorest district in California. It's critical we center equity in any green stimulus investments we make so that the communities most in need of jobs can benefit.

    1. Can you discuss model programs or policies at the local and state level that Congress can adopt alongside green investments to make sure communities of color aren't left behind?

    RESPONSE:

    Legislative Initiatives:
    Creating local hire policies and local procurement policies are essential for increasing employer demand to improve their hiring practices to include workers and businesses from diverse communities. Without these policies there are no incentives for breaking through closed hiring and contracting networks. L.A. County policies have helped ECC place over 100 YouthBuild (out of school/disadvantaged youth) into apprenticeship programs that lead to viable construction careers.

    L. A County Executive Order 11246 outlines specific guidelines in which equal opportunity is provided in all aspects of employment when it comes to Government Contractors who do over $10,000 in government contracts as well as establishing minority hiring and participation goals that are specific by trade.

    In LA County the Local Worker Hiring Program (LWHP) was adopted in 2016 (and updated July 2019) to ensure local workers are hired for projects in their communities. The LWHP established local workers shall perform at least 30% of the total California craft worker hours. Disadvantaged Local Workers shall perform at least 10% of total construction labor hours which are included in the overall 30% total. The size of the project determines whether or not these targets are mandatory, good faith effort or not applicable. Projects over $2.5 million are mandatory.

The Federal Government has instituted similar regulatory tools for workforce and supplier diversity in Dept of Transportation and HUD – Section 3…. but need to be similarly embedded and enforced as part of other federal agency programs (e.g., DOL, DOE, EPA, etc.).

These efforts towards local hire and to engage low-income residents help rural and urban poor who are often pushed out of the labor market by ensuring that large firms hire residents within the project area.

L.A. County Model Programs

Policies created need to go hand in hand with training programs in order to create a pipeline of workers from disadvantaged workers are connected to these growing living wage careers. If we don't provide the training needed for communities of color, we risk the reproducing income inequalities. We need to give disadvantaged communities the opportunity go into to the Green Building sector by providing training programs that build capacity and knowledge.

Current programs established by Emerald Cities Collaborative in the LA region are the Architecture Construction Engineering Students (ACES) Pathway Program and the Green Path Careers (GPC) Program that serve as models for broad replication.

Since 2015, over 10 high schools engaged with the ACES Pathway Program (ACES). ACES is a comprehensive in-school youth workforce development model that combines structured academic pathways to STEAM careers, access to pre-apprenticeship training, and paid internships. ACES engage disadvantaged students to explore careers in architecture, engineering and construction by capitalizing on local projects, concurrent college enrollment in STEAM courses, and strong industry participation. Thirty-seven percent of ACES students are female. The goals of the program are to facilitate college enrollment and transferable college credit during high school; increase diversity of students entering the design and building industries; expand experiential learning and industry mentorship through paid summer internships; and provide access to scholarships to assist students with the high cost of higher education.

Past and Current Participating Schools:

- Alhambra High School
- Mark Keppel High School

- San Gabriel High School
- Robert F. Kennedy Community Schools
- STEAM Legacy High School
- Helen Bernstein STEM Academy
- Mendez High School
- YouthBuild – Boyle Heights
- 5-Keys Charter
- Boyle Heights Youth Technology Center

The GPC Program provides Transition Age Youth (TAY) access to the emerging Energy Efficiency (EE) sector by offering education, training and work experience in the field. This initiative is made possible through collaboration between the SoCalREN, San Gabriel Valley Council of Governments (SGVCOG), Workforce Development, Aging and Community Services (WDACS), and Hathaway-Sycamores Child and Family Services.
The program is designed to address the barriers TAY face when aging out of the Foster Care system and moving into the growing workforce, while addressing the EE workforce expansion needs. GPC aims to assist TAY youth by eliminating the barriers of the EE workforce sector, by providing certification training, supportive services, and the coaching needed to emerge successful by providing the resources and support needed to begin their EE career.
The GPC program provides a multi-step approach that assists a participant in entering the Energy Efficiency workforce from the initial recruitment phase to becoming Job/Career Ready.

2. Dr. Fairchild, we also know that equity in the clean energy economy is not just about creating jobs, but supporting the growth of minority owned businesses. How can we ensure the clean energy economy we're building creates a new generation of CEOs that reflect our country's diversity?

RESPONSE:

In order to have an inclusive green economy we need to provide the resources and infrastructure small and minority businesses need to compete against the large companies. The industry is outpacing the knowledge and capacities of our small community contractor to keep pace. The building codes are changing, the technologies and equipment are getting smarter, greener and more expensive and out of reach of small contractors, are minority contractors cannot compete for the very larger multi-year, multi-billion dollar P3 projects. These trends taken together will put our minority contractor communities out of business in the next 5 years without investments in the capacity to compete.

This requires the on-going support to build capacity a small/minority business may need, which includes skills training for new and emerging technologies in the green sector. Small/minority businesses need to be equipped and prepared with available resources such as access to capital in order to grow in the clean energy sector. Our High Road Accelerated Minority Business Institute (HRAMBI) serves to position small, minority, women, disadvantaged and veteran-owned firms as leaders in the high road construction sector with state-of-the-art knowledge and skills in socially responsible green building and construction by:

1. Increasing the number of MWDVBEs committed to environmentally and socially responsible contracting.
2. Strengthen the capacities and competitiveness of MWDBEs with knowledge and competencies in green building policies and practices.
3. MWDBE access to affordable state-of-art building technologies, equipment, materials and benefit programs.
4. Increased contracts awarded to MWDVBEs

Investments from the Dept of Commerce, SBA, and other minority assistance programs needed to be targeted to build the capacity of minority entrepreneurs and contractors in green/smart building technologies.

For further information about ECC's L.A. programs please contact: Wendy Angel, LA Program Director @ wangel@emeraldcities.org

Subcommittee on Environment and Climate Change
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Michelle Michot Foss, Ph.D.
Fellow in Energy & Minerals
Baker Institute for Public Policy, Center for Energy Studies
Rice University

The Honorable John Shimkus (R-IL):

1. What are the biggest obstacles to reducing our reliance on critical mineral imports and increasing our domestic production?

RESPONSE:

Honorable Mr. Shimkus, this is an enormous question and there are a number of excellent resources for background.[1] It actually has two parts – one is direct replacement of imported raw materials. The other is whether we can substitute U.S. manufacturing (which would require appropriate supply chains) for goods that we import and that entail critical minerals inputs but are manufactured elsewhere because input costs are cheaper or more accessible (including labor availability and costs as well as associated raw materials supply chains to support manufacturing). When it comes to direct replacement of imported raw materials, the U.S. mining and minerals processing industries are affected by challenges that these businesses face worldwide. These include that gamut of environment, social, governance (ESG) risks that are being imposed across economic sectors (except, apparently, those that are perceived as "green" "clean" tech). In fact, the mining industry has demonstrated continuous improvement on the ESG front, as have other basic industries. The myriad safety, security, health and environment (SSHE) challenges in mining and minerals processing cannot be ignored. They can be addressed with proper controls that reflect realities of these businesses and allow some flexibility for operators. Mining and minerals processing operations consume water and energy, which must also be acknowledged but also can be managed. Labor is a huge consideration. Worldwide, the work force for these industries is ageing and for the U.S. and other developed countries, including China, demographics are not favorable for new recruitment and replacement. Trends worldwide in ore quality are worrisome for future

[1] A few are: https://www.mining.com/the-5-biggest-challenges-facing-the-mining-sector/, https://www.hatch.com/en/About-Us/Publications/Blogs/2018/08/Five-challenges-that-mining-needs-to-address-today, https://www.aggreko.com/en-fj/news/2018/auspac-news/07-july/five-common-challenges-facing-the-mining-industry, https://www.marsh.com/us/industries/mining-metals-minerals-insurance/solutions-to-mining-risk-challenges.html. The annual EY survey of top 10 business risks is excellent, https://www.ey.com/en_us/mining-metals/10-business-risks-facing-mining-and-metals. Also see https://www2.deloitte.com/xe/en/pages/energy-and-resources/articles/key-issues-facing-mining-sector.html.

demand and needs. In part, many of the resource opportunities in our country do not compare favorably with opportunities abroad. We could alter that equation by providing a more conducive business setting for our extractives industries. Volatile commodity prices and capital intensity of these industries are harsh realities. The more remote and difficult the target resource opportunities, the more costly the projects and value chains and the bigger the set of challenges and issues that must be managed including ESG and SSHE requirements and expectations. All of these realities should be reflected in analysis and opinions regarding policy recommendations, for instance those promoting aggressive investment and acceleration of materials intense applications, such as electric vehicles and alternative energy. They are not. Along with these and many other considerations, the U.S. has unique challenges associated with resource access, which mainly revolve around Federal lands and intense opposition to extractives industries in many locations. Our style of regulatory oversight across the SSHE landscape contributes to the cost structure of our mining and minerals processing industries, encumbering competitiveness. Finally, the most difficult obstacle is the most intangible – public and political will to face the music, so to speak, and engage in reasonable conversations about the importance of critical minerals to our modern lives and economies.

I would add that I now consider hydrocarbons to be potential candidates for critical minerals! Petroleum and natural gas are critical to advanced plastics and composites that permeate consumer products and that are essential to every alternative energy scheme. In fact they are the backbone – without these materials, everything from battery casings and packs to wind turbine blades and countless other applications are impossible. No viable substitutes exist. To the extent that we are taking oil and gas off the table, we are undermining our critical minerals security and preventing or, in the least, encumbering every single technology people want to pursue.

a. What are the workforce issues for Congress to consider?

RESPONSE:
To my point above about demographics – this has been an issue for all of the basic and manufacturing industries for decades. Recognizing these realities is the first step. Mining employment (excluding oil and gas but including coal) has dropped about 40 percent since 1990. (The decline in manufacturing employment over the same period is about the same, no surprise.)[2] Declines in employment and industry activity put pressure on technical and collegiate programs that historically prepared and produced these work forces. With the closure of the University of Alaska mining program we are host to only 12 collegiate programs. These typically handle student loads that are in the dozens. By comparison, the University of Botswana will handle student loads in the hundreds and even thousands.[3] Again, the SSHE realities in these businesses must be acknowledged

[2] All from U.S. Bureau of Labor Statistics, https://www.bls.gov/iag/.
[3] Information shared by colleagues at Missouri Science & Technology.

but they can be managed, in particular through emerging and expanding use of remote, digital, robotic and other enabling technologies that reduce the need for a human interface in the highest risk segments of these industries.[4] That means that training and education needs to evolve to reflect new approaches. All of this requires foresight and commitment, which we can achieve so long as the other enablers – public and political will – are firmly in place.

2. Is there such a thing as "clean" energy? What are the environmental trade-offs of clean energy technologies such as batteries, wind, and solar?

   RESPONSE:
   All energy sources and technologies require industrialization (including industrial provision of technologies to be used at smaller scale and in decentralized, distributed systems). Our goal should be to pursue any/all of these as cleanly as possible. This means being honest about inherent properties and constraints, the physical and chemical characteristics that dictate much of the economics associated with each option. We should start by recognizing the powerful leveraging effects intrinsic to hydrocarbons – petroleum and natural gas. For every dollar invested in these, we obtain energy, energy storage (inherent in the commodities) and thus "reliability", and materials. With the liquid fuels, we also obtain "fungibility" with regard to options for how these are transported and stored. It has long been my view that we should delete certain words from the energy lexicon. "Renewable" would be one. We have natural assets that can be converted to useful energy – wind, solar, hydro (rivers), marine (waves and tidal), biofuels (from agricultural and other products). The popular notion, even if all of these sources are not popular (hydro), is that they are renewable. These natural assets will always exist, but we must capture them and they are uneven, subject to natural availability (variable and intermittent). In fact, we can think of "quality" of these assets in the same way that we consider quality for other things, like energy and non-fuel minerals resources. Lower energy densities associated with alternative energy technologies transmit to lower quality. The lower the quality, the more expensive the capture. Likewise, wind, solar, hydro, marine are not accessible to every load center (location of demand). In fact, with a few exceptions, they tend to be remote, located far from load centers. This means extending electric power systems, since ultimately these feed into grids, to accommodate capture of these resources. To reach scale appropriate for global populations and affordable energy access today and connect sources to markets, all of options require industrial equipment and inputs at levels akin to any other major industrial effort. This means nonrenewable raw materials like minerals, energy fuels and especially materials, water, land (biofuels including "green gas" are, so far, very large consumers of soil and water) and myriad other resources that are all non-renewable. End of life including disposal and recycling are only just now emerging. We believe that alternative energy components can be recycled, as are many components of

[4] See "The Future of Work in Mining", https://www2.deloitte.com/xe/en/insights/industry/mining-and-metals/future-of-mining-industry.html.

legacy energy systems, but recycling is only just now emerging. Very little is known about volumes, logistics, capacities, or even business economics (i.e., profitability of recycling for alternative energy components). As a result, overall ESG footprints for alternative energy technologies are quite large and not well documented in public debates and discussions. In sum, they incorporate the need to capture alternative energy sources; the need to build industrial scale; the need to manage extreme variations in quality and forge new and expensive connections to markets; emissions (air, greenhouse gases, effluents into waterways) and other consequences like direct ecosystems impacts that permeate development and use.

3. Do the market prices for clean energy technologies accurately reflect their true costs? What are the environment, social, and governance issues that should be considered?

   RESPONSE:
   Regarding whether market prices for alternative energy technologies reflect true costs – no, they do not. Market prices reflect only the capital cost associated with purchasing and installing equipment. They do not reflect any of the "system integration costs" that are incurred to add system capacity, balance variability including adding storage and/or to address other reliability issues. This is a distinct risk for both business and government. Businesses face pushback from consumers and customers as the full cost of developing and using alternative energy technologies becomes more transparent. Governments face pushback from consumers and voters as transparency improves, including transparency associated with the extent of government funding and support that must be committed in order for alternative energy technologies to be accessible and affordable. Regarding the ESG issues stemming from alternative energy technologies – these range from the environmental footprint considerations I mentioned above to societal impacts as communities react to increased transparency regarding footprints to international geopolitical and trade security concerns. Again, there are distinct business and government risks associated with alternative energy policies, including mandates, and strategies. Businesses already are grappling with how best to assess, represent and provide assurance on ESG risk and uncertainty given the extensive limitations to transparency. Governments will face pushback from nearly every stakeholder group as ESG risks and uncertainties become better known and understood.

The Honorable Markwayne Mullin (R-OK):

1. As you mentioned in your testimony, the United States has finally managed to become energy independent. Thanks to hydraulic fracturing and the shale revolution, we emerged as a major exporter, which gives us leverage over OPEC and Russia. U.S. businesses and consumers have benefited the most with stable access to the world's most reliable and affordable energy supplies.

a. What is the energy security trade-off of rapidly transitioning away from fossil energy?

RESPONSE:
Honorable Mr. Mullin, we face an assortment of energy security trade-offs of a rapid transition. I can present a quick laundry list – any/all of these require further consideration and will require mitigation.

- Taking the most obvious first, our national defense rests on legacy fuels systems. Our equipment operates on petroleum fuels. Our bases and other facilities in the U.S. and worldwide are powered by legacy energy systems that operate in ways that ensure the reliabilities we need (100 percent all of the time for readiness). The U.S. Department of Defense and the service branches have all investigated various options for introducing alternative energy sources and technologies into our defense systems. This is accomplished most easily for fixed onshore facilities. DOD generally relies upon open markets for procurement of critical energy supplies. The U.S. has become one of the larger suppliers of fuels procured in open markets. DOD procurements are cheaper when the market for the fuels is larger – that is, energy costs for DOD, worldwide, will be lower, more cost effective, the broader the customer base. Our national defense benefits, hugely, from the very large customer base for petroleum and natural gas. Clearly, altering that picture in a fundamental way will make national defense both more expensive and less secure. All of the options for replacing oil and natural gas and other legacy energy fuels and systems for national defense have very long lead times and ramps. Serious thinking is needed to ensure functionality of national defense in the meantime.
- Outside of direct, national defense considerations, the biggest question is whether a rapid transition can work and, if not, what the implications could be. We could construct any number of scenarios in which a bumpy, costly transition that cannot provide sufficient competency fast enough puts at risk entire suites of energy and economic securities. These would range from system failures and disruptions to geopolitical and trade tensions. They would include pressures on fragile states providing most of the raw materials, fiscal pressures on all governments attempting to escalate a transition with public funding, inflation and monetary risks derived from commodity price pressures (for instance, for battery metals and biofuels crops) and government budget balances, damage to ecosystems if insufficient attention is paid to risks and mitigation. It is for these reasons that pre-pandemic energy security attainment for the U.S. was not a small thing, and why any scenario for transition needs to incorporate details on how to best manage the process and a frank assessment of risks and uncertainties.

b. Is China the biggest winner if we suddenly ban hydraulic fracturing and bet it all on wind, solar, and batteries?

RESPONSE:
Given that China is the largest and dominant producer of wind, solar and battery components, and the largest and dominant presence in all of the associated supply chains, and clearly has imperatives to remain in those positions, the answer, unfortunately, is yes. We – all societies that are net importers of Chinese goods – have transferred enormous wealth to China, to the betterment of the Chinese people, for the most part. The cost has been deterioration in our own capacity and a fair economic analysis needs to account for both sides. We would be transferring additional enormous wealth to China in a rapid and disorderly transition. As I mentioned during the hearing, but we did not have time to pursue, analysis of economic impacts of options needs to be thorough. In the least, we must account for the leakages of wealth and jobs if we depend on imports of alternative energy goods, and the costs that would be incurred domestically to replace imports unless we can figure out how to substitute with a cost structure as cheap as China's.

c. What are the renewable technology companies doing to secure and diversify their supply chains? Do you think they are taking this seriously?

RESPONSE:
Mr. Mullin, in all honesty, I don't know. From all of my interactions, I can see that pressure is growing on alternative energy companies to "own" their supply chain risks and deal with ESG realities. In July, incidents at Chinese polysilicon facilities gained attention within and outside of the solar industry.[5] Other similar incidents are starting to raise the bar. Alternative energy still is a very small share of world energy mix and so these realities have not penetrated the public domain as extensively as industrial accidents in other, much larger industries would. That said, we need to add to the risk and uncertainty column the possibilities of disruptions and outages in supply chains as businesses strive to accelerate capacity expansions in order to meet government targets and mandates.

d. What about the environmental and human rights issues? Are electric vehicles really "clean" if you account for the full life cycle impacts?

RESPONSE:
As stated before, we can be build, operate and use all energy fuels and technologies safely and cleanly. However, we don't satisfy environmental and human rights or achieve "cleanliness" simply by choosing fuels and technologies that are new or popular or perceived to be cleaner than legacy fuels and systems. They must really meet those standards and expectations, in real terms. Every

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[5] See, for example, https://www.bernreuter.com/newsroom/polysilicon-news/article/lessons-from-the-polysilicon-plant-accidents-at-daqo-and-gcl/ which raises questions about workforce competency and https://www.ft.com/content/b3e3f134-2295-46a6-98df-3ef5994539e1 for impacts on polysilicon prices.

single option that we have for fuels and technologies requires industrialization, and all must entail standards and practices to satisfy ESG and SSHE requirements and expectations. Established energy businesses have much more experience on this front. The electric vehicle industry including all suppliers and vendors as well as customers has a huge amount of ground to cover when it comes to identifying, assessing, managing, mitigating environmental and societal risks. So far, from what we can see, the broader industry understands these realities. In fact, I suggest that the industry, at least the leading companies, understands it better than governments and non-governmental organizations who are pushing for rapid transitions.