

**MANUFACTURING A CLEAN ENERGY FUTURE:  
CLIMATE SOLUTIONS IN AMERICA**

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**HEARING**  
BEFORE THE  
**SELECT COMMITTEE ON THE  
CLIMATE CRISIS**  
**HOUSE OF REPRESENTATIVES**  
**ONE HUNDRED SEVENTEENTH CONGRESS**

SECOND SESSION

HEARING HELD  
FEBRUARY 2, 2022

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## **MANUFACTURING A CLEAN ENERGY FUTURE: CLIMATE SOLUTIONS MADE IN AMERICA**

**WEDNESDAY, FEBRUARY 2, 2022**

HOUSE OF REPRESENTATIVES,  
SELECT COMMITTEE ON THE CLIMATE CRISIS,  
*Washington, DC.*

The committee met, pursuant to call, at 2:20 p.m., via Zoom, Hon. Kathy Castor [chairwoman of the committee] presiding.

Present: Representatives Castor, Bonamici, McEachin, Casten, Escobar, Graves, Palmer, Carter, Miller, Crenshaw, and Gonzalez.

Ms. CASTOR. The committee will come to order. Without objection, the chair is authorized to declare a recess of the committee at any time. As a reminder, members participating in a hearing remotely should be visible on their camera throughout the hearing.

As with in-person meetings, members are responsible for controlling their own microphones. Members can be muted by staff only to avoid inadvertent background noise. And as a reminder, statements, documents or motions must be submitted to the electronic repository to [SCCC.repository@mail.house.gov](mailto:SCCC.repository@mail.house.gov).

Finally, members or witnesses experiencing technical problems should inform the committee staff immediately.

Well, good afternoon, everyone. Thank you for joining us in this remote hearing of the House of Representatives Select Committee on the Climate Crisis.

Today we are going to hear about how the Bipartisan Infrastructure Law and the Build Back Better Act will attract new investments to help the United States decarbonize important sectors, expand domestic supply chains, manufacture climate solutions and create good-paying jobs.

So now I will recognize myself for 5 minutes for an opening statement. And thanks again for joining us today.

Tackling the climate crisis presents us with incredible challenges and opportunities. The challenges are clear. We must reduce pollution and reach net-zero as quickly as possible. We must lead other nations in the transition to renewables and electric vehicles, and we must make life-saving investments in resilience and public health and in environmental justice.

Meeting these challenges with clean energy provides us with historic opportunities to create millions of good-paying jobs, to drive down the cost of energy, and to drive down the cost of climate-fueled disasters.

It also gives us an opportunity to shore up supply chains and to clean up hard-to-decarbonize industries.

In doing all this, we intend for the United States of America to lead the 21st century global economy. So we must be clear-eyed and responsive to how the change over to clean energy will affect American families and our economy.

And as the clean energy economy grows, we will still have to grapple with the constraints posed by our long-time dependency on fossil fuels. But America has met challenges like these before, and I am confident that we will do so again.

We know what we need to do. In our Climate Crisis Action Plan, we recommend using incentives to retool and expand domestic manufacturing of clean energy, electric vehicles, and EV components. We support investing in a national network of zero emission fueling infrastructure, and we call for strong policies to strengthen manufacturing in America, the all important “Made in the USA” tag, with an eye on creating good jobs, especially in areas of the country that have struggled to attract economic investment.

And we have made significant progress on these fronts. As American automakers move to all electric vehicles in the coming years, the Bipartisan Infrastructure Law provides for the deployment of half a million chargers across America. And this historic investment in infrastructure also boosts jobs through modernizing the electric grid and the battery processing industry.

But to truly chart the course forward, we must get the cost-saving, climate-focused Build Back Better Act and the important domestic manufacturing focused America COMPETES Act to the President’s desk.

We are in a hyper competitive race with China and other countries to build these industries, to attract capital, and to create jobs. Automakers like Ford, GM, and Tesla are moving fast on investments. Just last week GM announced a plan to build a battery plant in Michigan and to retool a factory outside Detroit that will produce electric pickup trucks.

This follows announcements by Ford about EV and battery production expansion in Tennessee and Kentucky, and from Tesla in Texas.

So with the right policies and incentives, we will win the EV race against China and the European Union.

We can’t afford to lose it. Just last year, global investment in climate solutions reached \$755 billion. The global market for solar energy is expected to be worth more than \$220 billion by 2026.

And according to the National Renewable Energy Laboratory, we can create an estimated 2,000 jobs for every additional gigawatt of domestic solar manufacturing capacity that we build.

And with wind energy projects like the ones off the coast of New York and New Jersey, we can produce energy right here in America with technologies that are built by union labor, in America, with materials that are made in America. This is how we lower costs for families over time and win the 21st century.

Congress has got to make smart investments today to continue to lead the global economy tomorrow. And the Bipartisan Infrastructure Law laid that foundation. We must now build on it with the clean energy investments in the Build Back Better Act and with a forward-looking policy in the America COMPETES Act.

Today we will hear from industry leaders and experts on how these investments will attract companies to the U.S., create high quality jobs, and grow opportunities for everyone.

With that, I recognize our ranking member, Mr. Graves, for 5 minutes.

[The statement of Ms. Castor follows:]

**Opening Statement of Chair Kathy Castor**  
**Hearing on “Manufacturing a Clean Energy Future:**  
**Climate Solutions Made in America”**

**Select Committee on the Climate Crisis**

**February 2, 2022**

*As prepared for delivery*

Tackling the climate crisis presents us with incredible challenges and opportunities. The challenges are clear. We must reduce pollution and reach net zero as quickly as possible. We must lead other nations in the transition to renewables and electric vehicles. And we must make life-saving investments in resilience, public health, and environmental justice. Meeting these challenges with clean energy provides us with historic opportunities: to create millions of good-paying jobs; to drive down the costs of energy and of climate-fueled disasters; to shore up our supply chains; to clean up hard-to-decarbonize industries; and to lead the 21<sup>st</sup> century global economy.

We must be clear-eyed and responsive to how the change over to clean energy will affect American families and our economy. As the clean energy economy grows, we will still grapple with the constraints posed by our long-time dependency on fossil fuels. But America has met these kinds of challenges before—and I’m confident we will do so again.

We know what we need to do. In our Climate Crisis Action Plan, we recommended using incentives to retool and expand domestic manufacturing of clean energy, electric vehicles, and EV components. We supported investing in a national network of zero-emission fueling infrastructure. And we called for strong policies to strengthen manufacturing in America—the all important “Made In the USA” tag—with an eye on creating good jobs, especially in areas that have struggled to attract economic investment.

We’ve made significant progress on these fronts. As American automakers move to all electric vehicles in the coming years, the Bipartisan Infrastructure Law provides for the deployment of half a million chargers across America. The historic investment in infrastructure also boosts jobs through modernizing the electric grid and the battery processing industry. But to truly chart the course forward, we must get the cost-saving, climate-focused Build Back Better Act—and the important domestic-manufacturing-focused America COMPETES Act—to the President’s desk.

We are in a hyper-competitive race with China and other countries to build these industries, to attract the capital, and to create jobs. Automakers like Ford, GM, and Tesla are moving fast on EVs. Just last week, GM announced a plan to build a battery plant in Michigan, and to retool a factory outside Detroit that will produce electric pickup trucks. This follows announcements by Ford about EV and battery production expansions in Tennessee and Kentucky, and from Tesla in Texas. With the right policies and incentives, we will win the EV race against China and the European Union.

We can’t afford to lose it. Just last year, global investment in climate solutions reached \$755 billion. The global market for solar energy is expected to be worth more than \$220 billion by 2026. According to the National Renewable Energy Laboratory, we can create an estimated 2,000 jobs for every additional gigawatt of domestic solar manufacturing capacity we build. And with wind energy projects like the ones off the coasts of New York and New Jersey, we can produce energy right here in America, with technologies that are built by union labor in America, and with materials that are made in America.

This is how we lower costs for families over time and win the 21<sup>st</sup> century. Congress must make smart investments today to continue leading the global economy tomorrow. The Bipartisan Infrastructure Law laid a foundation. We must now build on it with the clean energy investments in the Build Back Better Act, and with the forward-looking policies in the America COMPETES Act. Today, we’ll hear from industry leaders and experts on how these investments will attract companies to the U.S., create new high-quality jobs, and grow opportunities for everyone.

Mr. GRAVES. Thank you, Madam Chair, and I want to thank all of the witnesses for joining us today. Good to see some of you all again and some of you all for the first time. This hearing is important, and the chair opened up by talking about moving in a direction that ensures American leadership.

And I think it is important to note that the United States actually achieved a pretty amazing leadership role in that we became entirely dependent on our ourselves for energy. We became energy secure. We became energy independent. And some more recent policies on energy and climate have begun to cause an erosion in that energy security and that energy independence.

For example, we have become more dependent upon Russia for our energy needs. Over the last several months, we have seen energy prices increase and this, of course, disproportionately affects those who can least afford it.

As a matter of fact, we have seen energy prices, whether it is gasoline or projected prices to heat and cool our homes, increase anywhere from 25 to 54 percent. And again, that is everything from gasoline to fuel our cars to the utility costs to heat our homes this winter.

In fact, 1 in every 5 Americans have said that they are unable to fully pay their electricity bills. This is a significant change from what we have seen historically where we had rather stable and rather affordable access to energy.

We have unfortunately seen other confusing policies where the administration has come in and shut down projects, like the Twin Metals Mine in Minnesota, whenever this is an opportunity for the United States to do what I believe every member of this committee has talked about, both Republican and Democrat, and that is to source our own strategic and rare earths in order to meet the needs of renewable energy and energy storage demands. And so really confusing.

We have seen advocacy to stop lease sales whenever this administration has released reports that maybe one of the witnesses was even involved in putting together, that—that shows that energy production in the offshore is actually the cleanest energy that there is, in terms of—measured by emissions, in terms of lowest emissions.

Some of the lowest emitting sources of conventional fuels, yet taking efforts or actions to actually shut that down, moving in a direction where not only we are going to become more dependent upon energy sources that have a higher environmental footprint but also have much lower labor standards.

And Madam Chair, I just think it is critical as we move forward, we take all of these things into consideration. What are we going to do with the E waste, where are the raw materials going to come from, looking at the mining practices, looking at slave and child labor issues.

In reality, Madam Chair, what we have seen is, we have actually seen greater achievements in terms of affordability of energy, in terms of energy security, in terms of emissions reduction, in terms of not becoming dependent upon other countries, and that is by policies that we saw historically in the United States.



So those actually were more successful at achieving the objectives that I laid out—affordability, lower emissions, higher energy security, less dependence upon foreign nations, particularly those nations that are less friendly to the United States.

And so I just really look forward to continuing to work on a bipartisan basis to truly follow the science, not the emotion, but to follow the science and to pursue policies that result in achieving those objectives that make sense for the American citizens, don't—not the policies that make sense for citizens of other countries, that in many cases may not be friendly to the United States.

I remind you, Madam Chair, the Biden administration, in this report, showing that we are going to have a 31 to 58 percent increase, for example, in natural gas demand globally, and at the same time, if this administration and if Members of Congress are carrying out policies to stop the domestic production of natural gas, all that does is, one, it cedes a huge economic sector to Vladimir Putin. We know right now what he is doing with those resources that he gains from these inadvisable policies.

And number two, it is going to result in dirtier—dirtier—fuel sources because as we have stated many times in this committee, the United States, our natural gas, for example exported to Europe, has a 41 percent lower profile of emissions and exported to Asia has a 47 percent lower emissions profile.

So I just think it is really important that we incorporate more science into these decisions and stop blindly heading down this path that is undermining America's interests and playing into the hands of other countries.

So I look forward to hearing from our witnesses and I yield back.

Ms. CASTOR. Thank you very much. And without objection, members who wish to enter opening statements into the record have 5 days to do so.

Now, I want to welcome our witnesses. I am going to proceed with introductions, and then when we come to Mr. McConnell, Mr. Crenshaw, I am going to ask you to introduce him.

First we have Paul Browning. He is the President and CEO of the North American division of Fortescue Future Industries. Mr. Browning leads FFI's efforts to expand hydrogen energy in North America with the goal of producing hydrogen from 100 percent renewable sources.

He was previously the CEO of Mitsubishi Power America, leading a team that expanded hydrogen projects and started a battery energy storage business.

Next, Ms. Abigail Ross Hopper is the President and CEO of the Solar Energy Industries Association. At SEIA, Ms. Hopper leads a national effort to expand the reach of solar energy as a significant percentage of U.S. energy generation.

She was previously the Director of the Department of Interior's Bureau of Ocean Energy Management which oversees development and leasing for offshore energy. She was also the Director of the Maryland Energy Administration.

Mr. Crenshaw, I recognize you to introduce Mr. McConnell.

Mr. Crenshaw, I am still not able to hear you.

Mr. CRENSHAW. All right. That should work now. Thank you, Chairwoman. I am happy to introduce the Honorable Chuck

McConnell, the Executive Director for Carbon Management and Energy Sustainability at the University of Houston. We are glad to have a Houstonian here on the panel. I know the committee is excited to hear your testimony, and I know the University of Houston has been leading the way in carbon utilization, recycling, and carbon emissions reduction, rather than eradicating the fuel source itself. So we are glad to have you. Thank you and I yield back.

Ms. CASTOR. Thank you very much. We also have Jessica Eckdish. She is the Vice President of Legislation and Federal Affairs at the BlueGreen Alliance. Ms. Eckdish directs BGA's Federal legislative policy and partnerships on climate, energy, and infrastructure issues.

Previously she managed the Sierra Club's legislative and administrative advocacy, leading efforts to secure methane emission standards for the oil and gas sector, as well as Federal clean air and water protections.

So without objection, the witnesses' written statements will made part of the record.

With that, Mr. Browning you are now recognized for 5 minutes for your presentation. Welcome.

**STATEMENTS OF PAUL BROWNING, PRESIDENT & CEO (NORTH AMERICA), FORTESCUE FUTURE INDUSTRIES (FFI); ABIGAIL ROSS HOPPER, PRESIDENT AND CEO, SOLAR ENERGY INDUSTRIES ASSOCIATION (SEIA); THE HONORABLE CHARLES MCCONNELL, EXECUTIVE DIRECTOR, CENTER FOR CARBON MANAGEMENT AND ENERGY SUSTAINABILITY, UNIVERSITY OF HOUSTON ENERGY; AND JESSICA ECKDISH, VICE PRESIDENT, LEGISLATION & FEDERAL AFFAIRS, BLUEGREEN ALLIANCE (BGA)**

**STATEMENT OF PAUL BROWNING**

Ms. BALLENTINE. Thank you.

Mr. BROWNING. Good afternoon, Chair Castor, Ranking Member Graves, and members of the committee. My name is Paul Browning. I am President and CEO of Fortescue Future Industries North America, or FFI.

I joined the company in January after a 30-year career leading multinational businesses that develop, manufacture, build, and finance large energy projects in the U.S. and around the world. Thanks for this opportunity to testify before you today.

FFI is a well-financed, global, green hydrogen company launched 18 months ago, that is committed to producing zero carbon green hydrogen made from 100 percent renewable energy. The unique appeal of green hydrogen is its ability to store renewable energy and use it to power a broad set of needs, including transportation, electric generation and storage, industrial heat, steelmaking, and others.

My testimony is going to focus on the following three points; one, green hydrogen is happening right now; two, green hydrogen will create and protect U.S. manufacturing jobs and improve U.S. competitiveness; and three, fully capturing the U.S. green hydrogen opportunity is going to require the right policy environment.

So my first point is that green hydrogen is happening right now, and I am going to use as that evidence of some of the work we have been doing at FFI.

Over the long-term, FFI's vision is to make green hydrogen the most widely traded commodity in the world. Our first job at FFI is using green hydrogen to decarbonize our parent company, Fortescue Metals Group, the world's fourth largest iron ore producer.

In 2022, we will begin to deploy green hydrogen technologies into our haul trucks, our locomotives, and our ships. Next, we will help decarbonize heavy industry around the world by annually shipping 15 million tons of green hydrogen by 2030, which is the equivalent of the annual gasoline consumption of Florida, New York, and Ohio combined.

Today, we employ more than 700 people across 23 countries and have a portfolio of over 400 gigawatts of renewable energy projects in various stages of development.

We are already investing in the U.S. Our recent activity in the U.S. market includes an acquisition in Delaware, an aviation fuel offtake agreement in California, and a green ammonia offtake agreement with Covestro, a company with facilities in 11 U.S. states.

We are also evaluating project opportunities across the western U.S. and Texas, and we are hiring in Texas, Delaware, and Florida.

My second point is that green hydrogen can grow manufacturing jobs and improve competitiveness. The world's demand for green products is increasing rapidly. Companies are demanding green steel, green aluminum, and green transportation services.

Decarbonizing heavy industry with green hydrogen can protect U.S. manufacturing jobs in a carbon-constrained world. Our green hydrogen projects will also create thousands of jobs, often in communities that formerly relied on coal mining or coal-fired power generation, and already have the water rights, power infrastructure, and workforce on hand for green hydrogen production.

And my third point is that fully capturing the U.S. green hydrogen opportunity requires the right policy environment. Today in the United States, green hydrogen and green ammonia projects are not eligible for tax credits, while fossil fuel-based blue hydrogen and ammonia projects require or receive 45Q carbon capture credits.

Current law is picking a winner by incentivizing fossil fuel hydrogen and not incentivizing green hydrogen.

Across the globe, governments are dedicating capital to building their own green hydrogen industries, and we want to ensure the U.S. remains competitive in this space globally. Like energy transition technologies that preceded green hydrogen, the key imperative is to reduce the cost of green hydrogen.

We have a proven recipe in the U.S. for achieving cost reduction in energy transition technologies like wind, solar, and lithium ion batteries. The recipe is, invest in R&D and drive massive scaling of the industry with Federal PTC and ITC legislation and state-level policies.

The Bipartisan Infrastructure Law provides the R&D support, and states and regulated utilities are providing policy support

through net zero carbon commitments. All that remains for you to do is to enact the Federal ITC and PTC for hydrogen that are contained in the Build Back Better bill.

In closing, the conditions are right for expansive growth in U.S. green hydrogen. With a laser focus on green hydrogen development, the U.S. can use its abundance of renewable energy to continue its energy leadership during the energy transition. This will create jobs, economic growth, and export markets for American made renewable energy.

Thank you for the opportunity to present my testimony today, and I look forward to your questions.

[The statement of Mr. Browning follows:]

**Testimony of Paul Browning**  
**Chief Executive Officer, Fortescue Future Industries (FFI)**  
**Before the House Select Committee on the Climate Crisis**  
**Hearing on**  
**“Manufacturing a Clean Energy Future:**  
**Climate Solutions Made in America”**  
**February 2, 2022**

Good morning Chairwoman Castor, Ranking Member Graves, and members of the Committee. My name is Paul Browning, and I am the Chief Executive Officer at Fortescue Future Industries, North America, or FFI.

I joined the company in January after serving as President and CEO of Mitsubishi Power Americas since 2016. Earlier in my career I was CEO of General Electric’s Thermal Power business and a Vice President at Caterpillar Solar Turbines. In those roles, I had the opportunity to lead large manufacturing operations around the world and in the US, including in Florida, Georgia, Kansas, Ohio, Connecticut, South Carolina, New York, Maine and California. My teams launched successful green energy businesses in green hydrogen, battery energy storage and renewable power project development, and developed and built energy projects.

As an American citizen, I’m honored to be invited to take part in the American democratic process today. I am excited to have joined FFI at the same time the world is entering an energy transition that will power more of our energy needs with renewable electricity, including hard to abate sectors where renewable electricity will be converted to renewable fuels such as green hydrogen.

FFI is a global green hydrogen company that is committed to producing zero-carbon, green hydrogen made from 100 percent renewable energy. FFI was launched 18 months ago, and in recent months we have developed an ambitious plan to build a large-scale green hydrogen business in North America. A unique appeal of green hydrogen is the breadth of its end-use applications: it can be used to lower carbon emissions in transportation, electricity generation, industrial heat, steelmaking, and other applications. Green hydrogen is already proven—its production, storage, transport, and use have all been safely demonstrated for decades or more.

Green hydrogen is an important option for the US: given the global imperative to address climate change, and the US goals to reduce greenhouse gas emissions by as much as 52% by 2030 and achieve a carbon-free power sector by 2035, we must immediately and significantly increase our investment in the lowest carbon alternatives like green hydrogen produced by renewable energy. Now is the time for America to lead with investment in innovation and scale, and FFI is prepared to lead with you.

Today, my testimony will focus on the following points:

- Green hydrogen is happening right now, and our work at FFI to develop green hydrogen at scale is evidence of this phenomenon.
- Green hydrogen presents an extraordinary opportunity for the US to create new and protect existing manufacturing jobs, increase US competitiveness, and enhance US energy security.
- Capturing the green hydrogen opportunity relies on the right policy environment.

- Our focus must be directed toward investing in green hydrogen production. With this type of laser focus, the US can capture the environmental, economic, and security benefits of a US green hydrogen economy.

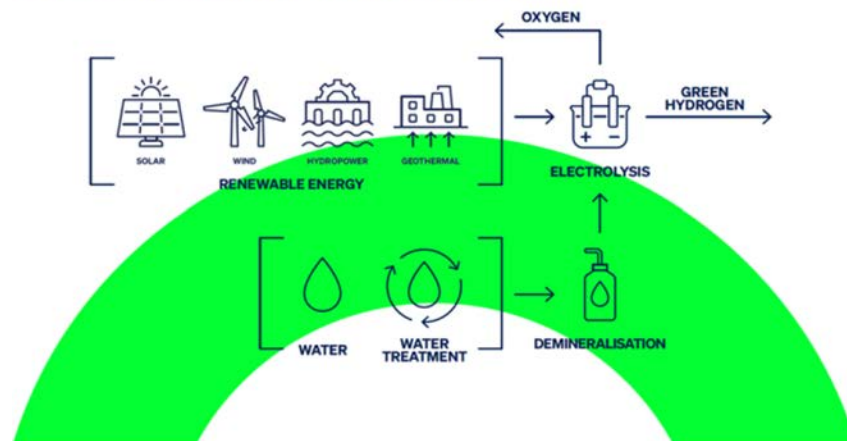
### **Green hydrogen overview**

Before delving into further details, I will answer the question that many are undoubtedly asking: **what makes hydrogen green?** In short, the carbon footprint of hydrogen is determined by the energy sources and the raw materials used to produce it.

Hydrogen is the world's most abundant element. Green hydrogen—hydrogen produced from renewable resources—is the only color of hydrogen that stores intermittent renewables like solar power and wind power, and allows us to deliver them when and where they are needed.

**I want to say that again: Green hydrogen stores renewable power.** It solves the intermittency problem by capturing this power in chemical form, so that it can be used at a later time, and at a different location. Green hydrogen can be used across sectors to lower carbon emissions in transportation, electricity generation, industrial heat, steelmaking and other applications.

### **Green hydrogen production process**



Green hydrogen is produced through electrolysis, in which electricity is used with a catalyst material to split demineralized water into hydrogen and oxygen. The oxygen is released back into the atmosphere, and hydrogen can be used within the US economy, or exported for uses around the globe. Electrolysis requires electricity, and when that electricity is generated using renewable energy resources like solar, wind, hydropower or geothermal energy with zero carbon dioxide emissions, the result is green hydrogen.

#### *Types of Hydrogen:*

Different types of hydrogen are characterized based on the carbon footprint and include:

- Green hydrogen produced from water through electrolysis powered by renewable electricity
- Grey hydrogen produced from natural gas through steam methane reformation
- Blue hydrogen produced from natural gas through steam methane reformation plus carbon capture
- Pink hydrogen produced from water through electrolysis powered by nuclear electricity

#### *Storage and Transport:*

The technology for hydrogen storage, pipeline and transport have been safely utilized for decades in the refining industry, which uses hydrogen to desulfurize motor fuels, and the NASA space program, which uses liquid hydrogen as rocket fuel. Green hydrogen can be safely transported in three ways to its point of use:

- As a compressed gas by pipelines, truck, or rail
- After being liquefied at a very low temperature in marine tankers, on trucks or by rail, or
- After being converted into ammonia, synthetic hydrocarbons, liquid organic hydrogen carriers (LOHCs) or methyl cyclohexane (MCH) by chemical tanker ship

*Green Hydrogen Use Cases:*

The US power grid is most heavily penetrated by wind and solar power in places like California and Texas, and these power grids are already showing a need to store renewable power to be ready for extreme weather events. Extreme heat and drought in California last summer resulted in large, long-lasting power shortages, and winter storm Uri in Texas did the same. These power grids are currently making massive investments in Lithium-ion battery energy storage to meet their short-term storage needs; but, to address week-long extreme weather events like Texas and California have recently endured, long duration storage technologies like green hydrogen will be needed. In addition, green hydrogen provides an alternative to building new HVDC transmission. Converting renewable energy to green hydrogen, transporting it via pipeline, and converting it back to electricity can be an attractive alternative to building new electricity transmission infrastructure.

In the transportation sector, companies such as Cummins, Daimler Trucks, and Hyzon are developing zero-emissions fuel cell semi-trucks that use hydrogen as fuel. They can refuel faster—with longer range and lighter on-road weight—than battery electric trucks. There are also efforts underway to convert shipping vessels and airplanes to hydrogen and green ammonia fuels.

And there is potential for green hydrogen to be blended into existing natural gas pipelines to decarbonize our industries and homes. Indeed, *HyBlend*—a DOE-funded consortium of six U.S. national labs—is studying ways to accelerate the use of existing natural gas pipelines for transporting hydrogen.

***Green hydrogen is happening right now, with Fortescue Future Industries (FFI) developing at scale***

My first point to make to the Committee today is that green hydrogen is happening right now, and our work at FFI is evidence of this phenomenon. FFI is focused exclusively on the value chain to create green hydrogen. It is the practical and implementable solution that will revolutionize the way we power our planet and decarbonize hard to abate sectors. While many companies in the hydrogen space are focused on just one aspect of the supply chain, such as production, transportation, or storage, FFI intends to pursue an integrated approach that includes developing power generation, electrolysis, storage, and transportation projects.

Our capacity to bring significant resources to the table and deliver projects quickly and at scale sets us apart. Over the long term, our vision is to make green hydrogen the most globally-traded energy commodity in the world. This is what will be required to decarbonize the US and global economies and end our reliance on fossil fuels.

As a wholly-owned subsidiary of the Fortescue Metals Group (FMG), the world's fourth largest iron ore producer, our first job at FFI will be to decarbonize our parent company, which has set an industry-leading goal to achieve net zero across its mining, production and transportation operations by 2030. This gives us the advantage of having an early adopter customer for our products and services. We have already demonstrated the use of green hydrogen and green ammonia to power haul trucks, heavy haul locomotives and iron ore carriers in 2021, and in 2022 we will begin to deploy these technologies into our fleet of trucks, trains and ships.

Our next, and perhaps most important, job is to help decarbonize heavy industry around the world by creating a global portfolio of renewable green hydrogen and green ammonia projects that will supply 15 million tons per year of green hydrogen to the world by 2030, rising to 50 million tons per year in the decade thereafter. We employ more than 700 people across 23 countries, and already have a global renewable power project portfolio of over 400 gigawatts in various stages of project development.

- We are building the world's largest electrolyzer plant in Gladstone, Australia with a capacity of 2 GW per year.
- In January, our company announced the acquisition of Williams Advanced Engineering (WAE), an offshoot of the Williams F1 team and world-leading technology and engineering business renowned for its ground-breaking projects in high performance battery systems and electrification. The FMG, FFI and WAE teams will come together to develop world-leading green hydrogen, green ammonia and battery electric freight trains and haul trucks for use in industrial applications.

- In December 2021, FFI and AGL Energy (AGL) announced a plan to evaluate repurposing the infrastructure at a coal-fired power station in Australia for green hydrogen production using renewable energy.
- In October, we announced<sup>1</sup> our first green ammonia supply agreement with construction giant J C Bamford Excavators (JCB) and Ryze Hydrogen of Great Britain to purchase up to 10% of FFI's global hydrogen production.
- Two weeks ago, we announced our second green ammonia supply agreement to provide up to 100,000 tons of green hydrogen equivalent per year, starting as early as 2024, to Covestro, a world-leading supplier of high-tech polymer materials, which has substantial operations *across 11 US states*.<sup>2</sup>

FFI is planning a large investment in the United States, which will include research and development, hydrogen offtake agreements, and large projects for renewable power, hydrogen production, green ammonia production and ammonia import/export facilities. These investment decisions are driven by the market conditions created by the combination of the bipartisan Infrastructure Investment and Jobs Act and the energy tax measures in the Build Back Better proposal which I will discuss later in my testimony, coupled with conditions on the ground.

As FFI evaluates sites for renewable electricity generation and green hydrogen and green ammonia production, the company considers four key factors:

- *Natural Resources*: Availability of high-quality renewable energy sources such as wind, solar, geothermal and/or hydropower, and access to available water sources.
- *Infrastructure*: Access to existing infrastructure, or the ability to build new infrastructure, for production, storage, and transportation.
- *People*: Our desire to reuse existing infrastructure often leads us to sites that formerly housed a coal or natural gas fired power plant or mining operations. We hope to hire and re-train the people working at those fossil fuel facilities to work at our projects and start a new career in the green energy sector.
- *Investment Environment*: The speed with which this industry moves to full capacity will depend on the investment environment which can be accelerated by smart government investments and tax incentives.

FFI has begun to acquire US companies with critical technology. In November 2021, FFI acquired Xergy to form FFI Ionix Inc, a Delaware-based technology company focused on the commercialization of advanced hydrogen membrane technologies. We also recently announced that we have signed a Memorandum of Understanding with Universal Hydrogen in California for a global offtake agreement to supply green hydrogen for the aviation sector through 2035. In the projects space, we are evaluating green hydrogen project opportunities across the Western US and Texas, and we plan to expand our activities across the country. These actions, coupled with our offtake agreement with Covestro mentioned earlier, are just the first steps in this journey.

And we're hiring as we speak, across the country:

*Delaware*: We plan to expand our existing Ionix team in Delaware, which specializes in advanced membrane technologies that will help us dramatically reduce the cost of electrolysis.

*Florida*: My team is recruiting along the I-4 corridor that stretches from Tampa Bay through Orlando for people with Project Development expertise.

*Texas*: We're also hiring as we speak in the Houston area where we plan to assemble a large team to execute our projects in North and South America. We're looking for civil, electrical, and chemical engineers, wind and solar experts and project construction specialists.

***Green hydrogen will create and protect US manufacturing jobs, improve US competitiveness, and enhance US energy security***

My second point to make to the Committee is that there is an enormous opportunity for hydrogen development in the US to create and protect manufacturing jobs while cutting carbon emissions and enhancing the energy security of the US and our allies.

<sup>1</sup> <https://ffi.com.au/news/fortescue-future-industries-signs-agreement-with-jcb-and-ryze-hydrogen-to-become-united-kingdoms-largest-supplier-of-green-renewable-hydrogen/>, downloaded 1-28-22.

<sup>2</sup> <https://www.covestro.com/en/company/covestro-worldwide/united-states/covestro-in-the-united-states/about-covestro-llc/sites#baytown>, downloaded 1-28-22.

*Building out the green hydrogen industry is a major economic opportunity for the United States.* Goldman Sachs forecasts that the green hydrogen industry could be worth up to 12 trillion dollars by 2050, and most analysts believe green hydrogen will account for between 12–25% of the total energy mix by 2050.

*Green hydrogen manufacturing can create jobs in the US*, many of them located in communities that formerly relied on fossil fuel industries like coal mining or coal-fired power generation and often have the resources, infrastructure and workforce required to site a hydrogen production facility.

*Additionally, green hydrogen will help protect US manufacturing jobs in hard to decarbonize sectors.* Today there are about 12 million Americans employed in manufacturing jobs, many in industries that are extremely hard to decarbonize, such as iron or steel production. But these jobs are in jeopardy, because already we are seeing leading companies like Apple, Google, Amazon and others require that their suppliers reduce carbon emissions to net zero. Demand for products like green steel, green vehicles, green agriculture and many others will increase rapidly. By replacing fossil energy sources with green hydrogen, it is possible to reduce the carbon footprint of US manufacturing and protect these jobs over the long-term.

*A robust domestic green hydrogen sector, will increase US energy security.* Green hydrogen made in America can power our country's industrial sector, keeping Americans at work in manufacturing as we move to a low carbon economy. The US can supply the world with green hydrogen, increasing our economic competitiveness and continuing the evolution of the US into an energy exporter. American-made green hydrogen can be a cornerstone of US energy diplomacy, contributing to global stability by reducing the reliance on natural gas supplied by adversarial nations.

***Fully capturing the US green hydrogen opportunity requires the right policy environment***

My final point for the Committee is that for the US to fully capitalize on hydrogen's potential, the right policies need to be put in place.

The most significant variable in the growth of the green hydrogen sector in the US is the policy environment. Across the globe, we are seeing governments dedicate enormous capital to attracting green hydrogen producers and building their own domestic industry. In the last year, we have seen the US begin to take similar steps. At this early stage in the development of this industry, foundational government support can help de-risk investment and attract private capital. It is imperative that this investment be targeted toward green hydrogen, which today does not have access to the federal support provided to fossil fuel-based hydrogen production.

Specific policy principles that are critical for the growth of the US green hydrogen sector include the following:

- 1) Unlike fossil-derived grey and blue hydrogen, green hydrogen has zero direct carbon emissions. Government support for research and development related to achieving rapid cost reduction of green hydrogen production is essential.
- 2) Today green hydrogen and green ammonia projects are not eligible for tax credits, while blue hydrogen and blue ammonia projects do receive a subsidy in the form of 45Q carbon capture credits. Green hydrogen should receive a production tax credit (PTC) and an investment tax credit (ITC). We should not allow fossil fuels to receive a subsidy when green hydrogen does not.

We believe the Build Back Better Act must be enacted with provisions that support green hydrogen to provide a level playing field within the hydrogen landscape. Without it, blue hydrogen will have an advantage through the existing 45Q provision, and we risk locking in unnecessary greenhouse gas emissions from the hydrogen sector.

***Conclusion***

The conditions are ripe for expansive growth in US green hydrogen production and use. Now is the time for America to lead with investment in innovation and scale, and FFI is prepared to lead with you.

Green hydrogen is a reality today. And given that it can be a game-changer in the transition to a low carbon economy that can decarbonize both hard to abate manufacturing and electricity generation, it should be a focus of government efforts to address climate change.

As global demand for green hydrogen rises, those countries with domestic production capacity will be able to meet their own demand at a lower cost without relying on imports. These global leaders will help supply the world, creating manufacturing jobs at home and reaping the economic benefits that come along with being an en-



ergy exporter. And American-made green hydrogen can advance our energy diplomacy objectives by reducing reliance on natural gas supplied by adversarial nations.

Governments around the world already recognize the opportunity and are adopting policies to create strong market conditions for hydrogen production. The time for action in the US is now.

FFI is investing in the United States now because in the last twelve months, the outlook for the US hydrogen market has changed dramatically with the investments adopted in the bipartisan infrastructure law and those energy tax measures proposed in the Build Back Better Act.

In summary, if we are to make progress on climate change, we must direct our focus toward green hydrogen production. With this type of laser focus, the US can solidify its position as a global leader in green hydrogen production and capture the environmental, economic, and security benefits of a domestic hydrogen economy.

Thank you for the opportunity to present testimony before the Committee today, and I look forward to your questions.

Ms. CASTOR. Thank you, Mr. Browning.

Next, Ms. Hopper, you are recognized for 5 minutes to provide a summary of your testimony.

#### **STATEMENT OF ABIGAIL ROSS HOPPER**

Ms. HOPPER. Great. Thank you and good afternoon. Chair Castor, Ranking Member Graves, thank you so much for having me here today and inviting me to testify before the Select Committee on the Climate Crisis.

The Solar Energy Industries Association, or SEIA, is the voice of the nation's competitive solar and storage industry. We represent a thousand private sector companies led by entrepreneurs, risk-takers, and business leaders. Our companies know what it is like to have to make payroll, and they know the challenges of running a business.

While our industry certainly has grown rapidly in recent years, solar is still a relatively small part of the energy mix. We represent less than 4 percent of the nation's energy grid. Still even with that small percentage, that reduces carbon emissions by 127 million metric tons per year, while creating American jobs and careers and growing the U.S. economy.

The good news is that lowering carbon emissions is not the only reason to accelerate solar deployment. As the solar and storage industry grows, we will need to hire 800,000 new American workers to reach a total workforce of more than one million strong. Along the way the industry is poised to invest more than \$820 billion into the U.S. economy.

So we are here today to talk about the importance of U.S. manufacturing, and SEIA has a manufacturing division that represents manufacturers throughout the solar supply chain. We, therefore, have a fairly unique insight into the opportunities and the challenges of growing the U.S. solar manufacturing base.

Starting about 3 years ago, we began to strategically engage with our manufacturers across the industry to understand the elements necessary to further build U.S. domestic manufacturing capacity.

One of the things we found is that the industry has changed a great deal over the last few years. There is now massive interest in a comprehensive build-out of economic solar manufacturing. That interest is driven both from the manufacturing side and the developer side.

But we have to recognize the importance of our existing manufacturing base. We currently have over 30,000 people in the solar

manufacturing workforce in the United States. They are employed in places like steel plants in South Carolina, Pennsylvania, and West Virginia.

It includes trackers and racking manufacturers in Arizona, Ohio, New Mexico, and California. And it includes manufacturers of solar panels and inverters in Georgia, Washington State, Florida, Ohio, Texas, Illinois, Wisconsin, and beyond.

And it doesn't stop there. We also supply inputs and raw materials to solar products here in the United States. That means quartz mining, metallurgical grade silicon, and polysilicon production in places like Alabama, Mississippi, Michigan, Tennessee, and Washington State.

In short, the United States has the natural resources and the private sector know-how to lead in clean energy manufacturing with the right policies in place.

Just to put a little bit of color on that, a medium-size utility scale project utilizes 12,000 tons of steel. And our industry will require 2.5 million tons a steel by 2030. That is American steel going to build American energy.

And that steel's going to come from factories in West Virginia and elsewhere in the United States.

And so based on conversations we are having with manufacturers and what they are telling us about the likely impact of the proposed policies, the United States will produce, in short order, an additional 15 to 20 gigawatts of domestic solar panel manufacturing. We are literally on the precipice of a manufacturing renaissance.

And it is not just panels and steel. U.S. polysilicon plants are also ready to roar ahead as their customers build factories here in the United States. The polysilicon industry has been treated very unfairly by China, put on its back foot since China put steep tariffs on U.S. polysilicon and made it impossible to sell into that market.

Some U.S. facilities are either producing minimally or literally mothballed. But idle capacity is ready to ramp up if we put the right policies into place.

So in sum, we have real potential for complete solar supply chain here in the United States, manufacturing and building for the solar industry. Now is the time to invest in American manufacturing. We have the technology, we have the know-how, and we certainly have the resources to make it happen.

So thank you very much for asking me to be here. I am happy to answer any questions you may have.

[The statement of Ms. Hopper follows:]

**Testimony of Abigail Ross Hopper, Esquire  
President and CEO**

**Solar Energy Industries Association**

**U.S. House of Representatives Select Committee on the Climate Crisis  
Manufacturing a Clean Energy Future: Climate Solutions Made in America**

**February 2, 2022**

Chair Castor, Ranking Member Graves, and members of the Select Committee, thank you for inviting me here today and for your commitment to the U.S. solar and storage industry and American solar manufacturing. I am Abigail Ross Hopper, President and CEO of the Solar Energy Industries Association (SEIA).

SEIA is the national trade group for America's competitive solar energy and storage industry with 1,000 private sector businesses that compete every day to keep prices for American consumers low while also meeting the demands for clean renewable energy. Approximately 230,000 Americans work in this \$25 billion industry.

The U.S. solar and storage industries are comprised of construction, manufacturing, and technological innovation. The solar industry today, representing more than 3% of our nation's electricity production, reduces carbon emissions by 127 million metric tons per year. Two and a half years ago, when I last testified before you, we had just hit 2 million U.S. solar installations. Today, we are well on our way to 4 million installations. The amount of solar currently in operation is the equivalent of taking 28 million vehicles off the road or planting 1.8 billion trees.

But lowering carbon emissions is not the only reason to accelerate solar deployment. As the industry grows, the solar and storage industries will need to hire 800,000 new workers to reach a total workforce of more than 1 million Americans. Along the way, the industry would invest more than \$820 billion into the U.S. economy.

Despite solar's expansion, we must grow at a rate four times faster than we are growing today to make the kind of progress necessary to address the climate crisis. Through this growth, we have a once-in-a-generation opportunity to create a renaissance in domestic manufacturing.

Simply put, this is a transformative opportunity for the U.S. economy. As part of the energy transition, the United States can invest in domestic manufacturing on a massive scale. That means empowering entrepreneurs, strengthening the private sector, creating well-paying jobs and fostering business stability through a combination of policy drivers.

As first articulated in SEIA's September 2019 Manufacturing White Paper, which is included as a link at the end of this testimony, our country needs a new approach to growing U.S. solar manufacturing, focused on a suite of long-term federal investments. These include:

- One, demand drivers such as a long-term extension of the solar investment tax credit with direct pay and related bonus credits for meeting certain domestic content thresholds;
- Two, ongoing domestic production support as our manufacturers and their suppliers scale operations in a hyper-competitive global environment; and
- Three, incentives for private sector investments in manufacturing capacity such as a refundable 48C manufacturing tax credit.

Importantly, all three categories of federal investments are required if we hope to truly compete as a nation in solar manufacturing. Fortunately, all three of these policies are included in the Build Back Better package. We need to recognize that the United States is competing for private sector investments not only against China but other countries as well. These three policy levers are critical to build out durable and globally competitive domestic manufacturing supply chains.

### **Harnessing the Power of Domestic Manufacturing**

Three years ago, SEIA strategically engaged with manufacturers across our industry to understand the elements required to build domestic manufacturing capacity for the solar and storage industries. The U.S. is rich in the natural resources necessary for the solar supply chain. We have quartz, metallurgical grade silicon, and polysilicon producers in places like Alabama, Mississippi, Michigan, Tennessee, and Washington State. We have the raw materials, innovative technology and private sector know-how we need to lead in clean energy manufacturing with the right policies in place.

Today, the U.S. has enough domestic manufacturing capacity to supply a fraction of our solar module and inverter needs. And we have little to no manufacturing of critical components like wafers and cells. For example, the U.S. currently has 7 gigawatts (GW) of module manufacturing capacity. In 2020, the U.S. installed 20 GW of solar, and we will need to install 90 GW per year to hit our climate goals.

Despite current capacity limitations, with the right policies in place, we can create tens of thousands more jobs in domestic solar manufacturing and attract billions of dollars in private investment. As we grow our domestic solar manufacturing base here at home, we must recognize that it will take time to scale operations.

The good news is that we can do this. The 30,000-person solar manufacturing workforce in the United States currently includes steel plants in places like South Carolina, Pennsylvania, and West Virginia. It includes trackers and racking manufacturers in Arizona, Ohio, New Mexico, and California. And it includes manufacturers of solar panels and inverters in Georgia, Washington State, Florida, Ohio, Texas,

Illinois, Wisconsin, and beyond. These companies, along with others, are ready to scale up and get to work.

#### **Tax Credits for Solar and Storage**

Clean energy tax credits for solar and storage are necessary to give manufacturers confidence that there will be domestic demand for their products. Previous short-term efforts, combined with the fact that solar manufacturing was in its infancy, weren't sufficient to sustain domestic manufacturing. But that is not the case today. The 10-year extensions included in Build Back Better would create a reasonable runway and continued growth of the solar and storage industries, supporting the manufacturing buildout the country needs.

#### **Domestic Production Support**

We forecast that with key policies in place, such as the Solar Energy Manufacturing for America Act (SEMAA) as drafted in Build Back Better, manufacturers will create 27,000 direct manufacturing jobs in the solar module value chain by 2025 and 40,000 jobs by 2030. SEIA has announced a goal of 50GW of domestic solar manufacturing capacity by 2030, including 50GW of polysilicon, wafer, cell, module, inverter, tracker, and energy storage production capacity independently. This aggressive target would create American solar manufacturing capacity equal to over 250% of the total 19.2 gigawatts of solar deployed in 2020.

#### **Expanded and Refundable 48c**

An expanded and refundable 48c manufacturing tax credit would provide support for capital expenditures and, as currently drafted in Build Back Better, helps to encourage investments in communities that are impacted by the energy transition. Our country has a long and proud history of domestic manufacturing, and much of that infrastructure is still in place across the country. Reinvesting in these communities can help bring jobs and economic growth to places where it is needed most.

#### **Removing Roadblocks to Deployment**

In addition to the tax policies included in Build Back Better to support domestic manufacturing, additional policies can remove roadblocks to growth in the U.S. clean energy manufacturing sector. Other federal and state policies such as streamlining interconnection policies and making strong and smart investments in grid infrastructure are critical.

State policies that limit solar deployment, including policies that limit the value proposition for distributed generation solar, must be defeated. We are currently seeing harmful proposals in various states to limit the ability of consumers to exercise their freedom to choose distributed solar and provide energy certainty and resilience for their families. These policies move domestic demand for solar goods in the opposite direction we need to be moving to ensure a strong market for domestic manufacturing and American dominance in the clean energy manufacturing space.

One ray of light is that the U.S. Department of Energy and the National Renewable Energy Laboratory are pilot testing an expedited permitting program called SolarAPP+. This program is reducing permitting times in municipal permitting departments from up to several weeks to a matter of hours. SolarAPP+ can expedite solar installations and reduce costs for local agencies and installers alike and we are urging municipalities and installers alike to adopt the program.

#### **Workforce Development**

As the country continues to build out its clean energy workforce, working to creatively recruit, train, and retain the men and women who will build the future energy economy must be a top priority. Solar alone will create upwards of 800,000 new careers within the next ten years. SEIA is working with our member companies and building relationships with workforce training organizations, including unions, to strategically develop a diverse workforce for the clean energy economy. Our country must continue to invest in this area, beginning in early grades, to help engage the next generation of clean energy workers.

#### **Trade and Forced Labor Prevention**

Due to many of our country's existing strengths, much of the domestic solar manufacturing supply chain can be rapidly scaled. For example, we have shuttered or minimally producing polysilicon plants that are ready to be restarted. However, as we grow our domestic solar manufacturing base here at home, we must recognize that it will take time to scale operations and reduce our reliance on imports.

We also have an obligation to ensure that, where imports play a role, the solar supply chain is ethical and free of forced labor. For example, in response to forced labor concerns in the Xinjiang region of China, SEIA began calling upon solar com-

panies in October 2020 to move their supply chains entirely out of that region. On December 10, 2020, and in support of the United Nations' Human Rights Day, SEIA announced a *Solar Industry Forced Labor Prevention Pledge*, which has been signed by over 300 companies representing the vast majority of solar panels sold and consumed in the United States.

SEIAs partnered with two leading solar audit firms to develop a *Traceability Protocol*, which includes an independent third-party audit mechanism. The protocol is designed to provide assurances to the U.S. government and purchasers that solar panels imported into the United States do not include inputs connected to forced labor.

Solar companies around the globe have adopted these traceability protocols and we are aware of more than a dozen ongoing audits to assess conformance with these measures. SEIA's next step is turning the *Traceability Protocol* into an official industry standard, and we are working closely with U.S. Customs and Border Protection to ensure the nation's forced labor laws are enforced. A link to the Traceability Protocol is at the bottom of this testimony.

SEIA and its members are committed to continuing to build a robust American solar supply chain and to adding tens of thousands of American jobs to tackle the climate crisis. We look forward to working with you and your staff to grow domestic solar manufacturing while ensuring an ethical supply chain.

Please see additional SEIA references for *Solar Supply Chain Traceability Protocol* <https://www.seia.org/research-resources/solar-supply-chain-traceability-protocol>

SEIA and *The Solar+ Decade & American Renewable Energy Manufacturing* <https://www.seia.org/research-resources/solar-decade-american-renewable-energy-manufacturing>

Ms. CASTOR. Thank you, Ms. Hopper.

Next is Mr. McConnell. Welcome, you are recognized for 5 minutes.

Ms. CASTOR. And don't forget to unmute.

#### **STATEMENT OF THE HONORABLE CHARLES MCCONNELL**

Mr. MCCONNELL. There is always one guy, isn't there? So thank you, Madam Chair, and the committee members for the opportunity to testify on manufacturing a clean energy future, and specifically solutions that are made in America.

It is particularly gratifying that the technology and commercial advancements in carbon management that were in the early stages at DOE some 10 years ago when I served as the Assistant Secretary, have evolved into solutions that can be deployed at commercial scale.

Such advancements are proof positive that such investments in technologies do pay dividends for the American people.

It is also gratifying to see that this committee is invested in carbon emission solutions and not the elimination of fossil fuels. Carbon management is what will create real solutions.

Carbon management is in full development with companies in oil and gas, petrochemicals, electric power, cement, steel, and other manufacturing entities. They are not only pledging to be net zero carbon by 2050 but are investing in real emissions reduction technologies.

This is the essence of our management efforts at the University of Houston that I am privileged to lead through our Center for Carbon Management and Energy. Our external university energy advisory board has supported the launch of our center and continues to invest in public-private partnerships with the university, such as the Texas Carbon Neutral Coalition.

Our CCME is designed to advance all the critical elements of transformative commercial solutions through multidiscipline col-

laborations in engineering, science, business, policy, and law, all of which are required for real solutions, solutions that are at scale in terms of emissions reduction and continue to provide reliable, affordable, and resilient energy supplies of fuels, chemicals, electricity, and manufactured products.

Let me identify three examples of project investments that will realize these real solutions.

First is carbon capture utilization and storage, CCUS. I am certain you are all aware of the \$100 billion project conceptualization that the 14 significant CO<sub>2</sub> emitters on the Gulf Coast have come together to promote. It is not one big project, but it is an alignment of the industry players to work together collectively, along with our university and community, to realize the vision.

Most of these industries are also members of the CCS consortia. That is made up of 40-plus member organizations from not only industry but multiple academic institutions, NGOs, and legal firms. We were launched last year through the support of DOE's Office of Fossil as part of the Southern States Energy Board's programmatic support, aimed at the broad commercial deployment of CCUS.

This designation from our UH CCME is not simply to be a regional center but to support national work in CCUS. Our consortia has developed a roadmap that is summarized in the written testimony submitted and have recognized three critical enablers for CCUS commercialization.

One is financial and investment incentives, two is policy and regulatory support, and three, people and stakeholder engagement. CCUS is not a perpetuation of the fossil fuel industry. It is a fundamental enabler for the energy transition.

Second, it is hydrogen and the development of massive increases in hydrogen production that must be decarbonized to deliver the clean fuel of the future. Our university is working with Shell and the Wood Group in a DOE project to decarbonize a major steam methane reformer through advanced carbon capture technology.

You know, natural gas-generated hydrogen is nearly 90 percent of the current world production. And volumes are anticipated to grow by five to ten times in the coming 50 years.

And thirdly, there is a need for 24/7 decarbonized electricity. This type of baseload electricity must fuel the energy transition electrification needs and utilize the abundant, secure, and low-cost fossil fuels in our country.

The world's first zero emissions, Allam Cycle Power Plant, will be built in Illinois at the ADM site by 8 Rivers and Warwick Carbon Solutions. The ADM carbon sequestration geologic source site was developed with DOE, as was the net power process technology.

Natural gas-based power with CCUS has been endorsed by this administration as a requirement for this clean energy future.

Let me emphasize, it is critical that we not confuse the mission to be the elimination of the fossil fuel industry. The fossil fuel industry supplies over 80 percent of the world's energy, and frankly we cannot grow by subtraction.

We must utilize all energy fuels and technologies. "And" is the mission. Reliable, affordable, resilient energy and carbon emissions reduction and the elimination of greenhouse gases that impact the

climate. And not just in our country but for the global marketplace that looks to the U.S. for such leadership. Thank you.

[The statement of Mr. McConnell follows:]

**Testimony of the Honorable Charles D. McConnell**

**Executive Director, Center for Carbon Management and Energy Sustainability, University of Houston**

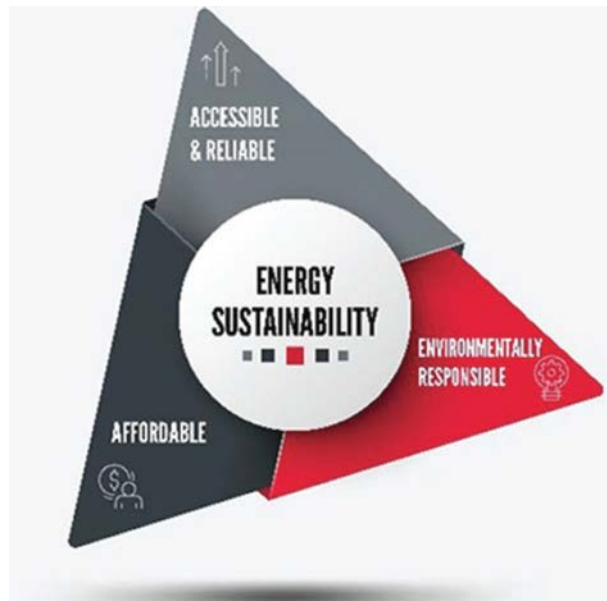
**To the House Select Committee on the Climate Crisis Hearing:  
Manufacturing a Clean Energy Future: Climate Solutions Made in America**

**February 2, 2022**

**Carbon Management: Focusing Policies, Investments and People for Real Commercial and Progressive Solutions**

Thank you for the opportunity to testify on Manufacturing a Clean Energy Future—and specifically solutions that are Made in America. It is particularly gratifying that the technology and commercial advancements in carbon management that were in the early stages at DOE, 10 years ago when I served as the Assistant Secretary, have evolved into solutions that can be deployed at commercial scale. The energy transition demands these solutions, and it is once again proof positive that such investments in technology development can and do pay dividends to the American people. We must grow these efforts by focusing on addition to the American industry by removing key barriers in technology, financing, policy while ensuring that energy equity and environmental justice is addressed. The US has a once in a generation opportunity to continue to be the global leader in energy, and it must happen through addition of capabilities and opportunities and subtraction of barriers and dogma.

The world's population and human development are growing at a rapid pace and the availability of affordable and reliable supply of sustainable energy forms the basis of this growth. The energy transition will succeed through a strategic approach to sustainable energy development, focused on satisfying what is known as the Energy Trilemma—energy supply that is reliable, affordable and environmentally sustainable.



### WHY CARBON MANAGEMENT IS CRUCIAL

The Center for Carbon Management in Energy (CCME) at the University of Houston (UH) was established in January 2019 with the vision of powering the energy transition to create solutions that can satisfy this Energy Trilemma. CCME and UH are partnering with industry and other thought leaders to lead impactful, multi-disciplinary change to technology, regulations, and policy, involving science, business, and law, as well as advancing education to develop a future-ready workforce ready to benefit the society at large.

We created this center in close engagement with our colleagues at UH, industry, and a broad group of stakeholders. Our external energy advisory board identified the need for the CCME, the university invested in the initial seed funding of the center, and our industry partners now continue to invest in the public private partnership to advance carbon management.

Carbon Management is in full development within companies in Oil and Gas, Petrochemicals, Electric Power, Cement, Steel, and several other manufacturing entities. They are not only pledging to be net zero carbon emissions by 2050—but are investing in real emissions reduction technologies. This is the essence of our carbon management efforts at the University of Houston.

Our UH CCME has positioned its efforts to span broadly across the US and is proud to have external collaborations in place with the Energy & Environmental Research Center (EERC) at the University of North Dakota in Grand Forks, the University of Wyoming's Energy Institute, the University of Illinois and their carbon sequestration efforts in partnership with Battelle in Columbus, OH as well. The further collaborations with other universities and associations through the Southern States Energy Board also provide a national organization of effort. All of these universities are organized around, and working on, various aspects of the decarbonization challenge that are essential to meeting the climate challenge.

Let me emphasize that it is critical we not confuse the mission to be the elimination of the fossil fuel industry. The mission is to eliminate emissions—and do it sustainably, affordably and reliably. The fossil fuel industry supplies over 80% of the world's energy at a time where energy demand and population growth are anticipated to challenge the access to energy in all parts of the world.

Frankly we cannot grow by subtraction—we must utilize all energy fuels and technologies. Choosing one solution exclusively is neither practical nor productive. Geographic constraints, access to fuels and technologies, and the general status of the economies in all regions of the world—all of these externalities and many others will drive the most effective means of decarbonization. Industry will be at the forefront of these emissions reduction efforts with their pledges to achieve Net Zero. The industry's actions to realize such Net Zero pledges will make significant impact. I recently published *an opinion in The Hill (Appendix A)* that outlines how such pledges are not hollow statements of dogma and address meaningful pathways to decarbonize.

*Clearly the mission is a mission that requires AND—not either/or  
Reliable—affordable—resilient energy AND carbon emissions reduction and the ultimate elimination of greenhouse gases that impact climate.*

*AND not just in our country but to the global marketplace that looks to the US for such leadership.*

### New Opportunities for Carbon Management

Currently, technical, economic, policy and regulatory challenges must be addressed to create the broad commercial deployment of Carbon Capture Utilization and Storage (CCUS). And industry has also recognized the key elements of the commercialization opportunities and challenges for commercialization of carbon capture utilization and storage to be

- Significant potential for CO<sub>2</sub> storage in underground deep geological formations, as well as storage through enhanced oil recovery (EOR), including offshore capacity for storage and EOR. This, coupled with proximity to sources that produce CO<sub>2</sub>, presents an opportunity to significantly reduce transportation costs and infrastructure requirements.
- Local wealth of intellectual capabilities and industrial know-how related to carbon management, especially carbon capture and sequestration through EOR, offering a unique and distinctive advantage;
- Nonetheless, legal, and regulatory barriers exist, driven in part by the consideration of CO<sub>2</sub> as a waste product. The role and characteristics of injection wells change over the lifetime of the project, leading to classification issues, risk and liability, and pore space ownership issues.



- And clearly the utilization of CO<sub>2</sub> as a product for use in chemicals manufacturing, building products, etc. provides an opportunity across the country for non-geologic utilization that will be essential to the broad commercialization opportunities.

Category	Transformative Challenges	Existing Research Programs, Proposed Legislation, Project Specific Challenges
Stakeholder Engagement, Environmental Justice, and Workforce Transition	<ul style="list-style-type: none"> <li>• Stakeholder engagement</li> <li>• Environmental justice</li> <li>• Workforce transition</li> </ul>	
Policy, Legal, and Regulatory Capacities	<ul style="list-style-type: none"> <li>• Facility permitting</li> <li>• Pipeline permitting</li> <li>• Class VI UIC primacy</li> <li>• Long-term site stewardship</li> </ul>	<ul style="list-style-type: none"> <li>• Increasing the duration and sizing 45Q to incentivize investment</li> <li>• Regulatory certainty associated with GHG reduction goals</li> <li>• State guidelines for access to pore space</li> </ul>
Commercialization Enablers—Risk Reduction, Financial Markets	<ul style="list-style-type: none"> <li>• Storage risks</li> <li>• Life-cycle assessment and cost-benefit of low-carbon products or fuels marketing of low-carbon products or fuels</li> </ul>	<ul style="list-style-type: none"> <li>• Incentives to develop CO<sub>2</sub> infrastructure</li> <li>• Feasibility of repurposing existing pipelines for CO<sub>2</sub></li> <li>• Facilitating source-sink matching</li> <li>• Costs associated with pipeline construction</li> <li>• Decrease parasitic load</li> <li>• Improve capture technologies</li> <li>• Cost to capture CO<sub>2</sub> from dilute and/or multiple streams</li> <li>• Optimization of space for retrofit</li> <li>• Identification of additional utilization purposes</li> <li>• Identify CO<sub>2</sub> purchasers and suppliers improve efficiency of CO<sub>2</sub> to products or fuels</li> </ul>

The National Petroleum Council (NPC) produced a document at the request of the Secretary of Energy at DOE and submitted it in Dec. 2019. Entitled *“Meeting the Dual Challenge—A roadmap to at scale deployment of carbon capture, use and storage”*. This national effort was then subsequently taken up by the UH CCME as we published a white paper called *“CCUS—A Lynchpin to the Energy Transition”* that outlines the phased implementation of CCUS in the Greater Houston area. My colleagues at UH’s Bauer Business school and UH Energy also developed a *whitepaper outlining the crucial role hydrogen should play in decarbonizing industry*. These documents provide insights into the opportunities and challenges and also the fundamental economics of investing in real emissions reduction technology that will produce real reductions.

And subsequently there are investments being made in the marketplace today by industries to make such impacts and they are in key strategic industry segments.

#### Projects Are Already Underway

- First is Carbon Capture Utilization and Storage (CCUS) discussed above. I’m certain you are aware of the \$100B project conceptualization that the 14 significant CO<sub>2</sub> emitters in the Gulf Coast have come together to promote. It’s not one big project but an alignment of the industry players to work together collectively along with our university to promote and realize the vision. Most of those industries are also members of the UH CCME organized CCUS consortia that is made up of 40 plus member organizations from not only industry but multiple academic institutions, NGOs, and legal firms. We were launched last year through the support of the DOE Office of Fossil as part of the Southern States Energy Board’s programmatic support aimed at the broad commercial deployment of CCUS. This designation for UH is not to simply be a regional center but to support that national work in CCUS required to achieve commercialization. Our consortia have developed a roadmap and aligned these critical industry participants to accelerate industry deployment and to deliver commercial impact. The consortia recognizes: (1) financial and investment incentives; (2) policy and regulatory frameworks; and (3) people and stakeholder engagement as the critical enablers that are essential to advance CCUS into a broadly deployed commercial transition enabler. CCUS is not a perpetuation of the fossil fuel industry—it is the most effective and rapid enabler of the energy transition.

- Second is hydrogen and the development of massive increases in H<sub>2</sub> production—decarbonized to deliver the clean fuel of the future. Our university is working with Shell and the Wood group in a DOE project to decarbonize a steam methane reformer through advanced carbon capture technology. Natural gas generated H<sub>2</sub> is nearly 90% of the current world production and volumes are anticipated to grow by 5–10× in the coming 50 years. In a separate project that will advance the US as a global leader in hydrogen and the hydrogen economy, we are working with Shell on transporting liquefied hydrogen. . . .
- And thirdly there is the need for de-carbonized electricity that is available 24/7. This baseload electricity can fuel the energy transition electrification needs and utilize the abundant and low-cost fuels in our country. . . . The World's first zero-emissions Allam cycle power plant will be built in Illinois at the ADM site by 8 Rivers LLC. The ADM carbon sequestration geologic site was developed with DOE as was the Net Power process technology and will provide commercialization of decarbonized baseload electricity. Natural gas-based power with CCUS has been endorsed by the administration as a requirement for this Clean Energy Future.

## **PARTNERSHIPS AND MADE IN AMERICA**

### **A Call to Act Now to Lead Carbon Management Globally**

The near-term challenge for carbon management is rapid deployment to benefit from economies of scale and reductions in commercialization risks. Currently, we have reliable and commercially proven technology to mitigate the challenge; and what we need are market-based solutions incentivized by economics, regulations, and policies that remain stable over time to accelerate early-stage development. This is all for the “good of the public.” That good is the reduction of GHG emissions in the most significant manner, in the most rapid and effective means possible. Decarbonization will come from conservation, it will come from new means of fuels for transportation for land, rail, and shipping and from the abundance of new technologies that are emerging daily.

But these technologies will be insufficient—especially in the short term—to make a meaningful impact to GHG emissions. Existing industries will continue to operate to meet the energy demands of society and the necessary recognition of the transformative technologies in these industries is critical.

Frankly we cannot grow by subtraction—we must have all energy fuels and technologies to meet this demand. What Made in America requires is:

1. Broader energy security and energy diversity to develop reliable and affordable energy options that meet the de-carbonization expectations globally.
2. Preserving existing jobs while creating new opportunities for long-term employment without dislocating or disbanding the substantial technological, financial, intellectual, and social capital that has been invested in and produced by our energy systems.
3. Minimizing disruption to the economy while ensuring energy access and safeguarding the rights of citizens.
4. Accountability and responsibility towards capacity building and inclusive participation of all stakeholders.
5. Providing a global roadmap for real success. Recognizing global differences and designing solutions that are able to migrate. This will accelerate positive global climate impact and accelerate US commerce to provide real solutions to the world.

Higher education institutions have a central role in advancing carbon management. The examples of ongoing research and projects at the University of Houston that I have described today are focused on delivering measurable results through technological, financial, policy, and legal breakthroughs. At the heart of these capabilities is the exceptional quality of our academic faculty and researchers. We remain committed to serving the city of Houston, Texas, and the United States through our wide-ranging educational and research offerings, partnerships with local and global entities, and contributions to the community.

Ms. CASTOR. Thank you, Mr. McConnell.

Next, Ms. Eckdish, you are recognized for 5 minutes.

### **STATEMENT OF JESSICA ECKDISH**

Ms. ECKDISH. Thank you, Chairwoman Castor, Ranking Member Graves, and members of the committee for the opportunity to tes-

tify today. My name is Jessica Eckdish, and I am the Vice President of Legislation and Federal Affairs at the BlueGreen Alliance, which brings together labor unions and environmental organizations to build a clean, prosperous, and equitable economy.

We are at a unique and critical moment to be discussing the role of manufacturing in achieving a clean economy. We know that climate change is a dire and urgent threat, and the longer we delay, the stronger the action required.

We also know that the industrial sector is responsible for a significant portion of these emissions. At the same time, manufacturing has an outsized impact on our economy, contributing significantly to our GDP, supplying good-paying jobs to workers across the country, and essentially serving as the backbone of the American middle class.

While manufacturing directly employs about 1 in 11 American workers today, we have lost nearly five million manufacturing jobs since 1997. Decades of bad policy, offshoring, and outsourcing has weakened our supply chains and cost jobs.

The COVID crisis has not only underscored the central importance of manufacturing to our economy and our security but has also revealed profound weaknesses in our critical supply chains.

These interconnected challenges are an opportunity. Worldwide our competitors are rushing to capture the manufacturing and jobs gains in the rapidly emerging clean economy. The decisions we make now will determine whether the next generation of investments are made here in the U.S. and whether those investments will result in the kind of good-paying jobs that are often out of reach for too many Americans.

We have an opportunity to transform our industrial base and rebuild American manufacturing to lead in the clean economy, to meet our climate goals, support good union jobs, empower a real and lasting economic recovery that extends to all.

The recently enacted Bipartisan Infrastructure Law takes important steps in this direction, which I outline further in my written testimony, but critical gaps remain which are filled in the House-passed Build Back Better Act.

To take electric vehicles as an example, the bipartisan bill makes important investments to build out a nationwide public EV charging network, establish a domestic supply chain for batteries, and expand the Advanced Technologies Vehicle Manufacturing Loan Program, the ATVM, to include a broader range of vehicles.

However, these investments alone will not ensure that the shift to EVs happens at the pace and scale needed to address climate change and that strengthens domestic manufacturing and supply chains, secures and grows good jobs, and helps reverse decades long declines in job quality and access to middle-class careers.

Additional policies and investments are needed. First, deployment incentives are needed to ensure faster, broader, and fairer adoption of domestically manufacturers electric vehicles.

The Build Back Better Act updates the EV tax credit to accelerate and facilitate purchase of EVs by lowering barriers to access the credit and to incentivize domestic assembly, domestic content, and purchase of vehicles made by union workers.

Second, we have to invest to make the U.S. a leading manufacturer of EVs and the technology that goes into them. Congress should first expand, retool, and convert U.S. automotive and component manufacturing through new and existing tax grant and loan programs.

Second, on-shore critical supply chains like batteries, cells, and the materials that go into them.

Third, modernize and cut emissions from our energy-intensive industrial base.

And finally, ensure that these investments translate into good jobs and are targeted to revitalize the industrialized communities and build new pathways into family-supporting careers.

The Build Back Better Act includes all of these key investments. Without this action, we risk ceding future industries to global competitors. Across the economy, we are already fighting against decades of short-sighted policy and investment decisions that have spurred offshoring and outsourcing, cost manufacturing jobs and family-supporting careers, and driven down living and working standards.

The U.S. is lagging far behind our competitors in investments to capture clean technology manufacturing jobs and to ensure that, for example, the good advanced engine and transmission jobs of today become the good EV propulsion jobs of tomorrow.

Whether or not workers across America see the gains from the coming clean economy depends on what Congress does now. The U.S. can once again lead the world in manufacturing the technologies and products of the future, but we need a proactive strategy and a significant national investment to do so.

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

[The statement of Ms. Eckdish follows:]

**WRITTEN TESTIMONY**

**Jessica Eckdish**

**Vice President, Legislation & Federal Affairs, BlueGreen Alliance**

**Before the 117th U.S. Congress**

**House Select Committee on the Climate Crisis**

**Manufacturing a Clean Energy Future: Climate Solutions Made in America**

**Wednesday, February 2, 2022**

Thank you, Chair Castor, Ranking Member Graves, and distinguished members of the committee. My name is Jessica Eckdish, and I am the Vice President of Legislation & Federal Affairs with the BlueGreen Alliance, a national partnership of labor unions and environmental organizations. On behalf of my organization, our partners, and the millions of members and supporters they represent, I want to thank you for convening this hearing on the critical role of manufacturing in achieving a clean economy.

The BlueGreen Alliance unites America's largest and most influential labor unions and environmental organizations to solve today's environmental challenges in ways that create and maintain quality jobs and build a stronger, fairer economy. Our partnership is firm in its belief that Americans don't have to choose between a good job and a clean environment—we can and must have both. Manufacturing provides a unique example of this principle and an opportunity to address the climate crisis, create good jobs, and inject equity into our society as we work to rebuild our economy and recover from the COVID-19 pandemic.

The world's leading scientific organizations have been unambiguous that climate change is a dire and urgent threat and the longer we delay, the stronger the action required. Over the last decade, we have witnessed worsening impacts on our communities. To avoid the catastrophic consequences of climate change, we must ensure rapid greenhouse gas emissions reductions—based on the latest science and in line with our fair share—to put America on a pathway of reducing its emissions to net zero by 2050 and to ensure we are solidly on that path by 2030.

At the same time, our nation is struggling with deep and crippling economic and racial inequality. According to the Economic Policy Institute, “the bottom 90% of the American workforce has seen their pay shrink radically as a share of total income,” from 58% in 1979 to 47% in 2015.<sup>[i]</sup> That is almost \$11,000 per household—or \$1.35 trillion in additional labor income. There is a direct correlation with the decrease of worker power over this time, as the share of workers in a union fell from 24% in 1979 to under 11% now.<sup>[ii]</sup>

The COVID-19 pandemic has cast a spotlight on—and exacerbated—all the parts of our society that already weren't working for people in the United States. It also revealed dangerous gaps in our manufacturing supply chains, and in the unsafe and unfair conditions faced by too many workers today.

In these interconnected challenges lies an opportunity to transform our industrial base and rebuild American manufacturing to lead in a clean economy—both to meet our climate goals, to support good union jobs, and to power a real and lasting economic recovery that extends to all.

Worldwide, our competitors are rushing to capture the manufacturing and jobs gains in the rapidly emerging clean economy. The decisions we make now will determine whether the next generation of investments in clean technology are made here in the United States, and whether those investments result in good-paying jobs that are out of reach for too many Americans.

As an integral part of a strategy to address the climate emergency, we have the opportunity to modernize and transform our industrial base to make it the most advanced in the world, while spurring the creation of a new generation of good jobs manufacturing clean technology. This industrial transformation can bring dynamic industries back to communities that have been left behind by deindustrialization and under-investment, and provide a stable base for broadly shared growth and prosperity.

The recently-enacted Bipartisan Infrastructure Law (BIL) takes significant steps in this direction, but it is not enough by itself. Congress must also pass the Build Back Better Act (BBBA). The investments and policies included in the BIL, when coupled with the BBBA, will create good jobs, revitalize the nation's manufacturing sector, fight climate change, and help inject equity throughout our society.

### **Manufacturing Matters**

The industrial sector represents a significant source of U.S. emissions, accounting for 29% of greenhouse gas emissions in 2019 when accounting for its electricity use. This significant source of emissions is only expected to grow. Globally, industrial sector emissions increased at an average annual rate of 3.4% between 2000 and 2014, significantly faster than total carbon dioxide (CO<sub>2</sub>) emissions.<sup>[v]</sup> Industrial sector emissions are also growing at a faster rate than other sectors. Between 1990 and 2014, industrial sector emissions increased by 69%, while emissions from buildings, power, and transport increased by only 23%.<sup>[vi]</sup>

Furthermore, while other economic sectors are projected to see flat or declining emissions, these climate benefits could be offset by increases in industrial emissions under a business-as-usual scenario.<sup>[viii]</sup> Industrial sector emissions in the United States are projected to increase 17.6% through mid-century.<sup>[vii]</sup> And reductions in the power and transportation sectors are projected to be offset by an increase in carbon emissions from industrial sources.<sup>[ix]</sup>

Within the industrial sector, which includes a range of economic activities, manufacturing accounts for roughly three-quarters of emissions. And within manufacturing, several key energy-intensive manufacturing sub-sectors are responsible for the majority of emissions.<sup>[x]</sup> The six largest sources of industrial sector emissions now—and projecting to the future—are chemicals, petroleum refining, iron and steel, food products, paper products, and cement and lime production. Tackling these industrial sector emissions must be central to our climate strategy moving forward. In addition, such emissions reductions would support improved public health outcomes for workers and communities that live near manufacturing facilities.<sup>[xi]</sup>

The economic stakes of decarbonizing and rebuilding the manufacturing sector are enormous. Manufacturing directly employs about one in 11 American workers, and contributes \$2 trillion a year to the gross domestic product (GDP). Including the industry's purchases of goods and materials, manufacturing accounts for one-third of

U.S. economic output or more, and its contribution to the nation’s global innovation and competitiveness is substantial; manufacturing accounts for more than two-thirds of private sector research and development (R&D), while the sector’s domestic strength plays a central role in the balance of U.S. imports and exports—and the jobs that go with them.

Manufacturing has a long history of supplying good-paying jobs to workers across this country and has been the backbone of the American middle class. However, the nation has lost nearly five million manufacturing jobs since 1997.<sup>[xii]</sup> Decades of bad policy, offshoring, and outsourcing have weakened supply chains and lost jobs, and the United States has not been taking full advantage of the opportunity to support and strengthen domestic manufacturing. The COVID-19 crisis has underscored the central importance of manufacturing to the country’s economy and security, while revealing profound weaknesses in our critical supply chains. The crisis also has spotlighted the urgent need to curb industrial air pollution, which has contributed to increased mortality rates from COVID-19.

If we fail to make the investments needed and put in place smart policies, American manufacturing will continue to weaken. We have a key opportunity to reverse this trend and invest in growing clean technology manufacturing and supply chains in the U.S.

### ***Key Clean Technology Supply Chain Gaps & Opportunities***

Countries around the world are rushing to capture the manufacturing and jobs benefits of the global shift to clean energy. Even as the U.S. joins other nations in rapidly deploying clean technology, our ability to manufacture these technologies is not keeping pace and we are dependent on other nations for critical sub-components or technology. Today, far too many of the solar panels, solar components, electric vehicle (EV) components, and parts and materials for wind turbines that build the clean energy are manufactured overseas and shipped to the United States.<sup>[xiii], [xiv], [xv]</sup>

#### *Solar*

The story of the U.S. solar industry is illustrative of the consequences of the failure to act proactively in the early days of a budding industry and the need for a comprehensive, coordinated industrial policy that marries strong trade and manufacturing rules.

In the early days of solar energy, the U.S. was the leader of solar energy research, development, and manufacturing. However, due to China’s aggressive moves through trade policy, subsidy, and massive domestic investment in PV manufacturing around 2008-2013, U.S. manufacturing of solar components was largely pushed to the sidelines. Because of inconsistent international trade policy and incoherent federal clean technology manufacturing strategy, the nation has struggled to build a competitive solar manufacturing industry. The few solar manufacturers we have left rely on international supply chains.

For example, U.S. polysilicon manufacturers are entirely captive to Chinese wafer manufacture, which dominates the global market, as their only customers. When China strategically decided to shut down the use of non-Chinese polysilicon in their wafer manufacturing, the U.S. suppliers were essentially frozen out of the supply chain. And it’s no better at the other end of the supply chain, where U.S. module manufacturers have no control over the materials sourcing, labor, or environmental practices behind the key components in their modules, because they have no choice but to source them from China. Recent reporting on the substantially lower environmental, human rights, and labor standards, in China, show how ultimately unsustainable this arrangement is, for example, with respect to the ongoing reports of forced labor.<sup>[xvi]</sup>

Over the years to come, with the dramatic fall in prices for solar and continuing improvements in the manufacture of solar components, the United States has an opportunity to expand PV manufacturing capacity in a way that provides quality, high-road jobs. With strong deployment measures, crafted hand in hand with deliberate manufacturing policies—including direct investment in manufacturing, measures to fill critical supply chain gaps, and a fairer trade policy—the United States can create high-quality jobs and improve our economic security at the same time. Our policies must also support high labor and environmental standards throughout the clean energy supply chain.

#### *Wind*

Primarily due to the extraordinary size of the components and the attendant logistical issues of international shipping, the story is brighter when looking at the onshore wind industry, though there is still room for improvement. There are currently more than 500 U.S. manufacturing facilities specializing in wind compo-

nents.<sup>[xvii]</sup> Currently more than 90% of nacelles—the housing for the generator, gearbox, and other mechanics—for U.S. onshore wind turbines are assembled in the United States, along with 40%–70% of blades and hubs and 65%–85% of wind towers.<sup>[xviii], [xix]</sup> However, the materials that can readily be shipped, such as internal nacelle components, like electronics, have very little domestic content. And very few of these facilities are union-represented. We must ensure we expand our domestic supply chain for wind and increase job quality.

The opportunities and risks are even more acute with respect to the budding offshore wind industry. Currently, the United States has just one offshore wind project operating—the Block Island Offshore Wind Farm off the coast of Rhode Island.<sup>[xxi]</sup> But the potential for responsible offshore wind development in the United States is substantial. According to the U.S. Department of Energy, if the nation utilized even 1% of its technical potential offshore wind capacity, it could power nearly 6.5 million homes.<sup>[xx]</sup> The industry is rapidly expanding both domestically and internationally and the United States is now projected to create 18.6 gigawatts (GW) of clean and cost-effective offshore wind power in seven Atlantic states within the next decade<sup>[xxii]</sup>. This has the potential to support 133,000 to 212,000 jobs per year in seven Atlantic states.<sup>[xxiii]</sup>

However, with this opportunity, the risk of components coming from overseas is high. For example, with the exception of the foundation, all of the major parts and components of the Block Island Wind Farm were manufactured outside of the United States. The nacelles for the project came from France, the towers from Spain, and the blades from Denmark.<sup>[xxv]</sup>

As the industry grows, sourcing components domestically represents a significant opportunity to help revitalize American manufacturing. The Special Initiative on Offshore Wind (SLOW)'s recent white paper predicts an almost \$70 billion buildout of U.S. offshore wind supply chain by calculating growth in a number of sectors, which include wind turbines and towers; turbine and substation foundations; up-land, export, and array cables; onshore and offshore substations; and marine support, insurance, and project management.

However, currently there is no domestic supply chain for these items, meaning that we risk significant portions of the investment to build offshore wind projects flowing out of the economy to purchase technology manufactured abroad, rather than supporting the growth of manufacturing and jobs domestically. We can either seize this opportunity to manufacture the steel, cement, aluminum, nacelles, and other supply chain components here in the United States or we can cede manufacturing the future of the offshore wind industry to our global competitors, where the world leaders and workers in Northern Europe are more than willing to meet our demand.

BGA was pleased to see the Biden administration announce the lease sale of the New York Bight offshore wind project. At 480,000 acres, this project will be the largest offshore wind lease sale in the U.S. history and will add 5–7MW of renewable electricity, powering upwards of two million homes. This announcement from the Bureau of Ocean Energy Management will proactively consider lease sales to companies who are using Project Labor Agreements, and are utilizing the domestic supply chain to procure materials made in the United States.

Strong, long-term policy that drives rapid and responsible deployment and provides investment certainty in offshore wind is necessary, coupled with policies to ensure utilization of domestically manufactured materials, invest directly in U.S. manufacturing facilities, and in related infrastructure like transmission.

#### *Electric vehicles*

Happening alongside the nation's transition to cleaner, cheaper forms of energy is an ongoing shift to cleaner vehicles, in particular EVs. The auto sector is at the heart of U.S. manufacturing, and ensuring the United States leads in EV deployment and manufacturing will be critical to sustaining good jobs in auto and auto components manufacturing.

The global transition to EVs is already underway, with our competitors moving quickly to capture the manufacturing and jobs gains in this transition. Today China holds a 70% share of global EV battery production capacity, with the US and Europe lagging with 16% and 10% shares respectively. Looking out ten years, current business-as-usual market projection puts the US even further behind—now lagging Europe with only 12% of global battery capacity.

The security of American jobs in an EV-dominated automotive market depends on swift policy action to leverage our world class manufacturing base and enable it to move rapidly to build electric vehicles, cells, batteries, and electric drivetrain components, at scale, in the United States. In short, the United States is at a crossroads with EV development. Either we enact policy that secures and potentially grows

manufacturing jobs or we step away from technological leadership and cede the next generation of manufacturing jobs to our competitors.

### **A National Strategy for Industrial Transformation**

We need a holistic approach to retaining and growing manufacturing in the U.S., while also investing in these industries to make them the cleanest and most competitive in the world. If done right, a robust federal commitment to rebuild American manufacturing can tackle emissions from this sector, support good, middle-class jobs across America, and help our economy recover in a way that we come out of this crisis more competitive in the global economy. The ability of U.S. manufacturers to produce clean technologies and to use cleaner processes will make them more competitive in a global economy in which market demand is shifting inexorably in that direction.

The U.S. can once again lead the world in manufacturing the technologies and products of the future. But we need a proactive and coherent national strategy to do so. We must make a significant coordinated national investment now to jumpstart domestic clean technology manufacturing, secure critical supply chains in the U.S., transform energy-intensive manufacturing in line with achieving net-zero emissions economy-wide by mid-century, and ensure a new generation of clean and safe industrial development in America.

In 2020, the BlueGreen Alliance released a comprehensive manufacturing agenda proposing a set of national actions to achieve global leadership across clean technology manufacturing; cut emissions from the production of essential materials; upgrade and modernize the entirety of the U.S. industrial base; and undertake a new generation of industrial development that rebuilds good American jobs and is clean, safe, and fair for workers and communities alike.<sup>[xxvi]</sup>

Such a national strategy must include:

- **Major new investments to spur domestic manufacturing and supply chain development** in rapidly growing clean technologies, as well as increased funding for research, development, and deployment to ensure that American innovation is translated into good jobs and cutting-edge manufacturing in the United States. This should include a focus on environmentally, economically, and socially responsible mining, as well as reclamation and recycling to ensure we're creating the materials necessary for a clean and secure energy future here in the United States;
- **Investments to transform our existing industries**, including investing in efficient domestic materials production and energy-intensive manufacturing to both limit emissions and make them more efficient and competitive globally;
- **Strong labor, environmental, procurement, and safety standards** to strengthen manufacturing and ensure that jobs across these advanced technology fields are good-paying jobs. This includes using proven tools to create and improve job quality—like project labor and community benefit agreements, Buy American, Davis-Bacon prevailing wage, and policies that ensure the use of domestic, clean, and safe materials made by law-abiding corporations.

The BIL makes a number of investments towards these goals. However, key gaps remain and additional policies and investments are needed.

### ***Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act)***

The BIL—takes a number of important steps in this direction. These include:

- \$550 million to DOE to provide technical assistance and grants for energy efficiency and emissions reduction at small and medium sized industrial firms. These smaller firms often lack the funding and technical expertise necessary to improve their facilities and processes, and can struggle to keep up. The BIL provides that support and thereby helps these firms to continue to compete in an increasingly carbon constrained global economy. By including investments in modernizing our basic industries, the BIL will not only reduce greenhouse gas emissions, but also create and retain jobs.
- Funding to the DOE to select and manage large-scale pilot and demonstration projects necessary to build next generation industries here. This includes \$500 million for project demonstrations of technologies to specifically reduce industrial emissions, as well as funding for other programs and technologies that expand beyond the industrial and manufacturing scope such as \$3.47 billion for carbon capture, utilization, and storage (CCUS); \$3.5 billion for direct air capture (DAC) hubs; and \$8 billion to create regional clean hydrogen hubs that would further develop the production, processing, delivery, storage, and end-use of clean hydrogen. These funds are critical for the U.S. to invest in its industrial and manufacturing future.



- Significant funding for a robust, nationwide EV charging network. Through formula and competitive grant programs, the BIL authorizes the Department of Transportation to provide states and other entities with up to \$7.5 billion to build publicly accessible fast chargers across the country. These programs serve to build up the public's confidence in EVs, ensure an equitable distribution of EV charging infrastructure in rural and low-income communities, and—with strict adherence to Buy America standards—spur the growth of a domestic supply chain for electric vehicle supply equipment.
- Up to \$5 billion to transition America's school buses, which are typically powered by diesel, to less polluting alternatives like electric school buses. The BIL creates a new U.S. Environmental Protection Agency (EPA) program, called the Clean School Bus Program, which equips school districts and other bus-purchasing entities with the funding and technical assistance to transition school bus fleets and install the appropriate charging/fueling infrastructure. Transitioning school bus fleets is a win for children's health, local communities' air quality, the environment—and with the right workforce protections and a strong commitment to supporting the domestic electric school bus supply chain—for the workers who drive and manufacture the clean school buses.
- Expansion of the Advanced Technology Vehicles Manufacturing (ATVM) Loan program to cover medium- and heavy-duty vehicles—as well as maritime vessels, trains, aircraft, and hyperloop technology—and the facilities making their component parts. Similar to the 48C tax credit for clean technology manufacturing and industrial emissions reduction investment targeted to coal communities, the expansion includes a \$750 million grant program and a significant investment in battery and battery component research and development, manufacturing, and recycling. These investments are an excellent step to retool U.S. automotive manufacturing to build the EV technology of the future in today's plants and communities.

These are all important manufacturing and industrial transformation provisions and implementation of these provisions, done right, will have a significant impact on achieving the goals outlined above. However, significant funding and programmatic gaps remain. For example, while the BIL includes funding for technical assistance, energy efficiency and emissions reduction, CCUS and industrial emissions demonstration projects, and hydrogen and direct air capture hubs—these latter programs are not targeted specifically at energy intensive industries and the funding allocated to deployment of emissions reduction technology for industrial firms is far smaller than the billions in investment necessary to meet the widespread need. In addition, the BIL does not fill a critical funding gap in the ATVM or provide the funding needed to fill clean technology supply chain gaps and for urgently needed manufacturing conversion grants to reopen, retool, and expand existing facilities to build the clean technology of the future.

Major additional investments are needed to support and grow clean technology supply chains and to enable strategic energy intensive facilities to deploy technology that deeply cuts carbon and conventional pollution, and safeguard critical industries and jobs in the United States. That's why Congress must now pass the BBBA, which fills critical programmatic and funding gaps not addressed by the BIL.

### ***Clean Technology Manufacturing & Supply Chains***

The House-passed BBBA includes critical incentives and fills key gaps left by the BIL to promote clean technology manufacturing, including efforts to update and improve our tax policy to reshape our clean energy economy, strengthen American manufacturing and domestic supply chains, and ensure that family sustaining jobs come with it. More specifically, the House-passed BBBA:

1. **Extends and Strengthens Clean Energy Tax Credits to Drive Demand for Domestic Manufacturing:** The BBBA extends and strengthens—and makes refundable—key clean energy tax credits, including those for onshore and offshore wind, solar, clean transportation, EV charging infrastructure, grid modernization, and energy efficiency. Critically, these tax credits are coupled with labor standards and procurement policies that ensure the use of domestic materials and support employers that adopt high road labor practices, including prevailing wages and utilization of registered apprenticeship.
2. **Grows Domestic Manufacturing and Clean Energy Supply Chains:** Policies that increase the demand for clean technology must go hand in hand with incentives to support and grow American manufacturing and domestic supply chains. Already, as the nation increases deployment of clean technology, our ability to manufacture those products and the parts and materials that go into them is falling further behind as demand increases.<sup>[xxvii]</sup> That is why targeted

investments and smart policies are needed to ensure that the nation is able to capture the benefits of the clean energy economy.

The BBBA includes two key policies that can support this. First, it **renews and robustly funds the Advanced Energy Projects Credit (48C)**: The Advanced Energy Projects Credit is a 30% investment tax credit created to reequip, expand, or establish domestic clean energy, transportation, and grid technology manufacturing facilities. The House-passed BBBA robustly funds this program at \$25 billion dollars and expands its scope to capture the manufacture of key energy and carbon reducing technologies, such as battery cells. The bill also targets these investments to key workers and communities.

Second, the bill **enacts new clean technology manufacturing production tax credits (PTC)** to create a durable incentive for domestic production of strategic clean energy technologies. In addition to the up-front investment incentive of 48C, this structure gives an incentive to expand operations to a globally competitive scale quickly and substantially to help fill gaps in the solar supply chain, by providing a per-unit credit for domestically produced modules, photovoltaic cells, photovoltaic wafers, and solar grade polysilicon.

Coupling a PTC with other manufacturing and deployment incentives could help reverse decades of disinvestment, offshoring, and inconsistent manufacturing policy that has weakened our once competitive edge. Importantly, such an incentive would reward large scale and efficiency, exactly what we need to compete in these rapidly expanding global industries and help ensure our manufacturing remains strong and resilient against future subsidies and potential dumping by our competitors. We need a coordinated approach, including measures such as new clean technology production tax credits as included in the BBBA, to incentivize strategic technology manufacturing here, harness American ingenuity, and drive down deployment costs while adding family-sustaining jobs across the country.

#### ***Automotive Manufacturing and Retooling Investment***

The BBBA also builds on the BIL to advance robust funding to strengthen the domestic automotive supply chain, protect workers and communities, and build the EV fleet of the future here. That includes investments to retool automotive manufacturing to build the EV technology of the future in existing plants and communities. A recent report from the Economic Policy Institute shows that robust policy to retool existing production, expand domestic clean vehicle manufacturing in the U.S., and onshore EV and EV technology production is essential to protecting and creating domestic manufacturing jobs in the coming shift to EVs. To this end, the BBBA:

1. **Refills the ATVM loan program:** The bill provides \$3 billion in credit subsidy funding to the ATVM loan program, which is essential to meet light-duty vehicle and component retooling needs and support expansion to medium- and heavy-duty vehicles and their supply chains. Coupled with the uncapped loan authority as provided in the BIL, these ATVM provisions will enable at least \$20B in new loans in these sectors. Past ATVM funding has supported the building or expansion of major facilities across eight states that today support tens of thousands of manufacturing jobs and hundreds of thousands of jobs collectively across the economy.
2. **Funds conversion and retooling grants:** The bill provides first-ever funding at \$3.5 billion for the important manufacturing conversion and industrial retooling grants program, which is focused on reinvestment in existing factories, particularly to retool facilities at risk of closure. This important program can play a critical role in protecting jobs and rebuilding local networks of manufacturing as technology shifts.
3. **Supports a job-sustaining transition to clean vehicles:** Consumer incentives stand to play a significant role in shaping the shift to electric vehicles and the manufacturing, jobs, and community impacts of that transition. The BBBA updates the existing 30D consumer tax credit to incentivize domestic assembly, domestic content, and high road labor standards. Through a phased-in domestic assembly requirement and a significant bonus for customers who purchase vehicles made by union workers, the structure of the proposed updated credit helps retain and grow the next generation of high-skill, high-wage, family-supporting jobs in the United States and support the growth of high volume, high-quality domestic electric vehicle production and supply chains necessary to remain competitive in this space over the long term. To address equity issues with the existing credit, the updated BBBA language makes the credit refundable at the point of sale, making it significantly easier to access

for moderate income and working-class households. Additionally, BBBA establishes a used EV tax credit, which further extends access to EVs for consumers and works to establish a robust secondary market for EVs.

BGA also supports the ongoing work to expand the 30C tax credit for charging infrastructure, as the robust proliferation of easily accessible charging will be essential to the success of EV adoption. Incentives for charging infrastructure should ensure availability for all communities, with a priority on filling gaps in low income, rural, and deindustrialized communities and communities of color, and availability for residents of multi-family housing, and be refundable. These incentives should also require safety-first workforce training for the installation and maintenance of electric vehicle supply equipment (such as the Electric Vehicle Infrastructure Training Program, or EVITP) and the domestic manufacture of charging stations.

### ***Investment to Support Industrial Transformation***

Policies to grow domestic manufacturing and clean technology supply chains must go hand in hand with a robust reinvestment in domestic manufacturing facilities to ensure that we not only once again lead the world in manufacturing the technologies and products of the future but also to ensure our manufacturers are the cleanest and most competitive in the world. Other nations are going first in modernizing heavy industry. They are demonstrating cutting edge, low-carbon processes for producing energy-intensive basic materials and fuels that will be essential to future global competitiveness and emissions reduction. If the United States hopes to compete and to lead, we need to invest in transforming our manufacturing and industrial sectors at the same or greater scale and pace.

Such investment must include technical assistance, financing, and other financial support for domestic facilities to re-tool and upgrade their facilities and processes as well as investment in innovation to drive down costs and barriers to critical industrial pollution-reduction strategies. The House-passed BBBA:

1. **Provides funding to deploy clean industrial technologies at scale:** Provides at least \$4 billion in new funding to aid companies in carrying out major carbon emissions and pollution-reducing upgrades at strategic energy-intensive manufacturing facilities.
2. **Funds rapid industrial emissions reduction through key tax credits:** It is essential to enable more rapid deployment of a wide range of industrial emissions reduction technology that not only saves and creates jobs and makes domestic manufacturing more competitive, but achieves important additional carbon—and conventional—pollution reductions in a key emitting sector. The bill increases funding for industrial CCS under the 45Q tax credit and extends industrial energy efficiency tax credits. Funding for projects that reduce emissions from energy-intensive industrial facilities—such as steel, cement, and aluminum production—under a robustly funded 48C Manufacturing Tax Credit can also be beneficial.
3. **Funds embodied emissions transparency and disclosure:** Provide \$250 million in funding to EPA to provide grant and technical assistance to manufacturers to develop and utilize Environmental Product Declarations (EPDs), which are essential for the accurate comparison of the embodied carbon in manufactured products and materials and for developing the data infrastructure upon which a Buy Clean program may be built.

These policies will help the U.S. achieve global leadership across clean technology manufacturing; cut emissions from the production of essential materials; upgrade and modernize the U.S. industrial base; and undertake a new generation of industrial development that rebuilds good American jobs and is clean, safe, and fair for workers and communities alike.

### ***Ensuring Job Quality and Fairness for Workers and Communities***

Finally, as we work to drive down emissions to address the climate crisis and stay competitive in the global race to develop the clean technology of the future, we must ensure that these investments translate into quality, family-sustaining jobs and support workers and communities.

We can see examples of how clean energy investments can spur economic recovery, the growth of a clean economy, and high-quality job creation. For example, a heavily unionized crew of tradespeople built the Block Island offshore wind project off the coast of Rhode Island, union auto workers on factory floors across the country are building cleaner cars and trucks, and workers in St. Louis and Los Angeles are gaining access to high-skilled jobs in energy efficiency retrofitting, pipefitting, and transit manufacturing. These are good, union jobs building and maintaining a

clean energy and climate-resilient economy, today. At the same time, not enough of the new jobs that have been created or promised in the clean energy economy are high-quality, family-sustaining jobs and the quality of jobs varies a great deal throughout these sectors.<sup>[xxx]</sup>

As we work to meet our climate goals, we need to make a massive investment in energy efficiency and the deployment of clean and renewable technology nationwide. At the same time, we must ensure that these investments translate into *good* jobs, and we must ensure that we are not only ensuring these are good jobs, but *accessible* jobs. This includes supporting and growing pathways into good union jobs in these and other sectors for workers of color and other segments of the population historically left out of these jobs.

To achieve these goals, a critical tool at our disposal is unionization. Research has shown that through the collective bargaining power of unions,<sup>[xxxi]</sup> workers are able to get more and better benefits such as health insurance and pensions, and are able to fight for more enforcement of the labor protections they have a right to under the law, like enforcement of safety and health regulations, and overtime. And research has shown that across the board, union members earn higher wages than non-union workers,<sup>[xxxii]</sup> and the difference is most pronounced for workers of color and women. White union members earn on average 17% more than their non-union counterparts. Female union members earn 28%, Black union members earn 28% more and Latino union members earn 40% more in wages than non-union Latino workers. Increasing union density in the clean energy sector is therefore a key way to address the inequity inherent in our economy.

Other key mechanisms for job quality, building career pathways, and increasing job access are prevailing wage standards, registered apprenticeship, pre-apprenticeship, and other union-affiliated training programs. Project Labor Agreements (PLAs), Community Workforce Agreements (CWAs) and Community Benefit Agreements (CBAs) are additional opportunities. These types of agreements often include local hire provisions, targeted hire of low-income or disadvantaged workers, and the creation of pre-apprenticeship pathways for careers on the project. We must ensure that steps are taken to require or incentivize these kinds of high road labor standards and responsible labor practices.

These kinds of policies will help ensure that as we meet our climate goals and support and grow our domestic manufacturing supply chains, that workers truly reap the benefits. Researchers from Princeton University<sup>[xxxiii]</sup> in a recent working paper found that increasing wages and the amount of domestic content in the solar and wind energy industries will result in significant benefits for workers in those industries, including billions in higher wages and hundreds of thousands of new jobs in the 2020s. The researchers found paying workers 20% more and increasing the use of domestic content would generate an additional \$5 billion in annual wages in the 2020s, which equates to increasing each worker's average annual wages by over \$12–13,000. And by producing more of these components here in the United States, we can support an additional 45,000 jobs in the 2020s.

Finally, as we transition to a new, cleaner economy, we can't leave impacted workers or communities behind. A transition that is fair for impacted workers and communities isn't something that will happen organically. We have to choose to invest in keeping communities and workers whole and in the economic development and diversification of regions impacted by this shift. We have to do so with a recognition that the best approach to energy transition among workers and communities is one that prevents economic disruption and employment loss in the first place. Part of this strategy should include targeting clean energy and manufacturing investments towards workers and in communities experiencing the economic impacts of energy transition as part of a broader set of investments to build a clean, prosperous, and equitable economy for all.

### Conclusion

As the United States ramps up efforts to grow the clean economy, making these investments right—and making them now—will give us the opportunity to lead globally, rebuild good, union jobs in manufacturing communities across the nation that have been struggling, and bolster innovation and production of the clean technology of the future here at home. At the same time, moving forward without putting the right policies in place to lift up the quality of the jobs created and ensure workers and communities see the benefits of these investments would put the burdens of economic transition on workers.

The solutions to the crises we're facing—climate change and economic and racial inequality—are as interconnected as their causes. We appreciate the work of this Committee to advance a path forward that recognizes this reality and provides solu-

tions to create a stronger, cleaner, and more equitable economy that works for all Americans.

The smart policies we’re talking about today would not only increase the standard of living of millions of Americans, but increase their quality of life, all while continuing to drive down the costs of the clean technologies we need to deploy to secure our children’s future and tackle the climate crisis. Such a win-win-win opportunity is nearly unprecedented in our history.

Thank you again for the opportunity to speak today.

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<sup>[ii]</sup> Ibid.

<sup>[iii]</sup> U.S. Environmental Protection Agency (EPA), *Sources of Greenhouse Gas Emissions*. Available online: <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

<sup>[iv]</sup> Ibid.

<sup>[v]</sup> Intergovernmental Panel on Climate Change (IPCC), *Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development*, 2018. Available online: [https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15\\_Chapter2\\_Low\\_Res.pdf](https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter2_Low_Res.pdf); IPCC, “Global Warming of 1.5°C.” Available online: <https://www.ipcc.ch/sr15/>

<sup>[vi]</sup> McKinsey & Company, *Decarbonization of Industrial Sectors: The Next Frontier*, 2018, Available online: <https://www.mckinsey.com/~/media/mckinsey/business%20functions/sustainability/our%20insights/how%20industry%20can%20move%20toward%20a%20low%20carbon%20future/decarbonization-of-industrial-sectors-the-next-frontier.pdf>

<sup>[vii]</sup> Third Way, *Industry Matters: Smarter Energy Use Is Key for US Competitive-ness, Jobs, and Climate Efforts*, 2018. Available online: <https://www.thirdway.org/report/industry-matters-smarter-energy-use-is-key-for-us-competitiveness-jobs-and-climate-effort>

<sup>[viii]</sup> Ibid.

<sup>[ix]</sup> Utility Dive, “EIA: US Far off Track for Global Climate Goals as Fossil Fuel Reliance Persists,” January 2019. Available online: <http://www.utilitydive.com/news/eia-us-far-off-track-for-globalclimate-goals-as-fossil-fuel-reliance-pers/546857/>.

<sup>[x]</sup> Third Way, *Industry Matters: Smarter Energy Use Is Key for US Competitive-ness, Jobs, and Climate Efforts*, 2018. Available online: <https://www.thirdway.org/report/industry-matters-smarter-energy-use-is-key-for-us-competitiveness-jobs-and-climate-effort>

<sup>[xi]</sup> Ibid.

<sup>[xii]</sup> Economic Policy Institute, *We can reshore manufacturing jobs, but Trump hasn’t done it*, 2020. Available online: <https://www.epi.org/publication/reshoring-manufacturing-jobs/#:~:text=Overall%2C%20the%20U.S.%20has%20suffered,Census%20Bureau%202020a%2C%202020b>

<sup>[xiii]</sup> U.S. Energy Information Administration, *U.S. shipments of solar photovoltaic modules increase as prices continue to fall*, 2020. Available online: <https://www.eia.gov/todayinenergy/detail.php?id=44816#:~:text=Effective%20February%207%2C%202018%2C%20the,subsequent%20year%20for%20four%20years.&text=In%202019%2C%20imports%20accounted%20for,of%20total%20solar%20PV%20shipments>

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<sup>[xvi]</sup> Council on Foreign Relations, *China’s Repression of Uyghurs in Xinjiang*, 2021. Available online: <https://www.cfr.org/backgrounder/chinas-repression-uyghurs-xinjiang>

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<sup>[xix]</sup> Lawrence Berkeley National Laboratory, *Wind Technologies Market Report*, 2020. Available online: <https://emp.lbl.gov/wind-technologies-market-report>

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<sup>[xxii]</sup> Oceana, *Offshore Wind Report*, 2010. Available online: [https://oceana.org/wp-content/uploads/sites/18/Offshore\\_Wind\\_Report\\_-\\_Final\\_1.pdf](https://oceana.org/wp-content/uploads/sites/18/Offshore_Wind_Report_-_Final_1.pdf)

<sup>[xxiii]</sup> National Renewable Energy Laboratory, *Offshore Wind Power in the United States, 2010*. Available online: <https://www.nrel.gov/docs/fy10osti/49229.pdf>

<sup>[xxiv]</sup> *Ibid.*

<sup>[xxv]</sup> General Electric, *My Turbine Lies Over the Ocean: It takes Herculean Labor to Build America's First Offshore Wind Farm*.

<sup>[xxvi]</sup> BlueGreen Alliance, *Manufacturing Agenda: A National Blueprint for Clean Technology Manufacturing Leadership and Industrial Transformation*, 2020. Available online: <https://www.bluegreenalliance.org/resources/manufacturing-agenda-a-national-blueprint-for-clean-technology-manufacturing-leadership-and-industrial-transformation/>

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Ms. CASTOR. Well, thank you and I want to thank all of the witnesses for your insightful and informative testimony. Now we will go to member questions. First up, I am going to recognize Congresswoman Bonamici for the first 5 minutes. You are recognized.

Ms. BONAMICI. Thank you so much, Chair Castor and Ranking Member Graves, but thank you especially to our witnesses for bringing your expertise here today.

Ms. Eckdish, thank you for your mention of all the work that you are doing with the BlueGreen Alliance. In fact, the bill we are debating today, the COMPETES Act is relevant too in terms of incentivizing and growing U.S. manufacturing. So I appreciate that.

Ms. Hopper, you referenced in your testimony the increased interest in expanding domestic solar manufacturing, and that is true in the Pacific Northwest, in my home state of Oregon, but also across the country.

We have the capability, we have the opportunity to onshore the solar supply chain, and create good-paying jobs here at home. So what are the most important policies that are in Build Back Better, for example, that will increase that—the manufacturing here, in-

vigorate the supply chain, the domestic supply chain, and what kinds of job growth will we see if the climate investments in the Build Back Better Act are enacted?

Ms. HOPPER. Thank you so much for that question. There absolutely is a great interest in onshoring a lot of the manufacturing processes. The critical sort of asterisk is if the right policies are in place. So the right policies are sort of trifold.

One is—let me start by saying companies want certainty. It doesn't matter what kind of company it is, what kind of business they are in, if they are big or small. Companies deploy capital when they have certainty about the market. And so everything I am going to talk about is about providing certainty.

In terms of providing demand certainty, the long-term extensions of the Investment Tax Credit and the Production Tax Credit provide a market certainty that there will be a continued and accelerated demand for the product.

An Investment Tax Credit for manufacturing investment provides a certainty, right? And then a Production Tax Credit for manufacturing sort of gives companies that runway to say, okay, there is going to be a stable policy environment so I can make the determination to build factories worth literally hundreds of millions of dollars, right, in your state or another member's state.

And so on the manufacturing side and sort of that suite of policies is really critical. They are all obviously contained in the Build Back Better agenda, but those are critical to providing the business environment so that companies will deploy capital.

Then if we think about the job creation and the economic impact that could have, looking solely at the manufacturing sector—just want to look at my notes so I get the number right—so we think by 2025, there will be about 27,000 additional direct manufacturing jobs. We have about 30,000 now, so almost a doubling in a couple of years. And it is pretty amazing. And then by 2030, about 40,000 additional direct manufacturing jobs.

Then if we look—that is obviously a sector of our—of our ecosystem here just in the solar and solar-plus-storage world. We think to get to the goals that the President has set, there will be about 800,000 more Americans employed in the solar and solar-plus-storage industry.

There is about 230,000 now, about 800,000 more in the next 8 years. So as you can see, you know, we can talk a lot about manufacturing and climate and all sorts of things, but this really is a story of innovation, job creation, and economic opportunity.

Ms. BONAMICI. Thank you. Thank you so much. I appreciate that. Yesterday I introduced my Regional Clean Energy Innovation Act that will create a DOE office responsible for identifying, overseeing, and funding regional energy innovation institutes, and they will help clean energy technologies achieve commercialization by leveraging regional market capabilities, industry expertise, and Federal resources.

So Mr. Browning, if we are to achieve some widespread green hydrogen commercialization, how will that affect different regions of the country, and which parts of the U.S. will benefit most from associated investment and job creation?

Mr. BROWNING. Thanks for the question. You know, our first focus area in the United States is in the western states, including your own. The reason for that is the western states have a lot of supportive policy in place.

Their power grids are also already heavily penetrated by renewable power, and that creates the right kind of environment for green hydrogen, which, you know, again, green hydrogen is a store of renewable power.

And so having a power grid that already has a lot of renewable power on it, gives us the renewable power we need in order to create green hydrogen.

As we put more and more renewable power on the grid, we are going to find that extreme weather events like, you know, the heat wave that the West had two summers ago that caused, you know, big power disruptions, the power grid is going to need to be able to store renewable energy in times when it is in abundance so that it can be available in extreme weather events or other periods of time when we are short on power.

And that role that green hydrogen is going to play in the power industry is also then going to create the scale that we need in order to make green power available for transportation uses and also—

Ms. BONAMICI. Thank you, Mr. Browning. I am sorry, but my time is long expired. I am going to have to yield back. Thank you, Madam Chair.

Ms. CASTOR. Good. I am sure we will have additional time to get into it a little bit more.

And next up, Mr. Crenshaw, you are recognized for 5 minutes.

Mr. CRENSHAW. Thank you, Madam Chair, and I want to start with my friend Mr. McConnell with a very general question, which is, if a lot of the radical environmentalists got what they wanted right now and we stopped producing any oil and gas in the United States, what do you think that would do to global carbon emissions, which is indeed our ultimate goal, to reduce global carbon emissions?

Mr. MCCONNELL. Well, it would certainly have an impact, but that is not a scenario that I don't believe anybody could envision or expect. The growth in the world's demand for energy continues to expand. We are going to grow by 50 percent over the next 50 years, and so oil and gas is projected to continue to be, along with coal and other fossil fuels, at least 70 percent of the world's energy mix.

Mr. CRENSHAW. And somebody is going to—

Mr. MCCONNELL. So the real issue about emissions reduction is to eliminate the emissions.

Mr. CRENSHAW. Right. And somebody's going to produce it, somebody's going to fulfill that demand.

Mr. MCCONNELL. Sure.

Mr. CRENSHAW. I mean, who has cleaner production standards—the U.S. or OPEC?

Mr. MCCONNELL. Well, I think we all know that we lead the world in that regard, and so from an energy security standpoint but really from an environmental standpoint, making it in America is really the choice.



Mr. CRENSHAW. My next question, I will move on to you, Ms. Hopper, were you at the Department of the Interior when they came out with a study that showed—this is from the Obama administration—that global emissions would increase without the current slate of Gulf of Mexico lease sales?

Ms. HOPPER. You would have to—I was there for 2 years. So I am not sure when that study came out.

Mr. CRENSHAW. It was in November of 2016, it was published at BOEM.

Ms. HOPPER. Yes, I imagine, I think I was, yes. 2015 and 2016.

Mr. CRENSHAW. I mean, so do you agree with the finding of that study?

Ms. HOPPER. I have to admit I don't recall the finding of that study, but I do have lots of trust in the scientists at BOEM.

Mr. CRENSHAW. Yeah. It is an interesting study, and we could potentially submit it for the record. I want to ask you about solar panels because one of the concerns I have is that we don't properly address tradeoffs, that we don't look at the direct environmental impacts of solar and wind generation, and only look at the potential climate impacts down the road.

And I often wonder if that is a mistake. I am not against solar or wind by any stretch of the imagination, but I do wonder if we—if we oversubsidize it.

And so, you know, one simple question would be this. I mean, how many solar panels would it take to make up the generation necessary to meet the Biden administration's goals? Do we have a ballpark estimate of that?

Ms. HOPPER. I don't have a ballpark estimate of the number of solar panels. I think the—

Mr. CRENSHAW. Or area.

Ms. HOPPER. So this is one number I do have. So NREL, National Renewable Energy Lab, issued a study. It is cited in the Department of Energy's future study that they issued this October of 2021 that says, you know, in light of the President's goal, if 40 percent of the U.S. energy generation came from solar—they were looking at land mass it would take about 0.5 percent of the U.S. land mass.

Mr. CRENSHAW. Okay. Princeton University estimated that in order to meet the goal of emission-free grid by 2025—that is the goal I am talking about, just to be clear—it would require expanding wind and solar by ten percent annually until 2030, and you would need a chunk of land the size of South Dakota. So it is not—it is not small by any stretch.

And then I want to move on to the claim that solar panels are actually net zero emissions. You know, is that really true? Because there is a lifecycle to solar panels, whether it is the mining of the material, the manufacturing of the panel, the transportation from China, not to mention land-use issues. You know, it is 300 to 400 times more land required for the same amount of energy than natural gas or nuclear plants. So how do we factor these costs in a little bit better?

Ms. HOPPER. Yeah. I know I am glad you raised that question because I think it is a question that a lot of people have, like most

of us, you know, want to make sure that this is ultimately a benefit to the environment.

On the land—I will answer your question—on the land-mass question, I think one of the most innovative parts of the solar industry is these, like, multi-use land opportunities. So we can have a long conversation about sort of the ways in which farmers, and solar in particular, co-exist on land, and the way that ag land, it is not necessarily being taken out of production, but it is an additive to a family farm.

Your question about lifecycle, though, is a critical one and also one that the National Renewable Energy Lab has done studies on. I have it here in my lap, but they recently did a study on the lifecycle emissions of solar panels as compared to other technology sources.

And even with some of the things that you have mentioned, sort of how the mining and the production and the transport, it is still significantly less lifecycle costs than other sources of energy, in particular coal.

But I think your point, though, is that—I think we—I am hopeful we would agree on this—is that building things overseas is not ideal, right, like manufacturing here in the United States—

Mr. CRENSHAW. That is certainly true. That is certainly true, and unfortunately I am out of time, and I have to yield back. But if I had more time, I would ask you about the permitting processes that are the big obstructions to building more solar farms and wind power in the United States.

Ms. HOPPER. Sure.

Mr. CRENSHAW. Maybe another member can ask that question. Thank you. I yield back.

Ms. HOPPER. Thank you.

Ms. CASTOR. Okay. Next up, Rep. Casten, you are recognized for 5 minutes.

Mr. CASTEN. Thank you, Madam Chair. Thank you so much to our speakers. You know, so I am going to take a little bit of a different perspective than my friend Mr. Crenshaw. I come from Chicago, home of Daniel Burnham, who famously said after the Chicago Fire, make no small plans.

And some people might be intimidated by the ambition of the change we have to make, but I choose to embrace it. I think that is what has made America great. Yeah, we are going to have to build a lot of stuff, and that is awesome. Let's do it, my goodness. Let's do it for the environment, let's do it for the economy.

But by the way, the markets are going to do it if we don't. And as you look around the various states in this country, 15 years ago, you know, you could divide the states and say there were coal states, there were gas states, and there were renewable states which was basically hydro.

Illinois was one of those coal states. Illinois has made this remarkable transition over the last 15 years. We went from having two dozens plants, by the end of this year, we are going to have maybe five coal plants, and the ones that are there are basically not running because they aren't economic because they produce an unviable product that has to compete against all this wind we are building, all the solar we are building that is so much cheaper, be-

cause markets are doing what markets are doing. They are providing people with what they want.

People do not fossil fuel. People don't even want solar energy. They want to know that when they turn their machines on, their power is there, they turn their lights on, that the power's there, that when they turn their shower on, the water is hot and they want it as cheaply as possible.

And so we are seeing these states like Illinois make the transition, where we are getting more and more from less and less input, and that is awesome. It is grows our competitiveness. It is having this wonderful advantage that we are attracting companies to Illinois like Rivian—I went and drove one of their pickups yesterday—sitting there in Bloomington-Normal, 3,000 employees, making something that, by the way, is cheaper to run right in the heart of coal country.

And if you look then at those states that have not made the transition, they call it the bottom of all the league tables, lowest GDP per capita in the country, West Virginia, Alabama, Kentucky. Highest GDP per capita, Massachusetts, California, New York.

The difference between those states is states that have built their economies around resource extraction and states that have built their economies around resource conversion.

That is something to embrace, but I raise that to put the question to you, Ms. Eckdish, because I think you are right at the nexus of this.

If we make this transition that is in our economic interest, that markets want to make, that markets are making, it will represent the biggest wealth transfer in the history of our species from energy producers to energy consumers. That scares the bejesus out of energy producers, and it scares the bejesus out of the employees in those industry because historically they have been left behind.

So Ms. Eckdish, as we make this transition, what do we need to do to make sure that the success that is coming in Illinois doesn't come at the expense of the good people of West Virginia? How do we make sure that we look out for people equally in this transition?

Ms. ECKDISH. Thank you for the question, Congressman, and certainly share your enthusiasm about the opportunity ahead of us. This, as I think you said, this transition is coming, but whether or not we capture the benefits of that transition here and whether or not our workers see the benefits of this transition is, I think, the task before us.

We know that our competitors are racing to make these investments. We need to capture those here, and I think we have a number of different ways that we can do that and ensure that our workforce benefits, including ensuring that as we are making investments to increase demand for these materials, that we are attaching domestic content standards to ensure that we are increasing demand for domestic manufactured goods.

But we also need to invest directly in building out these factories, building out assembly here in the U.S. And there is a number of different provisions in the Build Back Better Act, including the ATVM Loan Program, including a number of the Manufacturing Investment Tax Credits that Abigail mentioned, 48C, for ex-

ample, and Production Tax Credits that will help us build out those facilities here.

And to your question about West Virginia, I would say, we really do need to think about where we are making these investments and driving these investments towards the workers and the communities that need them the most.

And that includes labor standards, workforce standards, but also incentives or set-asides that will drive these investments to places that have seen closures.

There is an additional program in the Build Back Better Act focused on conversion and retooling grants that will target investments to recently closed or at-risk facilities, so we can really harness the existing assets that we have and make sure that the workers in those facilities are part of this transition and see themselves in this transition.

Mr. CASTEN. Well, thank you so much. I am out of time, but I think it is the challenge of our time. And markets are going to make these transitions. Our job as regulators is to make sure that we do them in a way that looks out for those equities. So thank you for your leadership on this, and I yield back.

Ms. CASTOR. Thank you.

Next, Representative Gonzalez, you are recognized for 5 minutes.

Mr. GONZALEZ. Thank you, Madam Chair, and thank you to our witnesses. First, I want to, I guess, give some advice to my Democratic colleagues. I am hearing a lot of references to Build Back Better as if that is the answer to our problems. Build Back Better, as far as I know, is dead. So if we are waiting for Build Back Better, I don't know how long it is going to take, but it is going to take a heck of a long time.

So I think what we should really do, if we are going to be serious about this, is do what I always advocate for, which is to find bipartisan ways to make really smart policy choices to help move our economy and move our country forward, and in turn, solve some of the many challenges that we have.

Secondly, it was mentioned GDP per capita as—in a correlation drawn between highest GDP per capita and those who have transitioned. Not on that list was Alaska, not on that list was North Dakota, which obviously have not transitioned in the same way, certainly North Dakota.

Secondly, California, I used to live there, and it is beautiful, and I like it in many ways, but it is the least affordable place in the country for a whole host of reasons. And it is the most unequal place in the country, socioeconomically. So not something that I think we want to suggest is a model for the entire world.

That being said, let's continue the discussion and hopefully again get towards some bipartisan solutions. One that I hope we can get to is this idea of clean steel technologies. Last year I introduced a clean steel technology bill. Hopefully it will be part of some bigger packages here coming soon.

But Mr. Browning, I want to start with you because I think steel, in particular, is one of the hardest to decarbonize but obviously essential. I know the steel industry well and would like to hear your thoughts on this.

So from your perspective, how far along are green hydrogen technologies and processes, and when do you expect this type of steel production will be cost-competitive?

Mr. BROWNING. Well, thanks for that question. You know, there is two main sources of carbon emissions during steelmaking. The first is the beginning process when you turn iron ore into iron. And we use coal today—metallurgical coal—to reduce iron ore to iron.

In the future we can use hydrogen to do the same thing. And as a matter of fact, it provides an opportunity if you are a miner like our parent company is, to make your product green iron, instead of iron ore. And then instead of shipping iron ore around the planet, you can ship iron to steelmakers, and it takes about 70 percent of the carbon emissions with steelmaking out.

Our company is investing in that technology right now, and we expect to be able to provide that to our customers because we have set a target to decarbonize our own operations by 2030 and decarbonize our scope three, or our customer, by 2040.

So we are looking at deploying that technology in the next decade for green steelmaking.

The other source of emissions is the natural gas that is used for heating furnaces and other things. And there you have a choice of either electricity or green hydrogen to, you know, take the place of natural gas. Both of those are well known technologies that, you know, we could deploy quickly.

Mr. GONZALEZ. Great. And how would increased funding for R&D at the Federal level help de-risk some of these investments and speed time to commercialization?

Mr. BROWNING. You know, like I said, just deploying green hydrogen gets after that second one. It is really the first one, you know, the reducing of iron ore to iron using hydrogen, I think if we—if the Department of Energy made that a—you know, one of their target areas, that would be something that I think would be very helpful to decarbonizing steelmaking.

Mr. GONZALEZ. Thank you. I only have 45 seconds left, so I will hold on questions, but again just want to urge all of us to be realistic about what the legislative paths forward are. I mean, we can all wish for our favorite policy, but if the political realities are what they are and folks aren't on board, we need to find another path. It is too urgent. I think we all agree that this is too urgent to just hope and pray for somebody to change his or her mind, as opposed to finding real bipartisan solutions.

And with that, I will yield back.

Ms. CASTOR. Yeah. Thank you, Rep. Gonzalez, and I hear you, hope springs eternal, but thankfully it is not just hope. I mean, we do have the foundation through the Bipartisan Infrastructure Law where folks came together and made progress. And we are—that is what this hearing is about, to try to find those solutions moving forward.

So next we will go to Rep. Escobar. Welcome, you are recognized for 5 minutes.

Ms. ESCOBAR. Thank you, Madam Chair, and thanks to the Ranking Member, and thanks to our panelists.

I want to just very quickly say to my colleague, Mr. Gonzalez, that I agree with him, and we have got to find bipartisan solutions.

I think as the Chair said, hope springs eternal, and we have got to keep working toward the greater climate vision in the Build Back Better Act, but we have got to find some immediate, urgent pathways, and make some head way, because the climate emergency and the climate crisis is unrelenting. And we have no time to waste.

To all of our panelists, I am really grateful for all of you sharing your expertise and knowledge with us. I represent an economically disadvantaged community in west Texas, El Paso, Texas.

And I am very interested, Ms. Hopper, in visiting with you and learning from you, a little bit more on the storage front. I want to give you some quick context, and then I am eager to hear your recommendations and get any counsel from you on this issue.

So we have an electric utility that is about to invest a significant amount of rate payer dollars—ultimately, they will be rate payer dollars—in a new facility, a new power generation plant, run with natural gas.

Lots of folks in my community, myself included, are very concerned about this massive investment, especially when many of us are eager to move as quickly as possible to solar.

What I keep hearing from the utility is that their big challenge is that there is not enough storage technology available today. And so this has got to be kind of, you know, sort of like a stepping stone, waiting for the day when there is more adequate storage for solar.

I live in a community that is not just economically disadvantaged, but we have the incredible asset of the sun. West Texas, we have, like, 360 days of sunshine in my community. So for a lot of us, there is this frustration that we are not moving quickly enough and that we will have abandoned assets like this multimillion dollar new plant that, you know, in a few years, may be an abandoned asset.

What can you tell us, are there avenues in the Bipartisan Infrastructure Law that we should be looking very closely at, or are there avenues that we should create, in order to better incentivize utilities in the situations that I just described for you, like in my community where storage is the issue?

Ms. HOPPER. Yeah, thank you so much for that question, and given the weather here, I really wish I was in El Paso today. It is really cold. You know, you are certainly—your community is not alone in both the desire to transition to a more sustainable energy mix and perhaps a frustration about the speed with which that transition is happening.

I would say that the Bipartisan Infrastructure Law does provide opportunities to further develop—there is a lot of R&D money in the storage piece. There is certainly money around supply chain and infrastructure for building out the storage piece.

But fundamentally, I would—I am a little skeptical of the claim that there is not enough storage, right? We have seen that, you know, solar has grown exponentially. Storage has grown whatever more is exponentially—or whatever word comes after growing exponentially.

It is an incredibly—and there are models in other states, in other utilities that have looked at natural gas facilities and solar-plus-

storage facilities. And their regulators and the companies have decided that the solar-plus-storage choice is a better deal for rate payers, right? That is the most important point. Right? It is more reliable, more affordable, and will not be a stranded asset.

And so I am happy to talk offline with you about some of the other examples that we may be able to point to, to make that economic case, but I do think that sort of in the—probably the thing that we can agree on, on a bipartisan basis moving forward in whatever vehicle it is around storage, is that there is the Investment Tax Credit for stand-alone storage that would likely be helpful to your utility as they think about deploying that asset. Issues around transmission and Investment Tax Credits for transmission build-out, my guess is that would be interesting to them as well. And so I think did both of what has passed and what still remains to be agreed upon would both be helpful to El Paso.

Ms. ESCOBAR. Thank you so much. I appreciate it, and we will definitely follow up. I would love to learn more about best-practice models that my community can look at.

Madam Chair, I am out of time. Thank you. I yield back.

Ms. CASTOR. Well, thank you very much. Helpful information to sunny states everywhere, so thanks for that.

Next we will go to Representative Carter. You are recognized for 5 minutes.

Mr. CARTER. Thank you, Madam Chair, and thank all of the witnesses for being here. I appreciate this very much.

Ms. Hopper, I will begin with you. You know, I have the honor and privilege of representing Georgia. Not only are we the number one forestry state in the nation, but we have made great strides also in solar energy. In fact, we are in the top ten now, I believe number seven, and we are headed shortly to be number four. And I have been a strong proponent of this. I think that solar energy is great, and it is certainly something that we have taken a lot of pride in and made a lot of progress in, as I say, in the State of Georgia, without mandates, without any mandates.

This has been totally voluntary and letting the market, as Mr. Casten has indicated, letting the market do its thing and guide us where it is going to guide us. And certainly this has been beneficial to us in the State of Georgia.

In fact, we have got the largest solar production factory in the country in Dalton, Georgia, the largest solar panel production. And that is very important, but these projects are necessary and are great for a number of reasons, but I have got serious concerns about aspects of the supply chain.

You know, we talk a lot about the supply chain nowadays, and one of the things that we talk about in particular with solar panels is just, we still depend on China. We still depend on China for the critical minerals that are necessary to manufacture the solar panels, even here, here in America. China is the OPEC of critical minerals.

I have got an article here, Madam Chair, that I would like to submit for the record—I ask unanimous consent—and the title of it is, “Behind the Rise of U.S. Solar Power is a Mountain of Chinese Coal.” And I would ask for unanimous consent to enter this into the record.

Ms. CASTOR. All right. Without objection.  
[The information follows:]

**Submission for the Record**

**Representative Earl L. “Buddy” Carter  
Select Committee on the Climate Crisis**

**February 2, 2022**

ATTACHMENT: Dalton, M., “Behind the Rise of U.S. Solar Power, a Mountain of Chinese Coal,” *The Wall Street Journal*, 2021, 31 July.

This article is retained in the committee files and available at:  
<https://www.wsj.com/articles/behind-the-rise-of-u-s-solar-power-a-mountain-of-chinese-coal-11627734770>

Mr. CARTER. You know, Ms. Hopper, would it be fair to say that the biggest reason solar has become so affordable is because China’s cheap energy is fueled by coal?

Ms. HOPPER. No, I wouldn’t agree with that.

Mr. CARTER. What is it fueled by then? How are they making these solar panels over there? What are the energy—what energy are they—how are they getting this energy?

Ms. HOPPER. There is a number of different parts of China, depending on where you are in China, some of it is coal, some of it formed by hydro. The part of your statement, though, that I don’t agree with is that that is the main reason for the price decline.

I think the main reason for the price decline is really U.S. innovation, American innovation. I mean, I know your company, I know Hanwha, I know Dalton, Georgia, and they are innovators, right? They are thinking about ways to drive down costs, to make things more efficient. I think that is the main reason solar prices have declined.

Mr. CARTER. Well, tell me, if you are familiar with the company that I am speaking of in Dalton, then you recognize that they are dependent on critical minerals from China. How do we address that here in America?

Ms. HOPPER. Yeah, no, it is a really important question. I think it goes to the sort of purpose of this hearing, if we can bring back some of those manufacturing elements. So if you think about what goes into a solar panel, right, the first raw material is quartz, right? That is a really abundant resource we have here in the United States.

Once you create—use the quartz to create the silicon, to create the polysilicon—we have mothballed polysilicon facilities here in the United States. Long story which I am happy to chat about, about what happened. If we can create the policies here in the United States so we can sell the polysilicon here in the United States, we don’t have to rely on China for any of this.

And so I think the kind of policies we are talking about will go to your concern, and we don’t have to worry about China. We can do it here in the U.S.

Mr. CARTER. But let me ask you this, if as my colleagues across the aisle are suggesting, that we can be energy independent by depending on solar and wind energy alone, are we truly independent if we depend on China for all of our critical minerals that are necessary to build this capacity?



Ms. HOPPER. Well, I think—I mean, I think that is sort of the point, is that we need to bring those opportunities back to the United States, that we need to be energy independent and that by good policy—

Mr. CARTER. But how can we be energy independent if we are not going to utilize fossil fuels in order to get us to that point where we can be energy independent?

Ms. HOPPER. So I lobbied, I represent the solar industry. I don't take whether or not we go—what we do with the other fossil fuels. I am very supportive of the solar industry. So I will let others on this call who are doing policy decide how much—how much oil and gas we should ultimately have.

Mr. CARTER. Well, last question if I may, what is your group doing to move the solar supply chain out of China? Is your group doing anything?

Ms. HOPPER. Absolutely. I know we are out of time, but I think this is so critically important. I am glad you raised it.

Ms. CASTOR. Go ahead.

Ms. HOPPER. Thank you, Madam Chair. We have done a lot to be really clear with our companies that sort of number one priority is that the solar supply chain needs to be ethical and there needs to be no forced labor, no child labor, nothing in our supply chain.

And so we have created a traceability protocol with some third-party auditors to ensure—so that manufacturers of product can have a third-party independent audit to ensure that there is no forced labor, no—that their supply chains are ethical. We have been working with the U.S. Government to make sure that that is being—

Mr. CARTER. But if you are operating and getting your product out of a country that is obviously using this, aren't you complicit in it by supporting the Chinese Communist Party?

Ms. HOPPER. I don't think so. I think that we are—have a pretty robust way to ensure—sorry, the sun is right in my eyes—to ensure that there is no forced labor in our supply chain.

Mr. CARTER. But you agree that there is forced labor in China where the supply chain—

Ms. CASTOR. All right. Thank you very—all right. So the time is—I let you have a little latitude there, but your time has expired. And I will turn to and recognize myself for 5 minutes.

This is what it is all about. This is what we are trying to do through the Bipartisan Infrastructure Law, through America COMPETES, that is being debated on the floor of the House today, to bolster our domestic supply chains, whether we are talking about chips that are needed in everything that we do these days, or solar panel manufacturing, or electric vehicles.

This is a global, competitive race, and we want to make sure we are setting the policies to make things in America again and to strengthen the supply chains. And this global pandemic has really shined a light on the weaknesses there, and it should be something that we can work on in a bipartisan way.

But I am very excited about the opportunities in clean energy and energy efficiency to help lower the costs for consumers and businesses, but doing so in a way that we are growing good-paying jobs all across the country.

Mr. Browning, can you please tell us more about the key considerations for incentives for green hydrogen? What makes the incentive useful to companies like yours, and talk about the interplay of the infrastructure law and the incentives out of the Build Back Better and even America COMPETES.

Mr. BROWNING. Okay. Thank you. Well, I want to start out by saying, you know, the biggest incentive that we have right now for green hydrogen is the market. We are seeing global demand for green products like green steel that we talked about earlier, green aluminum, green automobiles. So there is a market demand for products that are made with green energy.

But in terms of government incentives, you know, as I said earlier, that we have a proven recipe for this. It worked on wind, it worked on solar, it has worked on lithium ion batteries. And that is the government to support research and development and then the government to support a massive growth of the industry that allows us to automate and do all those sorts of things. And that is where the Production Tax Credit and Investment Tax Credit for hydrogen come in.

Ms. CASTOR. Thank you.

Ms. Eckdish, do you see potential for job creation when we are talking about green hydrogen, especially in communities that need economic investment or they are fossil fuel-tied communities and maybe they are looking at changes in the coming years?

Ms. ECKDISH. Yes, absolutely. Thank you for the question. You know, I think we talk a lot about how sometimes there is a mismatch between jobs impacted by clean energy and the job opportunities created by clean energy.

And this is one of those examples where that is not the case, and I think we are really excited about green hydrogen for a number of different reasons, but the sort of skill matching with the existing workforce in the energy sector is one really exciting reason.

And we think it really offers an opportunity to put people to work using the skills and the careers they have today. And that is true for a lot of areas of the economy, but I think particularly for the industrial sector where green hydrogen could be a really impactful opportunity to address industrial processes in particular and could play a really important role, both as a potential low-carbon feedstock or fuel in these industrial processes, so really to create an opportunity for industrial sector to be part of this clean economy.

Though there is still, of course, a lot of work to do to refine this policy around how green hydrogen is produced, where it is used, make sure that we are making progress in reducing emissions, but wholeheartedly agree that the workforce opportunity is there and significant.

Ms. CASTOR. Yeah. I think when you are talking about the average American, they don't understand the opportunities in green hydrogen, but they certainly understand the opportunities for electric vehicles, to save money, to drive cars and trucks that are fun, to clean up the air, to address the climate crisis.

And there have been some—I mean, the American auto manufacturers are really trying to win this race compared to our competitors from other countries.

What has excited you recently on the announcements for factories here in America, and then what are some of the challenges you want to highlight for us?

Ms. ECKDISH. Sure. Thank you. And you mentioned some of them earlier in your opening remarks, the recent announcements from Ford and GM announcing and even opening new facilities to transition, and in some cases, actually reopen shuttered facilities to transition from internal combustion to electric vehicle component manufacturing. So we are very excited about those.

There is a number of existing facilities in your state and around the country that are already part of the supply chain, but a tremendous opportunity to grow the supply chain if we put the right policies in place.

But I think there is really a risk here. We are really on the precipice of whether this opportunity is going to be realized. A recent report from the Economic Policy Institute found about 200,000 jobs really on the bubble and really at-risk if we don't make the right investments.

So I think we are really excited, but I see the time is expired, so I would be happy to talk more about how we can make sure that we gain those—

Ms. CASTOR. So get the tax credits we passed here in the House through the Senate and to the President's desk.

Ms. ECKDISH. Absolutely. As well as all the manufacturing investments that go along with that demand incentive.

Ms. CASTOR. Great. Thank you very much.

Next, Mrs. Miller, you are recognized for 5 minutes.

Mrs. MILLER. Thank you, Chair Castor and Ranking Member Graves, and thank you to all of our witnesses for being here today.

The topic of this hearing today is vitally important for the future of energy production in the United States. While I appreciate my colleagues across the aisle taking a serious look at how we produce clean energy and other products here in America, I fear their efforts may be focused more on hypotheticals than what is actually possible.

I would like to echo what Mr. McConnell stated in his testimony. We must utilize all energy fuels and technologies that are at our disposal. An all-of-the-above energy strategy is essential to providing our citizens with affordable power that they need, keeping energy-producing communities whole, and tackling the real challenge, which is lowering emissions, instead of demonizing our energy producers.

Unfortunately, President Biden's administration, his allies in Congress, and radical activists have attempted to cut traditional energy companies off from essential financing, making the transition to cleaner fuels all but impossible, dooming miners and gas and oil workers to a life of poverty and Americans to a future of darkness and unaffordable electric bills.

If we are serious about providing this clean energy future for our children and our grandchildren, we cannot have activists like President Biden's jet-setting climate envoy, John Kerry, telling the coal miners of West Virginia to go make solar panels if the government were to shut down their mines.

Vilifying our energy communities, instead of working to find commonsense solutions such as carbon capture, will only do more to divide our country and put our futures more at risk.

Mr. McConnell, given the need for an all-of-the-above energy strategy, carbon capture is one technology that will be essential to save our traditional energy communities. In your opinion, what are the largest regulatory hurdles that Congress must undertake in order for the transition to carbon capture to take place?

Mr. McCONNELL. Well, there is several of them. First and foremost, the 45Q legislation that is currently being considered and the increases that have been discussed and largely agreed across the board.

This is an industry that requires the same type of support that wind and solar received in the early stages of its infancy, and frankly still continue to receive. But it is fundamentally important and it is not just because we—the industry believes that it is the right thing to do, but if you look at the energy—the International Energy Agency globally suggests that without carbon capture, we have no choice and no chance to achieve climate targets. None.

And so the ability to decarbonize the existing fuel systems around the world, which are well over 80 percent of fossil fuel, we are talking about the next 20 to 40 years of real impact. And we cannot expect electric vehicles and windmills and solar panels to create that delta and impact on the climate.

They are good to do. We should continue to do them, but it is not the only solution. It is not the silver bullet. Carbon capture utilization is essential, and it has to be done.

The second thing I think is not only just the financial incentives, but it is regulatory. It is regulatory and policy that is going to allow de-risking of the technology. So if you look at carbon capture as something for the good of the public, which it is, it is an emissions reduction technology that frankly is unparalleled in anything that we have talked about in the entirety of this hearing today.

It, itself, will have that kind of impact, but it needs the regulatory and policy support to be able to complete the pipelines, the necessary injection systems, all of the things that industry is coming together to do.

Mrs. MILLER. Thank you. I have one other question. What role does blue hydrogen have to play in this transition of carbon capture?

Mr. McCONNELL. Well, blue hydrogen is an essential fuel. It has been stated several times today, and I couldn't agree more. But let's think for a second. A green hydrogen electrolyzer represents about 1/50th of the capacity of a one single refinery need for hydrogen.

So we are talking about a nascent technology that is going to be important over time, but it is going to require a lot of desalinated water, a lot of electricity that we don't have today.

And all of these things that will, in the future, over the next 20 to 40 years, certainly evolve, but if we want to make an impact today, we have to take the hydrogen that we are producing with natural gas, which we have in abundance and it is inexpensive, and decarbonize it through CCUS and create the volumes of hydrogen that are going to make this hydrogen economy go.

But it is not at the expense of green hydrogen. It is because it is going to be also necessary in spades.

Mrs. MILLER. But not blue hydrogen?

Mr. MCCONNELL. Blue hydrogen is fundamentally decarbonized hydrogen, and so whether it is blue or green or purple or orange, as long as it doesn't have the CO<sub>2</sub>, that is the key. And that is the importance of combining those technologies.

Mrs. MILLER. Thank you so much. I yield back my time.

Ms. CASTOR. Next up, Rep. Graves, you are recognized for 5 minutes.

Mr. GRAVES. Fantastic. Madam Chair—

Ms. CASTOR. And excuse me, we are expecting another Democrat. They just didn't arrive. Sorry. Go ahead.

Mr. GRAVES. Wait, I am sorry, I missed that. Can you say that again?

Ms. CASTOR. We are expecting another Democrat for questioning, but they have not arrived yet, so they are—

Mr. GRAVES. Okay.

Ms. CASTOR [continuing]. But if they don't arrive after you are done, we will go ahead and close it.

Mr. GRAVES. Okay, great. Thank you, Madam Chair. Hey, I want to thank again the witnesses and I have enjoyed listening to this dialogue, but I got to admit I am a little confused sometimes as well.

Ms. ECKDISH, I want to ask you a question. Do you support the Twin Metals Mine?

Ms. ECKDISH. We don't take positions on specific projects as an organization.

Mr. GRAVES. That is courageous. Okay. So let's go back through what we have heard today. We have heard Mr. Casten talk about how market forces have to drive what is going on. Yet as noted earlier, we have the solar industry represented here today—and Ms. Hopper, appreciate you being here, great to see you again—who has received all sorts of subsidies dating back to, I believe some of it dating back—I want to read a quote. In 1983, the American Wind Industry Association claimed that solar and wind would be, quote, “competitive and self-supporting on a national level by the end of the decade if assisted by tax credits and augmented by federally sponsored R&D.”

Yet here we are with the—and I will quote Senator Joe Manchin, now dead Build Back Better, that tries to add over a hundred billion dollars in subsidies back to some of those very industries, the solar, the wind, and EV credits.

And according to Steven Moore, if all tax credits are included, that number could reach half a trillion dollars, and quote, “no other industry in American history has ever received this lucrative a paycheck.” We keep talking about market forces, yet all we are doing is trying to distort and manipulate them, and we are trying to do it in a way that clearly is not meeting the own targets of the industry themselves.

It really is, I will use the word again, just confounding to sit here and listen to what is going on right now. I heard Mr. Casten say earlier that—what did he say? The public doesn't want fossil fuels,

the public doesn't want solar, I don't even know where he was going.

The Biden administration released a report saying we are going to have a 31 to 58 percent increase in natural gas demand over the next—well, between now and 2050—a 31 to 58 percent increase. Apparently the public does want it according to the Biden administration. This is global demand.

Do you really think that you are going to be able to go to some third world country and say, hey, we want you to pay New England or California rates for electricity and it is going to be awesome? No, there is not a chance in the world that it is happening.

And so I want to turn to Mr. McConnell for a minute. Mr. McConnell, when you look at technologies like, as you noted, net power using natural gas-fired electricity to produce electricity market rates, net zero emissions, do you believe it is in America's best interest, or better yet, actually in the environment's best interest for us to be dissuading, setting aside, preventing that type of innovation from moving forward to achieve our environmental and economic goals?

Mr. MCCONNELL. Well, Congressman, frankly, when you say our environmental goals, we are talking about the globe. It is a global issue, and we all recognize that. And sometimes here in America, we get wrapped around our own axle—

Mr. GRAVES. I kind of feel like—

Mr. MCCONNELL [continuing]. Right? We are less than 10 percent of the emissions globally. And so if we don't have the development of globally transferrable technologies that are going to be accretive to the industries and the people around the world that today use well over 80 percent of their fuel being coal and gas, we have to demonstrate not only the leadership and the capability, but it is a manufacturing opportunity for us to export technology, to export value to world countries, and to grow our own economy by using that global strategy to do that.

It is not just about solving our own backyard, but it is the global issue. But we have an opportunity in the United States to create global capabilities and value that we can export and get value from.

Mr. GRAVES. And maintaining our energy security, energy independence, and the economy that we are exporting today.

Mr. Browning, I am curious, from your perspective, looking at what has been happening, and even some of the debate today, you know, my two cents is that we truly—you know, Mr. McConnell said this—we are part of the globe, we are, all of us are. And if we are truly looking holistically at the future of the environment and—do you believe that some of these policies that are raising prices, raising emissions, really move in the right direction?

Mr. BROWNING. Well, thanks for the question. Keep in mind our country has an incredible resource in renewable power. Some of the best wind power in the world is in the mid-continent of the United States. Some of the best solar power in the world is in the Southwest of the United States. We could be a renewable power superpower.

We can meet all of our own energy needs with renewable power, and we can export our own renewable power in the form of green

hydrogen to other parts of the world. And so, you know, I think that very the same reasons that we talk about, you know, our existing fossil fuel industry and some of the resources we have there, we have to recognize, you know, do we want to be on—do we want to be the beneficiaries of a change that is going to happen in the future in the energy transition, or do we want to be the victims of that change?

If the growth going forward is going to be in energy transition technologies, don't we want to at least have a position there as at least a hedge for the future? There is countries like Saudi Arabia which are today's, you know, largest oil producer, they have the largest green hydrogen project in the world. Saudi Arabia is getting ready for an energy transition. And again, if they are wrong, they still have their existing industry, but if they are right, they are positioned to be a leader in the future.

And our country has always been an energy leader. So, you know, why not position ourselves to be a leader in energy transition technologies. You know, it just makes common sense.

Mr. GRAVES. Madam Chair, thank you for the extra time. I just want to make note, look, I agree with Mr. Browning, but it is about aligning incentives in a way that gets us to market sustainability, and clearly the path forward so far hasn't achieved that. Yield back.

Ms. HOPPER. Madam Chair, you are on mute.

Ms. CASTOR. Thank you. Yeah, thank you for that. And I will note that—and we will put these in the record at the end, but when we are talking about fossil fuel subsidies, I don't think anyone can argue with a straight face that renewables have nowhere near the amount of subsidy that fossil fuel industry has enjoyed over time. CRS estimates \$4 billion at a minimum annually. Oil Change International says it could be up to \$15 billion. Of course, there is the intangible drilling costs, tax credit.

And then when you look at the other side of the ledger, a 2019 report from the IMF found that not only was the United States number two subsidizer of fossil fuels globally, but when they looked at explicit tax subsidies, as well as the ways Americans pay for the environmental and social health costs of fossil fuels, they calculated a whopping total of \$650 billion. And that was just in 2015. So there is not a level playing field. I think that is clear.

Next we will go to Representative Palmer. You are recognized for 5 minutes.

Mr. PALMER. Thank you, Madam Chairman.

Mr. McConnell, do you have any idea how much land space would be required to go to a hundred percent renewables if we produced predominantly wind and solar?

Mr. McCONNELL. You know, we have had some conversations here today. I don't have an exact number for you, but somewhere in the neighborhood of the entirety of the state of South Dakota, has been—has been identified. But I would like to make a point on that question. We talk about installed capacity of electricity, and we talk about installed renewables and installed wind and solar.

But that is not delivered electricity. That is electricity that is available some 20 to 25 percent of the time. And so when you start talking about installed capacity as the answer to our energy needs,

it is not. And the storage we have in this country is less than five percent.

Mr. PALMER. Let me ask you this. What is the single biggest threat to our electric grid? I will leave that for anybody. Mr. Browning, you know what that is?

Mr. BROWNING. Well, it depends on where you are in the country. But if you are in Texas or you are in California right now, one of your concerns is, you have got a lot of renewable power on your grid, and when you have an extreme weather event you need to be able to store that renewable power to make it available for that later time.

Mr. PALMER. Well, I actually—the North American Electric Reliability Commission put out a report, and they said the number one threat to our electric power grid reliability is changing the fuel mix. And that is what concerns me.

We got a lot of people, you know, that claim to know the science and don't have an engineering background that seem to think that we can just turn this thing into a completely renewable power grid overnight, and that is simply not possible.

I am for renewables, but if you want to talk about clean energy with no emissions, why aren't we talking about next gen nuclear? I mean, does it make sense when the life expectancy—generation life expectancy for a next-gen power facility is a hundred years, versus maximum maybe 25 years for solar, maybe 25 to 30 for wind, does that make sense to you, Mr. McConnell?

Mr. MCCONNELL. It doesn't, and whether it is nuclear or whether it is decarbonized fuel secure energy, whether that is coal or gas, the whole idea is, how can we deliver baseload electricity with zero carbon emissions? That is the question, not whether or not it is wind or solar or fossil, you know?

Mr. PALMER. Well, we are not going to stop it completely with advances in technology, but there is also a cost that a lot of my colleagues don't want to talk about, and Europe's experiencing this right now in terms of excess winter deaths. And China, a lot of my colleagues are big supporters of China. That is what this bill is really about. They are really supporting China and their renewable effort.

But what they don't want to admit is what is going on with the forced labor in China, the genocide, where a lot of these components are made, but also they may not be aware of this, that China's push for—to look greener, they literally are letting people freeze because they don't have access to power. And we are seeing this in Europe with excess winter deaths, in the U.K. and Europe.

That is what concerns me, having worked for a couple of international engineering companies, including one that was in the environmental systems area, there is a cost in terms of lives lost, in terms of health consequences for people. Should my Democrat colleagues just consider this collateral damage? Mr. McConnell.

Mr. MCCONNELL. No. I wouldn't—I wouldn't go that route at all. In fact, we have the capabilities for it not to be, and I think that is the whole key. We can't just make unilateral decisions that we want to be something over the next 5 to 10 years.

We have to make an energy transition occur. We have to have suitable baseload energy, fuel-secure supplies of electricity, and we



need to build in the renewable programs that we are talking about. But this idea that we are just going to slam it all over to one end right away at the expense of reliability and cost is really a fool's errand.

And that is not what people are looking for, and it is clear. We had that—we had that issue in Texas, and we suffered through it in a big way.

Mr. PALMER. Well, I yield back. My time is expired. Thank you, Madam Chairman.

Ms. CASTOR. Well, thank you very much. And frankly, Mr. Palmer, I was surprised that you went down that road because I—it is just impossible to ignore the climate-fueled deaths in our own country over—just over the past year due to the heat wave out West, due to a bizarre cold snap in Texas and—

Mr. PALMER. Madam Chairman, the reports, the science on this is, there is 20 times more—17 to 20 times more people die from coal-related issues than—

Ms. CASTOR. I don't think you want to go down that road, Mr. Palmer, so let's move on.

I will recognize Mr. McEachin for 5 minutes.

Mr. MCEACHIN. Thank you, Madam Chair, and thank you for your leadership in convening this hearing today. You know, confronting the climate crisis poses unique challenges and opportunities. We are facing the much necessary prospect of transforming the way we generate and use energy, and in doing so, have a chance to do—and have a chance to do so using made in America materials and American labor.

We also have the opportunity and the responsibility to uplift and include in this transformation environmental justice communities that have historically been left out of this conversation.

We must take action to get to net zero global economy by 2050, and we must ensure that we have the manufacturing industrial capacity to do so.

The Biden administration has taken steps to ensure the Federal Government procurement process is done in a sustainable fashion, including achieving a hundred percent carbon-free electricity by 2030 and net zero emissions from Federal procurement by 2050.

The Federal Government can and should leverage its buying power to do more to move us towards our climate goals, but obviously we still need to do more.

My first question is for Ms. Jessica Eckdish. I hope I didn't hurt your last name too badly. Virginia has taken a lead in the offshore wind and energy space with Simmons Renewable Energy committing \$200 million to build the first U.S. offshore wind turbine blade manufacturing facility.

Obviously, I am proud to see Virginia leading in this space. But you note in your testimony that the industrial sector represents a significant source of U.S. emissions, accounting for 29 percent of the greenhouse gases emissions in 2019, when accounting for electricity use with emissions from the industrial sector expected to increase through mid century, negating the emissions reductions we may see in the power and transportation sectors.

If we are to take climate threat seriously, we must work to reduce emissions across all sectors, including the industrial sector.

What policies can we put in place to bend this curve of projecting emissions increase? What do we risk if we do not make the necessary policy changes to do so?

Ms. ECKDISH. Thank you so much for the question, and you did not butcher my name at all, so good job. But I think this is a really important question, that job creation and the manufacturing sector has to go hand in hand with emissions reduction, not only for, you know, climate purposes, for the health of our communities, but this is also about competitiveness.

Just as other countries are, you know, rushing to capture these clean energy technology jobs, they are also investing significantly in emissions reductions in these sectors. So we are really falling behind on both fronts.

And as the global economy becomes increasingly carbon-constrained, we need to position our manufacturers to compete globally.

You mentioned already procurement as one key avenue to do that as part of the Biden administration initiative that you mentioned. There is a first time Buy Clean program that is being stood up as well to really use the purchasing power of the Federal Government to support and drive innovation and support clean domestic manufacturers and domestic manufacturers that are making those investments.

But we also need to really support our industrial partners in making those investments. The Build Back Better Act has a critical \$4 billion investment to DOE that would aid companies in carrying out major carbon emissions and pollution-reducing upgrades at their facilities.

There is a number of important provisions in the bipartisan infrastructure bill that would help along those lines as well.

So I think procurement, direct investment are key ways to make sure that our manufacturers are competitive in this increasingly carbon-constrained global economy.

Mr. MCEACHIN. Thank you for that.

Madam Chair, I am going to give you 55 seconds back. I yield back.

Ms. CASTOR. Great. Thank you, Rep. McEachin. And thank you to all of our witnesses today for this very interesting and enlightening discussion.

Rep. Graves, do you have a unanimous consent request?

Mr. GRAVES. Yes. Thank you, Madam Chair. I would like to ask unanimous consent that a release by Jobs for Minnesotans, a January 26th release, be included in the record and an E&E News article, dated January 28th, "Clean Energy Search Won't Meet Net Zero Goals." Ask unanimous consent to be included in the record.

Ms. CASTOR. All right. Without objection.

[The information follows:]

**Submissions for the Record**  
**Representative Garret Graves**  
**Select Committee on the Climate Crisis**

**February 2, 2022**

ATTACHMENT: "Biden Administration Takes Politically Motivated Action to Cancel Twin Metals Mineral Leases," Jobs for Minnesotans, 2022, 26 January.

The press release is retained in the committee files and available at: <https://jobsforminnesotans.org/biden-administration-takes-politically-motivated-action-to-cancel-twin-metals-mineral-leases/>

ATTACHMENT: Storrow, B., "Clean energy surge won't meet net-zero goals," *E&E News*, 2022, 28 January.

The article is retained in the committee files and available at: <https://subscriber.politicopro.com/article/eenews/2022/01/28/clean-energy-spending-surged-last-year-report-2-ee-00002682>

Ms. CASTOR. And without objection, I will enter into the record a February 2022 letter from the Solar Energy Manufacturing for America Coalition that reviews domestic solar manufacturing challenges and opportunities and provides evidence for how a solar manufacturing tax credit, like the one we passed in the Build Back Better Act, would be beneficial for the economy and for American workers.

[The information follows:]

**Submission for the Record**  
**Representative Kathy Castor**  
**Select Committee on the Climate Crisis**  
**February 2, 2022**

February 1, 2022

The Honorable Kathy Castor  
Chair  
Select Committee on Climate Crisis  
U.S. House of Representatives  
Washington, D.C. 20515

The Honorable Garret Graves  
Ranking Member  
Select Committee on Climate Crisis  
U.S. House of Representatives  
Washington, D.C. 20515

Dear Chair Castor and Ranking Member Graves:

In advance of your hearing on February 2 examining how the Build Back Better Act would expand domestic clean energy supply chains and create good-paying jobs, the Solar Energy Manufacturing for America Coalition<sup>1</sup> wanted to share its response to the Department of Energy's Request for Information on their Energy Sector Supply Chain Review.<sup>2</sup> We hope the information below is of help for the upcoming hearing and the committee's ongoing work to support clean energy manufacturing.

If you have any questions regarding the information provided, please contact Yogin Kothari or Diego Garrison.

Best,  
SEMA Coalition

\*\*\* COMMENT \*\*\*

January 14, 2022

**Re: RFI Supply Chain Review**

On behalf of the Solar Energy Manufacturing for America (SEMA) Coalition,<sup>3</sup> an informal group of solar manufacturing companies with operations in the United States, we appreciate the opportunity to provide feedback on the Department of Energy's (DOE) energy sector supply chain review.

With solar poised to be the world's leading source of energy by 2040, American solar manufacturers are taking steps to reshore and rebuild a U.S.-based supply chain. For example, in 2021 alone: Meyer Burger announced an investment in a new

<sup>1</sup>SEMA Coalition

<sup>2</sup>DOE Supply Chain RFI

<sup>3</sup>SEMA Coalition: <https://supportussolar.com/>

400MW solar manufacturing facility with the potential to scale up to 1.5GW;<sup>4</sup> First Solar broke ground on a new 3.3 GW solar manufacturing facility;<sup>5</sup> Heliene announced expansion plans that will bring their total manufacturing capacity to 900 MW;<sup>6</sup> Silfab Solar secured an additional \$100 million in investment to expand U.S. manufacturing capacity;<sup>7</sup> and Hanwha Solutions invested \$160.47 million into an idle REC Silicon polysilicon production plant to restart operations for solar grade polysilicon.<sup>8</sup>

Unfortunately, over the last decade, U.S. manufacturing of key components of the solar supply chain has been crowded out by overseas monopolies and choke points on key portions of the value chain. As a result, American workers are poorly positioned to capture the good-paying manufacturing jobs that will result from the pending solar boom. It is essential for the U.S. government to understand these critical challenges and invest in long-term policy solutions to attract and sustain domestic solar manufacturing.

Below, we provide responses to some of DOE's questions in the Request for Information<sup>9</sup> on Area 2: Solar PV Technology.

**1. What are the current and future supply chain gaps and vulnerabilities as we scale up the adoption and use of solar PV technologies? Of these gaps and vulnerabilities, which are the most crucial for the U.S. to address and focus on and why?**

Critical supply chain gaps and vulnerabilities exist around China's domination of key elements of the solar PV supply chain. China has developed a near global monopoly on the solar ingot and wafer segment, with a corresponding dominance of cell manufacturing. The lack of domestic manufacturing of ingots, wafers, and cells is a significant challenge for both ends of the solar PV supply chain. U.S. polysilicon producers have no direct customers for solar-grade polysilicon production and U.S. solar PV module manufacturers have no choice but to import key components and are thus unable to produce panels entirely made in America.

The BloombergNEF graph illustrates China's current domination of the solar supply chain. China has a global market share of: over 70% for PV grade polysilicon; 95% for solar ingots and nearly 100% for solar wafers; 80% for solar cells, and 75% for solar modules. If this trend continues or remains unaddressed, the U.S. could face a situation where nearly all solar PV technologies and key components of the supply chain are produced and manufactured in China or by Chinese companies in third-party nations. This would result in losing even more high-quality manufacturing jobs and further erode America's research and development capabilities in the solar PV sector.

The U.S. must prioritize addressing the lack of domestic ingot, wafer, and cell production as it is the key to reshoring and rebuilding the entire solar supply chain and supporting and expanding the existing domestic solar PV sector manufacturing presence—polysilicon and modules.

For American polysilicon manufacturers whose solar grade production remains mostly idle, having direct access to domestic solar PV supply chain customers is likely their only path to long-term success. Polysilicon, the foundational material necessary for solar PV modules, is also critical for semiconductors, consumer electronics, and next-generation electric vehicle batteries. Given the importance of polysilicon manufacturing to America's economic, energy, and national security, we cannot afford to lose this vital industry and manufacturing capacity to China or other overseas competitors.

For American PV module manufacturers, having domestic ingot, wafer, and cell production will help reduce reliance on imported components, limit exposure to supply chain disruptions, and position them to better compete with vertically integrated overseas competitors.

In addition, domestic capacity of the middle part of the solar PV supply chain can help lower embodied carbon in American-made solar panels given cleaner U.S. electricity sources and manufacturing processes, while guaranteeing strong labor stand-

<sup>4</sup> Meyer Burger: <https://www.meyerburger.com/es/newsroom/artikel/meyer-burger-to-bring-400-mw-high-performance-solar-module-manufacturing-facility-and-hundreds-of-jobs-to-arizona-plans-to-scale-site-to-15-gw-capacity>

<sup>5</sup> First Solar: <https://investor.firstsolar.com/news/press-release-details/2021/First-Solar-Breaks-Ground-on-new-680m-3.3-GW-Ohio-Manufacturing-Facility/default.aspx>

<sup>6</sup> PV Magazine | Heliene: <https://pv-magazine-usa.com/2021/09/09/heliene-to-expand-its-module-manufacturing-capacity/>

<sup>7</sup> PV Magazine | Silfab Solar: <https://pv-magazine-usa.com/2021/09/15/silfab-secures-investment-to-expand-its-u-s-solar-module-production/>

<sup>8</sup> Q CELLS: <https://www.q-cells.eu/about-q-cells/press-releases/20211118.html>

<sup>9</sup> DOE RFI: <https://www.regulations.gov/document/DOE-HQ-2021-0020-0001>

ards in manufacturing throughout the solar PV supply chain. It will also result in the creation of thousands of good-paying clean energy jobs, support research and development and innovation of solar PV technologies, and help us meet our rapid deployment targets to address the growing climate crisis.

**2. Where in the solar PV supply chain does it make sense for the U.S. to focus and prioritize its efforts both in the short-term and the long-term, and why? Where in the supply chain do you see opportunities for the U.S. to build durable domestic capabilities of solar PV manufacturing? For areas in the supply chain where U.S. opportunities to build domestic manufacturing capabilities are limited, which foreign countries or regions should the U.S. government prioritize for engagement to strengthen/build reliable partnerships, and what actions should the government take to help ensure resilience in these areas of the supply chain?**

The U.S. must focus and prioritize its short-term and long-term efforts in support of the solar PV supply chain on domestic polysilicon, ingot, wafer, cell, and module capacity to grow and preserve the entire value chain. In the immediate term, it is imperative to support the remaining existing manufacturing in both polysilicon and modules. In the medium to long-term the U.S. must foremost ensure American polysilicon producers have domestic off-takers for solar-grade polysilicon. Having domestic manufacturing capacity for ingot, wafer, and cells will ultimately result in support and growth of the remaining solar supply chain and allow 100% domestic content solar panel manufacturing.

The U.S. can support and build durable domestic solar PV manufacturing capabilities for polysilicon, ingots, wafers, cells, and modules. With the right set of smart manufacturing policies, the U.S. can reshore and rebuild each key element of the solar PV supply chain at scale before it is lost for good. By investing at each key step of the solar PV supply chain, existing polysilicon capacity will have domestic ingot and wafer customers and that will result in new and additional investments in U.S.-based cell and module manufacturing. Ultimately, this would allow the U.S. to rely on entirely domestic solar PV modules to meet its deployment demands and remove the need to ship modules across the globe, resulting in significant climate, cost, and supply chain benefits.

**3. What challenges limit the U.S.'s ability to realize opportunities to build domestic solar PV manufacturing? What conditions are needed to help incentivize companies involved in the solar PV supply chains to build and expand domestic manufacturing capabilities?**

To date, the U.S. has maintained a temporary, subscale, and piecemeal approach to supporting domestic solar PV manufacturing. Policies have been more focused on demand creation with little to no support for domestic manufacturing. Historically, most policies have been focused on lowering initial capital expenses (CapEx) and as a result, have been less durable. However, American solar PV manufacturers face unsustainably higher operating expenses (OpEx) throughout the supply chain compared to their subsidized overseas competitors. This focus solely on up-front costs has led to smaller investments relative to overseas competitors as the policy uncertainty, particularly against OpEx in subsequent years, creates too much risk for investors at the scale necessary to compete. Alternatively, China has prioritized long-lived, large-scale, and comprehensive policies to de-risk capital investments by giving certainty of return—ensuring domestic demand and subsidizing exports and international expansion. This has allowed them to “go big” in their manufacturing capacity in a way that U.S. manufacturers have not been able to match.

To reverse the last decade’s trend in which the U.S. has lost control of key components of the solar PV supply chain, the federal government must invest in long-term, durable policy solutions that address the OpEx challenges to attract and sustain domestic manufacturing investments at scale and at every step of the value chain.

The most important condition needed to incentivize companies involved in solar PV supply chains to build and expand domestic manufacturing is a policy environment that prioritizes OpEx support. Although CapEx (such as new facility costs) can be substantial in some cases, consistent support for annual operating costs is more important in the solar PV manufacturing sector. Reducing upfront costs does little to incentivize scale or increase global competitiveness.

Solar PV manufacturers must regularly procure costly components and materials which is why policies designed to support and/or offset OpEx are more effective in supporting the growth of the domestic industry against heavily subsidized foreign competition. For example, National Renewable Energy Laboratory (NREL) data illustrates how materials and components are the biggest costs to solar module manu-

facturers. These costs, spread out over several years, makes operating solar PV manufacturing facilities more expensive compared to foreign competitors. NREL writes that in the case of module manufacturing, “[m]aterials constitute more than 80% of costs. . . .”<sup>10</sup>

The challenge faced by solar PV module manufacturers proves to be true throughout the supply chain. Several companies considering making a significant investment to domestically produce solar wafers have made clear that while grant or tax credit support for up-front costs can be helpful, it does little to reduce perceived risk, and thus does not incentivize the larger investments needed. Alternatively, a production-based credit is much better designed to quickly turn a positive cash-flow and address investment risk, thus incentivizing much higher upfront investments and speed to market. And while it is true that the OpEx to CapEx ratio for wafer, cell, and polysilicon production is narrower than it is for modules, those factories are necessarily built at a significantly larger scale to compete globally, with much higher perceived investment risk.

**4. How can government (federal, state, local, and Tribal) help the private sector and communities involved in solar PV manufacturing build and expand domestic solar PV manufacturing in the U.S.? What investment and policy actions are needed to support domestic manufacturing of solar PV?**

The SEMA Coalition strongly believes the most important step the federal government can take is to enact a well-designed solar manufacturing production tax credit, such as the one proposed by Senator Jon Ossoff and Representative Dan Kildee in the Solar Energy Manufacturing for America Act and as included in House-passed Build Back Better Act. A solar manufacturing production tax credit will help spur a robust, end-to-end solar PV manufacturing supply chain to address the gaps and vulnerabilities described above.

The tax incentive structure proposed by Senator Ossoff and Rep. Kildee and included in the Build Back Better Act is designed to encourage more production and larger facilities by defraying early operating costs and guaranteeing a return on investment at each stage of the solar PV supply chain. By incentivizing manufacturing at each stage of the solar PV supply chain directly, it ensures global competitiveness and provides market certainty. If the U.S. wants to realize opportunities to build domestic solar PV manufacturing that is globally competitive, this type of policy design will be essential as it will allow American manufacturers to become profitable sooner and reward innovation, efficiency (for example, allowing vertical integration), and scale, instead of dollars invested.

**6. What other input should the federal government be aware of to support a resilient supply chain of this technology?**

In addition to a solar manufacturing production tax credit, the federal government should be aware of other smart policies to support a resilient solar PV supply chain, including establishing a federal solar manufacturing coordinator and establishing procurement policies in support of American-made ultra-low carbon solar panels.

A high-level federal solar manufacturing coordinator could help ensure coordination between the various federal agencies to ensure a whole-of-government approach to support domestic solar manufacturing. Procurement standards to support the purchase of solar PV panels with lower embodied carbon can also support domestic manufacturing as the U.S. has a “cleaner” supply chain and clear competitive advantage over China. And lastly, we must ensure the federal government procures or uses American-made solar panels, whether it purchases them directly or enters into power purchase agreements, by closing the existing Buy American “solar loophole.”

*Conclusion*

Restoring a U.S.-based solar PV manufacturing supply chain is a true win-win for American workers and the continued technological innovation in our efforts to address climate change. An American solar PV manufacturing supply chain will help reduce our clean energy dependence on China, improve supply chain resilience, and ensure strong labor and environmental standards in clean energy manufacturing.

According to SEIA and Wood Mackenzie, by 2025, the total projected U.S. solar deployment is nearly 30 GW in a baseline scenario (with smart policies like Build Back Better, the projection is closer to 50 GW).<sup>11</sup> We believe with the right policy support and signals from DOE, the Biden Administration, and Congress—such as a solar manufacturing production tax credit—we have a unique opportunity to not

<sup>10</sup>NREL | Crystalline Silicon Modules: <https://www.nrel.gov/docs/fy19osti/72134.pdf>

<sup>11</sup>SEIA & Wood Mackenzie: <https://www.seia.org/solar-industry-research-data>

only substantially meet the demand in either scenario, but build a globally competitive, environmentally friendly, and socially responsible U.S.-based solar supply chain. As the Biden Administration considers making historic investments in good-paying jobs and takes concrete steps to address climate change, the time to reshore and rebuild the domestic solar supply chain is now. We stand ready to collaborate with DOE as it conducts its energy sector supply chain review and partner on smart policies to support domestic solar PV manufacturing.

Ms. CASTOR. Without objection, all members have 10 business days within which to submit additional written questions for the witnesses. I ask the witnesses to respond as promptly as you are able, and I want to thank everyone again for joining us for our first hearing of 2022.

Our next one later this month will examine actions taken and additional needs to improve grid resilience across the country.

Thank you all very much. We are adjourned.

[Whereupon, at 4:01 p.m., the committee was adjourned.]

**United States House of Representatives  
Select Committee on the Climate Crisis**

**Hearing on February 2, 2022**

**“Manufacturing a Clean Energy Future:  
Climate Solutions Made in America”**

**Questions for the Record**

**Paul Browning**

**President and CEO, North America**

**Fortescue Future Industries**

THE HONORABLE KATHY CASTOR

- 1. Benefits from renewable energy generation can be maximized by expanding the capacity of the electric grid to maintain reliability, including during severe weather events such as extreme cold in Texas or wildfires in California. While there are a number of technologies and strategies (such as expanded transmission, battery storage, clean hydrogen, pumped storage hydropower, demand response efforts, energy efficiency, and more) that will help maintain or even improve grid reliability as we deploy more renewables, you spoke specifically to the potential of green hydrogen here.**

**Can you elaborate on the role green hydrogen can play to store renewable energy, for use during extreme weather events as well as during normal operations, to maintain grid reliability?**

Response: Green hydrogen has the capability to store renewable power. Green hydrogen, hydrogen produced from renewable resources, is the only color of hydrogen that stores intermittent renewables like solar power and wind power, and allows us to deliver them when and where they are needed. It solves the intermittency problem by capturing this power in chemical form, so that it can be used at a later time, and at a different location.

The U.S. power grid is most heavily penetrated by wind and solar power in places like California and Texas, and these power grids are already showing a need to store renewable power to be ready for extreme weather events. Extreme heat and drought in California last summer resulted in large, long-lasting power shortages, and the winter storm Uri in Texas did the same. These power grids are currently making massive investments in Lithium-ion battery energy storage to meet their short-term storage needs; but, to address week-long extreme weather events like Texas and California have recently endured, long duration storage technologies like green hydrogen will be needed. In addition, green hydrogen provides an alternative to building new high-voltage direct current (HVDC) transmission. Converting renewable energy to green hydrogen, transporting it via pipeline, and converting it back to electricity can be an attractive alternative to building new electricity transmission infrastructure.

**2. How would a hydrogen production tax credit help encourage domestic manufacturing of hydrogen?**

Response: Thank you for this important question. As I mentioned in my testimony, capturing the green hydrogen opportunity relies on the right policy environment to attract investment in green hydrogen manufacturing which has the potential to create jobs, economic growth, and potentially export markets for American-made renewable energy.

Congress took a great first step in including the hydrogen research and development provisions in the Bipartisan Infrastructure Law (BIL). FFI fully supported the inclusion of those provisions in the BIL and currently we are working with the Department of Energy to ensure that those provisions are implemented in a manner that helps advance the domestic production of green hydrogen.

While FFI appreciates and applauds Congress for including these initial investments, we believe Congress can take additional steps to promote an attractive business environment for further investment that will help commercialize and scale up the green hydrogen sector. Specifically, we fully support and urge Congress to enact the green hydrogen provisions included in the Build Back Better Act which includes both a production tax credit (PTC) and an investment tax credit (ITC).

We believe a PTC and an ITC for green hydrogen provides much needed certainty to our industry by creating a favorable business environment to attract increased investment and level the playing field in the hydrogen sector. Today, green hydrogen and green ammonia projects are not eligible for tax credits, while fossil fuel-based hydrogen and ammonia projects are eligible to receive a subsidy in the form of 45Q carbon capture credits. It is important to ensure that hydrogen technologies that have access to the 45Q credit are not able to “double dip” and access both the 45Q and the new hydrogen tax credits that are included in the Build Back Better Act.

Should Congress fail to enact a PTC and an ITC for green hydrogen, the U.S. will become a less attractive market for investing in the growth of the green hydrogen sector. Other countries across the globe are investing in this industry and the most significant risk the U.S. faces should these tax credits not be enacted is losing its competitive edge in this sector and missing the economic benefits a green hydrogen economy can provide. The U.S. is in the beginning stages of investing in this industry and we want to ensure the U.S. remains competitive in this space globally as the imperative of transitioning to renewable energy sources boosts domestic energy security and diplomacy.

**Questions for the Record**

**Abigail Ross Hopper  
President and CEO**

**Solar Energy Industries Association**

THE HONORABLE KATHY CASTOR

**1. How would a solar investment tax credit help encourage domestic manufacturing of solar energy components?**

The United States is poised for a boom in domestic manufacturing. Clean energy tax incentives have launched massive private investments and can do so for manufacturing. In our 2019 Manufacturing Whitepaper, SEIA recognized that federal policies, including demand and supply incentives, are critical to building a strong domestic manufacturing base. The business incentives offered in recent legislation and continuation of the solar investment tax credit offer just that.

A wave of announcements is starting to show how strong U.S. solar manufacturing can be if these incentives become law. Companies such as Enphase, REC Americas, Moxon, Hanwha Q CELLS, and Meyer Burger are looking to either create new manufacturing capacity in the United States or expand existing facilities. The incentives would also spur manufacturing of inverters and trackers. New facilities will stimulate investments in new machine tool capacity such as ingot pullers, pick and place machines, and laminators, and from companies that produce solar glass, junction boxes, encapsulants, back sheets, and frames.

**2. Why is it important for the federal government to invest in recycling and reuse of critical minerals, such as tellurium, that are important inputs to clean energy technologies such as solar panels? For instance, the Bipartisan Infrastructure Law invests \$7 billion in critical mineral supply chains, including a \$140 million program recently announced**



**by the Department of Energy to develop a first-of-a-kind refinery to extract rare earth elements from coal ash waste. How could these efforts complement new mining and processing domestically and around the world?**

Securing supply chains is an issue of national security. Most solar panels do not use critical minerals. Efforts to innovate around ways to reuse and recycle critical elements as well as support for research around materials that can function in the solar and storage supply chains is an important role for the federal government. We support efforts to responsibly and safely extract and process key elements necessary for solar and storage domestically. Innovation developed while utilizing U.S. resources can also help lead the world in better management of our global natural resources and can spur an economic opportunity. Continuing to rely on materials from countries that do not share America's interests threatens U.S. climate and energy security. The United States needs stable, long-term industrial policy to create business certainty and an environment where domestic manufacturing for clean energy can thrive.

**3. How can solar energy and electric vehicles be complementary solutions as we work towards increasing economic growth and meeting our climate goals?**

A recent study found that solar owners are 66% more likely to own an electric vehicle. Still, EVs are a small fraction of the number of cars on the road today. While there are more than 5.6 million EVs worldwide, they only account for 2.2% of the global vehicle market share and less than 2% of the vehicle market in the United States. There's room for both automobiles and utilities to embrace these newer technologies and develop new business models that can benefit them both. For example, both fast charging infrastructure and community solar are ripe for collaboration and further innovation. These innovations will ultimately help to lower prices and improve access to both technologies, enabling more customers to drive EVs and go solar. Electric vehicles and solar go hand in hand and additional federal investments will help spur the growth of both industries.

For example, SEIA board member Sunrun recently announced a partnership with Ford Motor Company to serve as the preferred installer of solar Ford to charge the new electric F-150 Lightning truck. When charged, this truck can also serve as a backup power source for the homeowner if there is a power outage. Innovations like this are keys to unlocking the promise of solar and storage as climate and resilience solutions.

**4. How could scaling up solar energy help reduce residential energy bills and transportation fuel costs for U.S. consumers and consumers around the world?**

Scaling up solar energy and electrifying both heating and transportation can help save consumers money and mitigate the impact of any fossil fuel price shocks. While the price of petroleum and its products (gasoline, heating oil and propane) moves based on global supply and demand dynamics, the cost of electricity is based mostly on domestic factors. Increasing electricity generation from solar, other renewables and with the help of energy storage, the remaining impact of variable fuel costs on electricity prices will decrease further because solar and wind have zero fuel costs and are now the most cost-effective source of new electricity generation. We can start putting more electric vehicles on the road that can then charge from affordable and predictable domestic electricity. We can start replacing heating oil and propane heaters with electric heat pumps that cost little more than an air conditioner, again moving to affordable and predictable domestic electricity.

To go even further, we can pass policies support domestic manufacturing to make sure we can make solar equipment, batteries, electric vehicles, and heat pumps here and further increase the resilience of our supply chains, removing the risk of increased shipping costs and more.

**5. Could you please explain how renewable energy development, land conservation, and the protection of sensitive species can be complementary goals?**

Utility-scale solar power generation facilities play a number of important conservation and ecosystems services roles. To ensure these roles grow and adapt as more utility-scale solar is deployed to meet private- and public-sector clean energy goals, the solar industry frequently collaborates with experts from government (including the National Renewable Energy Laboratory (NREL) and the Solar Energy Technologies Office (SETO)) and NGOs (including the Electric Power Research Insti-

tute and Renewable Energy Wildlife Institute) on siting-related research and best practices.

#### *Background*

Protection of wildlife and ecosystems is and will remain a paramount concern for the solar energy industry as it seeks to build nearly 125 new gigawatts annually of new solar capacity. Deploying more solar energy will sharply reduce the carbon, sulfur, and mercury emissions that come from burning fossil fuels, saving approximately 60,000 American lives each year, and helping our nation address the threats of climate change, which are existential to many species of concern<sup>1</sup> and the ecosystems on which they rely.<sup>2</sup>

A January 2022 study by Lawrence Berkeley National Laboratory<sup>3</sup> found that utility-scale power density has increased significantly since 2013. Whereas a general rule of thumb had been that utility-scale solar required 5–10 acres/MW, the most recent study found that, as of 2019:

Fixed-tilt facilities generate 0.35 MW/acre—i.e., about 3 acres/MW

Tracking facilities generate 0.24 MW/acre—i.e., about 4 acres/MW (tracking facilities require fewer PV panels to generate the same output as fixed-tilt but require greater spacing and therefore more land)

In other words, a given utility-scale facility with 100 MW nameplate capacity constructed today would require around 300–400 acres of land, depending on the technology and configuration of the facility. Compared to 2013, this means that new solar facilities require 20–70% less land to generate the same amount of electricity. And there is reason to expect that solar power density will continue to increase as it has since 2013, as confirmed by NREL efficiency trends for module manufacturers.<sup>4</sup>

#### *Land Conservation*

The biggest loss of land comes from expanding urban areas and low-density residential development.<sup>5</sup> This loss is usually permanent, whereas the life of a solar facility can span from 20 to 40 years, allowing land to be reclaimed after decommissioning and put back into agricultural or other use. By conserving and temporarily converting working lands, solar development can help regenerate healthy vegetation, soil, and water, reduce erosion, and displace higher-impact forms of energy production.<sup>6</sup> This is not the case with other forms of development such as residential and commercial construction that permanently remove soil and vegetation. Increasingly, solar developers are also adding dual-use capability to solar facilities, enabling the same parcel of land to be used for solar power in addition to growing crops, accommodating sheep or cattle grazing, and/or enhancing local ecosystems with native and pollinator-attracting plants. According to the American Solar Grazing Association, co-locating grazing operations with solar facilities increases soil carbon sequestration, moisture, microbes, and biodiversity, while reducing reliance on herbicides and fossil fuels used in clearing and mowing equipment. It can also enhance water quality by reducing runoff.

In addition, proposed solar projects undergo extensive environmental review before being permitted. There's no advantage to trying to develop a solar project in sensitive habitat or in a manner that disturbs large tracts of land suitable for agriculture—these can make the permitting process take longer and increase costs and uncertainty. Responsible developers spend significant effort and resources assessing siting, including considerations for minimizing impacts to land, before moving forward with a project.

#### *Protection of Sensitive Species*

As noted above, the benefits of reducing the impacts of climate change on wildlife are well-understood. Solar energy is environmentally beneficial to many species by reducing greenhouse gas emissions and mitigating climate impacts to their habitats. Generally speaking, habitat loss is usually one of the largest drivers of any given species' decline. Large-scale solar development can also serve a land conservation role that will benefit future wildlife populations. This includes development of deep roots for non-displaced vegetative species and proliferation of regional vegetation to increase habitat for wide range of species.

Solar developers take protection of species into account well before breaking ground on a project. Common siting tools can inform developers about mapped critical habitats, known species ranges, and critical constraints analysis to determine the protected species and habitats at or near solar sites, as confirmed through later field verification. Developers may also rely on other forms of due diligence such as outreach to the U.S. Fish and Wildlife Service and state wildlife agencies. A variety of pre-construction studies are often conducted by solar developers. These can in-

clude habitat assessments to minimize impacts on species of potential concern, wetlands, trees, and other sensitive resources on the landscape which support wildlife.

In November 2021, SETO released the results of its Request for Information regarding Solar Impacts on Wildlife and Ecosystems.<sup>7</sup> Some of their key findings include:

“[T]he most well-understood benefit of solar energy is its role in mitigating the adverse impacts of climate change. . . . [U]tility-scale solar energy will play a pivotal role in decarbonizing the grid and that achieving decarbonization goals is crucial for preserving biodiversity throughout the U.S. and globally.”

“[T]he most common process for assessing adverse impacts to wildlife from solar development is compliance with federal statutes that protect sensitive species and their habitat. These federal laws include the Endangered Species Act (ESA), Bald and Golden Eagle Protection Act (BGEPA), and National Environmental Policy Act (NEPA).”

“[S]olar development could create habitats through vegetation restoration or microclimates beneath panels and could preserve habitats that would have otherwise gone to other forms of development.”

“Mitigation strategies . . . include the use of native vegetation and habitat buffer zones. . . . [N]ative vegetation can be used to reduce habitat impacts of solar facilities. Vegetation choices can preserve habitat as well as provide support for pollinators and assist with the infiltration of stormwater. Many respondents also pointed to vegetation management practices that minimize the use of herbicide and mowing as a positive for wildlife.”

“One of the most common minimization methods . . . is the use of wildlife-friendly fencing. Small and medium animals can access the site with only 4–6 inches of clearance at the bottom of fencing. Including openings in fences and promoting species mobility through habitat corridors was a commonly mentioned way of reducing the wildlife impacts of solar development.”

THE HONORABLE EARL L. “BUDDY” CARTER

1. **The Biden Administration has openly signaled their hostility to domestic mineral production with the cancelation of the Twin Metals Mine in Minnesota (see attached op-ed). Some domestic solar manufacturers are nearly entirely reliant on China for tellurium, a mineral that is a copper mining byproduct. Given the Twin Metals decision, is SEIA actively lobbying the administration to approve more domestic mineral production?**

SEIA supports domestic mineral production. The vast majority of the solar panels installed in the U.S. are crystalline silicon, which does not use tellurium and the components of which are available in the United States. About 5% of global solar module production utilizes tellurium. According to the U.S. Geological Survey in 2020, imports of Tellurium from 2015–2019 were from Canada, 64%; China, 25%; Germany, 7%; and other, 4% (<https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-tellurium.pdf>).

2. **According to the attached article, “China accounted for 61% of estimated global tellurium production in 2020 and 21% of world reserves, according to the U.S. Geological Survey.” How can a SEIA member claim to be “decoupled” from China while also admitting Chinese tellurium is essential to their process? Given the opacity of the tellurium market, how can Congress and U.S. Customs and Border Protection be sure tellurium is not being produced with forced labor?**

**Attachments:**

**Op-ed on Twin Metals:** <https://thehill.com/opinion/energy-environment/592877-twin-metals-mine-cancellation-is-a-gut-punch-to-us-steelworkers#>

**Article on Tellurium mining:** <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/first-solar-s-growth-plans-hinge-on-opaque-market-for-tellurium-68010925>

Tellurium is used in about 5% of solar panel production. Tellurium can be obtained from multiple locations. According to the U.S. Geological Survey in 2020, imports of Tellurium from 2015–2019 were from Canada, 64%; China, 25%; Germany, 7%; and other, 4% (<https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-tellurium.pdf>).

There are currently efforts underway to diversify supply and develop more tellurium in the United States as well. It is also important to have diversity in technology.

Since October of 2020, SEIA has been calling on solar companies to move their supply chains out of Xinjiang. The risks of forced labor in the region are just too high. Companies have told us that they have moved supply chains out of Xinjiang, and many are having independent third-party audits. These audits are conducted to verify that their supply chain partners do not use forced labor and that materials in solar products do not come from Xinjiang.

By understanding the source(s) of key inputs, manufacturers can then evaluate their supply chains for the risk of forced labor and provide the audited results to stakeholders, such as U.S. Customs & Border Protection.

### References Page

*Witnesses may use internal footnote citations or create a reference page at their discretion.*

### Questions for the Record

**Jessica Eckdish**  
**Vice President, Legislation & Federal Affairs**  
**BlueGreen Alliance**

THE HONORABLE KATHY CASTOR

- 1. There is a global competition to build the vehicles of the future. How would incentives for domestic manufacturing of clean vehicles help the United States compete and create good-paying jobs? And how would electric vehicle tax credits help encourage domestic manufacturing?**

Federal and state governments have the ability to shape the domestic EV supply chain—and the jobs that support it—through EV tax credits. The new federal EV consumer tax credit (36C, formerly 30D) in the House-passed Build Back Better Act reduces the upfront cost of EVs to drivers, and makes buying domestically-manufactured, union-made EVs an easier, and more affordable choice through its phased-in domestic assembly requirement and its collective bargaining bonus.

The phased-in domestic assembly requirement in 36C, which would take effect beginning in 2027, encourages auto manufacturers to locate their EV production here in the United States by ensuring strong demand for U.S.-made EVs well into the future. Such policies have proven impacts on automakers' decisions; the Biden Administration's commitment to establishing U.S. leadership in EV manufacturing has driven many automakers—foreign- and domestic-owned—to make major, long-term investments in new and existing U.S. facilities (see Figure 2 of BGA's report on the EV tax credit).<sup>1</sup> These investments mean good manufacturing jobs, not only in assembly, but also down the automotive supply chain. Research on employment multiplier effects from the Economic Policy Institute shows that 100 additional jobs in motor vehicle manufacturing support and create over 1400 supply chain and induced jobs (jobs in the service industry, consumer goods, etc. that are created when more people have disposable income).<sup>2</sup>

The 36C collective bargaining bonus, which reduces the purchase cost of union-made EVs to consumers by an additional \$4,500, works to further lower the upfront cost of EVs and accelerate EV deployment, while ensuring that these new domestic auto manufacturing jobs are family-supporting jobs with high wages and good benefits, in safe and equitable work environments. Federal incentives such as the EV tax credit should prioritize support for companies that are doing right by their workers and setting industry standards for this sector that is still in its nascency.

Tax credits are just one of a slew of tools that policymakers can use to shape the future of EV manufacturing in America. It's important to pair demand-side tactics like credits and rebates with direct investments in EV manufacturing that provide immediate support to auto manufacturers who choose to build here, such as through

<sup>1</sup>BlueGreen Alliance. 36C EV TAX CREDIT MUST SUPPORT GAINS FOR CLIMATE, WORKERS, AND COMMUNITIES. Available online: <https://www.bluegreenalliance.org/wp-content/uploads/2021/11/1121-36C-Factsheet-vFINAL.pdf>

<sup>2</sup>Economic Policy Institute, "Updated employment multipliers for the U.S. economy," January 2019. Available online: <https://www.epi.org/publication/updated-employment-multipliers-for-the-u-s-economy/>

the Advanced Technology Vehicle Loan Program at the Department of Energy, and Section 132 Domestic Conversion & Retooling Grants. Both of these critical programs, which extend capital to domestic manufacturers producing clean vehicles, are also funded by the Build Back Better agenda and must be prioritized if we are to achieve our climate goals in ways that create good jobs here in the U.S.

A recent report<sup>3</sup> from BGA, NRDC, AFL–CIO, USW, UAW, The Greenlining Institute, and the Economic Policy Institute found that over 220,000 domestic manufacturing jobs depend on if and how policymakers respond to the global shift to cleaner vehicles. A proactive policy response that captures the economic benefits of the transition for U.S. workers will onshore the EV supply chain through direct manufacturing investments, and grow the share of U.S.-made EVs in the U.S. vehicle market through a smart EV tax credit.

## **2. How can we ensure that there are high road labor standards for domestic manufacturing and production of climate solutions?**

In my testimony, I stated that we must ensure that investments in energy efficiency and the deployment of clean and renewable technology investments translate into good jobs that are also truly accessible jobs. This includes supporting and growing pathways into good union jobs in these and other sectors for workers of color and other segments of the population historically left out of these jobs.

To achieve these goals, a critical tool at our disposal is unionization. Research has shown that through the collective bargaining power of unions,<sup>4</sup> workers are able to get more and better benefits such as health insurance and pensions, and are able to fight for more enforcement of the labor protections they have a right to under the law, like enforcement of safety and health regulations, and overtime. And research has shown that across the board, union members earn higher wages than non-union workers,<sup>5</sup> and the difference is most pronounced for workers of color and women. White union members earn on average 17% more than their non-union counterparts. Female union members earn 28%, Black union members earn 28% more and Latino union members earn 40% more in wages than non-union Latino workers. Increasing union density in the clean energy sector is therefore a key way to address the inequity inherent in our economy. It is critical that the House-passed Protecting the Right to Organize Act is made law.

Other key mechanisms for job quality, building career pathways, and increasing job access are prevailing wage standards, registered apprenticeship, pre-apprenticeship, and other union affiliated training programs. Project Labor Agreements (PLAs), Community Workforce Agreements (CWAs) and Community Benefit Agreements (CBAs) are additional opportunities. These types of agreements often include local hire provisions, targeted hire of low-income or disadvantaged workers, and the creation of pre-apprenticeship pathways for careers on the project. We must ensure that steps are taken to require or incentivize these kinds of high road labor standards and responsible labor practices. Congress should add conditions on federal funding to require high-road labor standards as part of projects aimed at solving the climate crisis or prioritize projects that include these standards.

Policies that increase the demand for clean technology must also go hand in hand with incentives to support and grow American manufacturing and domestic supply chains. Already, as the nation increases deployment of clean technology, our ability to manufacture those products and the parts and materials that go into them is falling further behind as demand increases. That is why targeted investments and smart policies are needed to ensure that the nation is able to capture the benefits of the clean energy economy. These include domestic content requirements on clean energy deployment tax incentives, support for capital investment in new or expanded clean technology manufacturing capacity, and ongoing support through a clean technology manufacturing production tax credit.

These kinds of policies will help ensure that as we meet our climate goals and support and grow our domestic manufacturing supply chains, that workers truly reap the benefits. Researchers from Princeton University<sup>6</sup> in a recent working

<sup>3</sup>Economic Policy Institute, “The stakes for workers in how policymakers manage the coming shift to all-electric vehicles,” September 2021. Available online: <https://www.epi.org/publication/ev-policy-workers/>

<sup>4</sup>Economic Policy Institute, Black workers face two of the most lethal preexisting conditions for coronavirus, racism and economic inequality, 2020. Available online: <https://www.epi.org/publication/black-workers-covid/>

<sup>5</sup>Bureau of Labor Statistics, Union Members—2021, January 22, 2021. Available online: <https://www.bls.gov/news.release/pdf/union2.pdf>

<sup>6</sup>Bureau of Labor Statistics, Union Members—2021, January 22, 2021. Available online: <https://www.bls.gov/news.release/pdf/union2.pdf>

paper found that increasing wages and the amount of domestic content in the solar and wind energy industries will result in significant benefits for workers in those industries, including billions in higher wages and hundreds of thousands of new jobs in the 2020s. The researchers found paying workers 20% more and increasing the use of domestic content would generate an additional \$5 billion in annual wages in the 2020s, which equates to increasing each worker's average annual wages by over \$12–13,000. And by producing more of these components here in the United States, we can support an additional 45,000 jobs in the 2020s. Finally, as we transition to a new, cleaner economy, we can't leave impacted workers or communities behind. A transition that is fair for impacted workers and communities isn't something that will happen organically. We have to choose to invest in keeping communities and workers whole and in the economic development and diversification of regions impacted by this shift. We have to do so with a recognition that the best approach to energy transition among workers and communities is one that prevents economic disruption and employment loss in the first place. Part of this strategy should include targeting clean energy and manufacturing investments towards workers and in communities experiencing the economic impacts of energy transition as part of a broader set of investments to build a clean, prosperous, and equitable economy for all.

