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Sam E. Fowler, Chief Counsel
Nicole Buell, Professional Staff Member
Richard M. Russell, Republican Staff Director
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- American Lithium Corp.: Letter for the Record
- Barrasso, Hon. John: Opening Statement
- Barrasso, Hon. John: Letter from Senators Wicker and Barrasso to FCC Chairman Ajit Pai, dated 10/28/2020
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The text of the discussion draft addressed in this hearing is available at https://www.energy.senate.gov/services/files/8E5E06C5-60F6-4C50-8D19-20A80D0F255B
THE INFRASTRUCTURE NEEDS OF THE U.S. ENERGY SECTOR, WESTERN WATER AND PUBLIC LANDS, AND CONSIDERATION OF A LEGISLATIVE PROPOSAL

THURSDAY, JUNE 24, 2021

U.S. Senate, Committee on Energy and Natural Resources, Washington, DC.

The Committee met, pursuant to notice, at 9:35 a.m. in Room SD–366, Dirksen Senate Office Building, Hon. Joe Manchin III, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. JOE MANCHIN III, U.S. SENATOR FROM WEST VIRGINIA

The CHAIRMAN. We are here today to discuss infrastructure investments to address our energy sector, public lands, and western water needs. While we will be focusing our discussion on our jurisdiction, let me begin by noting that infrastructure, broadly speaking, is truly a bipartisan issue that serves as the backbone of society. It is critical at this time in our history that we come together to invest in our country in ways that are both fiscally responsible and reflect the needs of our nation. With the right strategy, reinvesting in our nation’s infrastructure can also strengthen the economy, create jobs, boost our competitiveness, and help tackle climate change. Although I do not anticipate we will all agree on the size or scope of investment necessary to do this, I think all of my colleagues will agree that the areas within our jurisdiction are an important piece of the broader conversation about our infrastructure needs.

Let me turn now to the draft legislation before us [discussion draft of the Energy Infrastructure Act] and the areas in which it invests. First off, the bill funds the demonstration of pilot projects included in the bipartisan Energy Act in an all-of-the-above way, with billions of dollars for advanced nuclear, carbon capture and direct air capture, renewables, energy storage, and industrial emissions solutions. You have all heard me say time and time again, we need to address climate change through innovation, not elimination, and that is what this legislation would do. That includes going after the low-hanging fruit, like energy efficiency, and doing what we can to reduce energy use in our residential, commercial, and industrial buildings. This not only results in real emission reductions, but it also saves people money.
The text also builds on and complements the Energy Act by investing in CO$_2$ infrastructure that will be needed to make CCUS (Carbon Capture, Utilization and Storage) and direct air capture a reality in the way we need it to be. It would invest in technologies that have low or no emissions, including supporting our existing zero-emission nuclear fleet and advancing hydrogen technologies that can significantly decarbonize our energy, industrial, and transportation sectors without relying on foreign supply chains. It would also build out supply chains that are needed for clean energy technologies, including making it easier to responsibly mine critical minerals and investing in domestic refining capabilities, in addition to onshoring battery manufacturing and recycling. We currently rely on other countries for each piece of that supply chain, some with questionable mining practices, and that is just not right.

This legislation would also invest heavily in our electrical grid to improve the resilience, flexibility, and security of our energy infrastructure. We have seen across the country, time and time again, that the grid is not as resilient as we need it to be from extreme weather events, wildfire, and cyberattacks. On the theme of resilience, this legislation would also make substantial, targeted investments to restore the health of our forests and mitigate the wildfires that have been impacting many of the communities in our western states.

It also includes significant investments into legacy cleanup efforts to address issues with abandoned energy infrastructure that powered our country to greatness. That includes plugging orphaned wells, which not only puts people to work, but also curbs methane emissions, which are 84 percent more potent than CO$_2$ in the first two decades. It also includes investing in the reclamation of abandoned mine lands (AMLs). Our coal communities bear the scars of having mined the coal to power this country to greatness over the last century. While this funding will do a great deal of good, it will still not be enough to cover all of the outstanding reclamation work that is desperately needed to finish the job and protect the health and safety of these communities in many cases, and provide new economic opportunities for these areas. So I will be continuing to work with my colleagues to complement this funding with an extension of the AML Reclamation fee that is set to expire in September. Inaction is truly not an option.

These are just a few of the highlights of all the infrastructure investments the bill contemplates. This almost $95 billion investment would deliver on the President’s American Jobs Plan in many big ways that can garner bipartisan support. I look forward to discussing these proposals and the needs they address with our panel today. With that, I turn to my friend and Ranking Member, Senator Barrasso, for his opening remarks.

**OPENING STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM WYOMING**

Senator Barrasso. Well, thanks so much, Mr. Chairman, and thank you for your commitment to develop bipartisan infrastructure legislation. We are very grateful. It is critical that this Committee and the Senate as a whole proceed through regular order, not the partisan reconciliation process. I commend you, Mr. Chair-
man, for holding this hearing to begin a regular order legislative process on infrastructure legislation. I applaud you also for drafting a bill that recognizes the necessity for advanced nuclear and carbon capture technologies. I am also grateful that the legislation includes money for water infrastructure in the West. If any projects within this Committee’s jurisdiction meet the definition of infrastructure, they are clearly Bureau of Reclamation projects.

At the same time, Mr. Chairman, it is difficult to understand the rationale behind the lack of process used to draft the legislative proposal before us today. We all recognize the need to move infrastructure legislation in a timely manner. Neither I nor my staff had the opportunity to review or provide input on the draft bill before it was released last Thursday. It is also true for most of the Republican members of this Committee. So I believe we should work to build a broad consensus. The lack of consultation means we are not including the priorities for all of the Committee members who represent the states with different needs. There is time to right the ship to build this consensus and to pass something that we can all support. So I am ready to work with you, Mr. Chairman, to do just that.

I believe the draft bill still needs work. It does not authorize programs where we should and it does appropriate money where we should not. The Senate Energy and Natural Resources Committee is, after all, a committee that authorizes programs—does not appropriate funds. I am aware of no precedent where this Committee appropriated anything close to the $100 billion included in this draft bill. I am troubled that the bill includes $5 billion for a program designed to further bail out the State of California and its failing electric grid. The State of California already has a $75 billion budget surplus.

I am concerned that the bill funds the Department of Energy to coerce states to adopt building codes which may restrict the use of natural gas. I am opposed to spending $500 million for schools to plant outdoor gardens and install green roofs. I am concerned about appropriating 10 times the amount of money that Congress has authorized for weatherization assistance. I am opposed to a 20-fold increase for an energy efficiency program and am concerned that this bill includes almost no permitting reform. Permitting reform is one thing that we really need to actually get infrastructure built. The draft also leaves open critical questions. How will we pay for this bill? Will the bill be incorporated into Majority Leader Schumer’s partisan reconciliation process or will it go by regular order? Is this bill a wise and prudent use of American taxpayer dollars, or does it spend money on initiatives which the private sector already intends to support?

Now I, along with all the Republicans on this Committee, am ready to get to work, Mr. Chairman. We have policy ideas and legislation that address America’s infrastructure needs. We also need answers to our questions and changes to address our concerns. I want to again thank you, Mr. Chairman, for holding this important hearing and for beginning this committee process on this very important topic. I also want to welcome the witnesses to the Committee today and look forward to the testimony from all of you.

The CHAIRMAN. Thank you, Senator Barrasso.
I would like to welcome all of our witnesses to the Committee and thank you for being part of the important discussion today.

Today, we have with us Dr. Kathleen Hogan, Acting Undersecretary for Science and Energy at the Department of Energy; Hon. Tanya Trujillo, Assistant Secretary of Interior for Water and Science at the Department of the Interior; Mr. Chris French, Deputy Chief of the U.S. Forest Service; Dr. Douglas Holtz-Eakin, the President of American Action Forum; Mr. Collin O’Mara, the President and CEO of the National Wildlife Federation; and finally, Mr. Mark Mills, a Senior Fellow with the Manhattan Institute.

Before we get started with you, Dr. Hogan, I have Senator Wyden who has a committee that he has to run to real quick.

OPENING STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM OREGON

Senator Wyden. Mr. Chairman, thank you very much for your thoughtfulness and Senator Barrasso as well. I pledge to make this a filibuster-free zone, and I will take just one minute to be very brief.

Mr. Chairman, I want it understood that I think you have put out a laudable product here, and I am not saying this just because you included three of my pieces of legislation. I do want everyone to know—and I see my western colleagues, you know, with us—that every living soul in the West is collectively holding their breath right now for the next devastating wildfire to hit, and people sure have reasons to worry. Parts of my state are already on fire because of the record-breaking heat and severe drought conditions and it is still only June.

So Chairman Manchin, your hearing on energy infrastructure could not be more timely. Obviously, we are working in several areas with respect to infrastructure to implement the President’s Build Back Better agenda. There is an urgent need to address this climate crisis and invest in clean, renewable energy, and the three bills that I would like to put additional, supplemental material into the record on are the Disaster Safe Power Act and the prescribed fire legislation and additional language with respect to the Forest Service Legacy Roads and Trails program. We are going to need, in my view, increased funding above what it is in this proposal, but I think we all know that we have to work on these issues in the way this Committee has always focused, which is to do it in a bipartisan way.

I thank the Chairman for the chance to take this minute and the indulgence of, particularly, my western colleagues, because I think it would be fair to say, for purposes of the record, we are very much like-minded on this issue.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Wyden.

And also, we have Senator Cantwell.

Senator CANTWELL. Thank you.

The CHAIRMAN. She has to go to her Commerce Committee.
OPENING STATEMENT OF HON. MARIA CANTWELL,
U.S. SENATOR FROM WASHINGTON

Senator CANTWELL. Thank you, Mr. Chairman. I appreciate the indulgence. I hope to come back much later, obviously, in this process, but I just wanted to thank you for your draft legislation. So important to the very important needs to ensure electricity prices remain affordable, harden our grid against increasing intense and extreme weather, and the importance of cybersecurity as well as the competitiveness to manufacturers to export great products around the world.

Temperatures in Washington State are going to reach a record high next week and this weekend. And so I think that these debilitating highs that impact so much of our western economy now need to be dealt with. Mr. Chairman, you incorporated several provisions on the Grid Modernization and Expansion Act—very important legislation. I hope that this 21st century grid is smarter, more resilient, more reliable, and more affordable. So thank you for including those provisions, and I appreciate your leadership.

The CHAIRMAN. Thank you, Senator.

Is there anyone else in the Committee that wants to make a quick statement before we go to the witnesses?

If not, thank you all.

We will start with Dr. Hogan.

OPENING STATEMENT OF DR. KATHLEEN HOGAN, ACTING UNDERSECRETARY FOR SCIENCE AND ENERGY, U.S. DEPARTMENT OF ENERGY

Dr. HOGAN. Chairman Manchin, Ranking Member Barrasso, and distinguished members of the Committee, thank you for the opportunity to testify on behalf of the Department of Energy on the role of energy infrastructure in achieving the Biden-Harris Administration’s clean energy and jobs goals and our initial evaluation of the infrastructure discussion draft.

Affordable, clean, reliable, and secure energy is essential to a prosperous America, and DOE is already jump-starting efforts to improve our energy infrastructure and create jobs, enhance national security, and transition to the clean-energy economy of the future, and we are prioritizing the communities who have been left behind. We have set ambitious new goals to cut solar costs, add new gigawatts of offshore wind capacity, and reduce the cost of clean hydrogen. And with other agencies, we have identified nearly $38 billion in existing federal resources to help the hardest hit communities as they shift their reliance on fossil fuels. And we are leading an interagency working group on coal and power plant communities to promote investments in such communities.

So this discussion draft of the Committee will help us do more, but today’s challenge will not be met without the scale and scope of the American Jobs Plan. President Biden released the American Jobs Plan in March. It is the biggest investment in America since World War II, positions the U.S. to win the global energy market, will put millions of Americans to work, and lays the foundation for economic growth for decades to come. The plan recognizes the urgency to act. It goes beyond addressing critical infrastructure and requires addressing head-on the challenges posed to our security
and our economy by the climate crisis. It proposes investments in clean energy research, a full range of demonstration projects, it would deploy technologies to deliver clean, affordable energy to every community, and invest in factories to propel U.S. leadership in clean energy manufacturing, providing good-paying jobs. We see this discussion draft as inspired in part by the American Jobs Plan and advancing the recent Energy Act of 2020. I will speak to some expanded DOE capabilities as well as some areas where greater authority and funding would be beneficial.

First, the discussion draft, building on the Energy Act of 2020, appropriates important funding toward key research facilities and demonstrations, including and as you mentioned: energy storage, advanced nuclear, renewable energy, critical minerals, and industrial decarbonization. It includes additional efforts on carbon capture, hydrogen, carbon transportation and storage, grid resilience, and cybersecurity—all elements of the American Jobs Plan. It broadens key DOE capabilities with the existing nuclear fleet, the loan guarantee program, and upgrading our nation’s electricity transmission system, largely consistent with the President’s vision for a grid-deployment authority at the Department of Energy. It helps lower utility costs for schools, federal facilities, low-income homes, and other buildings and facilities.

That said, additional capabilities, flexibilities, and funding as outlined in the American Jobs Plan are needed. For example, more flexible and larger state, tribal, and local grants to advance clean energy throughout the country, greater supply chain investment beyond the batteries and critical minerals sphere, and more resources to help retool existing factories and transition workers. Additional transmission-related provisions, so DOE can support states and utilities as they plan, permit, and pay for hardened, expanded, and modernized transmission systems. Additional scope for DOE’s loan program and additional funding to allow use of the broadened scope, and a clean energy standard to leverage private sector investment, yield locally tailored energy mixes, and offering another way to provide incentives for nuclear power as you envision.

So we do have before us a generational opportunity to invest in our future, capitalize on an emerging $23 trillion global clean energy market and create millions of good-paying careers, while making our electricity grid, our homes, and our communities safer, cleaner, and more resilient. So again, the Committee’s infrastructure discussion draft is an important step, but this generational opportunity to Build Back Better requires the American Jobs Plan. We look forward to working with you throughout the legislative process and here to answer questions. Thank you.

[The prepared statement of Dr. Hogan follows:]
Testimony of Dr. Kathleen Hogan

Acting Under Secretary

Office of Under Secretary for Science and Energy

U.S. Department of Energy

United States Senate

Committee on Energy and Natural Resources

June 24, 2021

Chairman Manchin, Ranking Member Barrasso and distinguished members of the committee, thank you for the opportunity to testify on behalf of the Department of Energy (DOE) on the role of energy infrastructure in achieving the Biden-Harris Administration clean energy and jobs goals, the Department’s authorities and capabilities, and the Department’s initial evaluation of the infrastructure discussion draft from this committee.

We all know that 21st Century modern infrastructure is critical to a prosperous America and our future. Infrastructure is the backbone of our society. It is roads and bridges; the electrical grid that keeps the lights on; ports, airports, and trains; the pipes that pump water into our homes; schools and buildings; and the broadband that both brings the world and learning to our children and brings opportunity to our businesses. Infrastructure is expansive, it creates jobs, and it improves the economic vitality in all pockets of America.

Affordable, clean, reliable, and secure energy plays an essential role in the U.S. economy. In addition to advancing our core science and security missions, DOE has wasted no time to jump-start efforts to create jobs and build the clean energy economy of the future, an economy that works better for American families and an economy that works for all kinds of communities with jobs for all kinds of workers. We set ambitious new goals to cut solar costs by more than half and add 30 gigawatts of offshore wind capacity by 2030. We must deliver these goals while addressing long-standing and persistent racial and environmental injustice and taking action to benefit disadvantaged communities who have for too long borne the disproportionate share of environmental and health impacts or who are at risk of being left behind during energy transitions. We have worked with other agencies to identify nearly $38 billion in existing federal resources to help the hardest-hit areas as they shift their reliance on fossil fuels. We are, in addition, leading the interagency working group on coal and power plant communities to promote job-creating investments in communities already impacted by the energy transition. With droughts, heat waves, and wildfires plaguing the West and straining our energy system, we face the need to enhance our power grid, making it more resilient against all forms of extreme weather. Additionally, the ransomware attack on Colonial Pipeline underscores the urgent need for greater investment in cybersecurity across all critical infrastructure sectors. We have engaged
the private sector on strategies for hardening our critical infrastructure against these evolving threats as well as strengthening our energy security through a multiagency effort to bolster domestic supply chains for key components of our energy system such as the lithium batteries we need for both energy storage and electric vehicles.

While we are encouraged by the discussion draft introduced by Senate Energy and Natural Resources Committee and the visible alignments with key parts of the American Jobs Plan, we firmly believe that the challenge will not be met without an effort on the scale of the American Jobs Plan. We look forward to working with you throughout the legislative process.

**American Jobs Plan**

In March, President Biden released the American Jobs Plan. This represents the biggest investment in America since World War II and is a once-in-a-generation investment in our nation’s economy and especially in our energy infrastructure and our ability to win the global energy market. This plan will put millions of Americans to work and lay the foundation for economic growth for decades to come. The ambitious investment outlined in the American Jobs Plan properly recognizes the urgency not only for us to address critical infrastructure needs, but also to address head on the challenges posed to our security and our economy by the climate crisis. We need no more warning bells—our carbon emissions reductions are not yet close to the levels needed to avoid the worst impacts of climate change. The American Jobs Plan recognizes the urgency of the climate problem and the importance of building a stronger and more equitable foundation for economic growth by proposing an ambitious investment in building a new clean energy economy. That includes accelerating our global leadership in clean energy R&D and climate science, boosting innovation by standing up the full range of demonstration projects envisioned by this committee in the Energy Act of 2020, and committing the resources necessary to actually deploy zero-carbon technologies that can deliver clean affordable energy to every community. Most critically, it includes the resources to rebuild our manufacturing base, to stand up the factories that will make America a global leader in manufacturing the clean energy technologies that will be the foundation of this century’s economy. Through the American Jobs Plan, our country will lead global markets in manufacturing clean energy technologies, providing good-paying jobs to the American people and allowing them to support their families and strengthen their local economies. A priority of the American Jobs Plan and of Secretary Granholm’s is leaving no community behind: the proposal specifically prioritizes energy transition communities, including coal communities, as well as disadvantaged communities who for too long have borne the disproportionate share of environmental and health impacts.

President Biden’s plan will mobilize private investment to modernize our power sector. This starts with proposing a ten-year extension and phase down of an expanded direct-pay investment tax credit and production tax credit for clean energy generation and storage. These credits will be paired with strong labor standards to ensure the jobs created are good-quality jobs with a free and fair choice to join a union and bargain collectively. It will support state, local, and Tribal governments choosing to accelerate this modernization through complementary policies—such as clean energy block grants that can be used to support the zero-carbon energy programs and projects that best fit their local needs and that promote high-quality jobs, and environmental justice. It also will use the federal government’s purchasing power to procure 24/7 carbon-free
electricity for federal buildings and transition to a zero-emission federal fleet. It ensures that the combination of investments both leverages private-sector action and meets our goals for zero-carbon energy in a way that can be customized for each state with a clean electricity standard, like those that have been adopted in a wide range of states on a bipartisan basis as proven tools for delivering low-cost zero-carbon energy.

The American Jobs Plan also recognizes the need to modernize and make resilient our electric transmission system to better withstand extreme weather, to be more secure against attempts at cyber intrusion, and to move cheaper, cleaner electricity to where it is needed most. It creates a targeted investment tax credit that incentivizes the buildout of at least 20 high-voltage capacity power lines and mobilizes tens of billions in private capital off the sidelines – right away. Additionally, it establishes a new Grid Deployment Authority at DOE that would coordinate existing authorities and support creative financing tools to spur additional high priority transmission lines to meet state, regional, and national needs.

Reports estimate that the race for clean energy technologies that reduce carbon emissions constitutes a $23 trillion global market – in emerging markets alone – over the next decade. The size of America’s share will depend on smart manufacturing investments that give our workers and companies the tools they need to compete. The American Jobs Plan will invest $300 billion to retool American manufacturers and small businesses including extending the 48C tax credit program which supplies clean energy projects with American-made parts and equipment and $52 billion for existing access-to-capital programs to support modernizing supply chains for electric vehicles and other clean energy and grid technologies.

The American Jobs Plan also recognizes the need to invest in demonstrating next generation technologies and doing so in a way that ensures distressed communities are not left behind in the energy transition. It will invest in 15 hydrogen demonstration projects and demonstrate carbon capture retrofits on 10 industrial facilities. It will invest $15 billion in demonstration projects across these and other technologies authorized in the Energy Act of 2020, including utility-scale energy storage, advanced nuclear, floating offshore wind and others.

These examples give a sense for the breadth, depth, and necessary scale of the American Jobs Plan. In addition, DOE has many existing authorities and capabilities that position it to take on this once-in-a-generation challenge and lead us through the next decade. DOE, with the support of Congress, has been given a robust set of tools to leverage strategically across the entire research, development, demonstration and deployment value chain. These tools have already driven dramatic advancement in many of the clean energy technologies we need to achieve a zero-carbon future, such as setting a solar energy cost target and achieving it nearly four years earlier than expected and we are ready to do so much more. With these tools and the additional tools included in the American Jobs Plan, DOE has the power to achieve the goals set by this administration.

The Department has and is using its Congressionally provided tools to build infrastructure that will power a modern, resilient, clean economy. And with additional tools, and DOE can build on that foundation to accelerate job creation, economic competitiveness, and decarbonization.
Infrastructure Discussion Draft

The Department is pleased to see many pieces in the Senate Energy and Natural Resources infrastructure discussion draft inspired by the American Jobs Plan and taking important steps to advance the Energy Act of 2020.

Under this committee’s leadership, the bipartisan Energy Act of 2020 laid out a roadmap for our research, development, demonstration, and deployment of advanced nuclear technology, carbon capture, geothermal, wind, solar, critical materials, and so much more. The infrastructure discussion draft builds on the Energy Act of 2020 and appropriates critical funding towards many of the demonstrations authorized in that Act, including energy storage demonstration projects, advanced reactor demonstration projects, direct air capture technology prize competitions, industrial emissions demonstration projects among others. Demonstrations are a key step in scaling technology solutions and can create good-paying jobs with a choice to join a union and collectively bargain. The infrastructure discussion draft goes beyond the Energy Act of 2020 in key areas like hydrogen hubs and manufacturing, scaling carbon transportation and storage, and cybersecurity. We see these areas as consistent with the American Jobs Plan.

The infrastructure discussion draft builds on the Critical Minerals title in the Energy Act of 2020 and establishes a grant program for battery material processing and manufacturing as well as a recycling and second life application program for electric vehicle batteries and other advanced energy products. Advanced, lithium-based batteries play an integral role in 21st-century technologies such as electric vehicles and grid-scale storage that will be critical to securing American’s clean energy future. Today, the U.S. relies heavily on importing advanced battery components from abroad, exposing the nation to supply chain vulnerabilities that threaten to disrupt the availability and cost of these technologies as well as the workforce that manufactures them. Demand for EVs and stationary storage alone is projected to increase the size of the lithium battery market five- to ten-fold by the end of the decade, underscoring the need for strong and swift policy action to support a robust domestic supply chain, as well as the opportunity to establish leadership in a market that will be expanding globally. The discussion draft provides essential funding aligned with the critical areas recently outlined in the Federal Consortium for Advanced Batteries’ National Blueprint for Lithium Batteries, which DOE released. When it comes to expanding supply chains, we think an even greater and broader investment is warranted, both in terms of the scale of investment appropriate to securing supply chains and expanding manufacturing in the battery and vehicles space, as well as in other sectors. These investments must ensure sustainable production, refining, and recycling capacity domestically, while ensuring strong environmental, environmental justice, and labor standards and meaningful community consultation, including with Tribal Nations. U.S. workers could have major opportunities in new manufacturing to support a range of zero-carbon technologies, from steel manufacturing for offshore wind and solar support structures in Appalachia to shipbuilding in the Gulf states. The American Jobs Plan proposes a broader approach, including resources to help retool factories and transition existing workforces.

The discussion draft also includes a number of provisions that will help upgrade our nation’s electricity transmission system to build the modernized, resilient and efficient grid that the country so clearly needs. The provisions are consistent with the President’s vision for a Grid
Deployment Authority at the Department of Energy. The draft would enable DOE to provide needed funds to states and utilities to invest in hardening, expanding, and modernizing the grid, including through the State Energy Program. The draft proposes an innovative financing tool that could allow DOE to help address the “chicken and egg” problem in which transmission customers may be unwilling to sign up before a project is built despite the project financing’s contingency on customer commitments. By authorizing DOE to serve as an “anchor customer” on new lines and resell its capacity once a line is built, the Transmission Facilitation Program proposed in the discussion draft could reduce some of the risks of building interregional transmission. Additional financing tools, such as the ability to engage in public private partnerships, an authority we already have in certain geographies, and to seek cost recovery for investments, could unlock billions in additional, critical interregional projects. I also want to highlight the discussion draft’s proposals to improve transmission planning, cost allocation and siting. With additional resources and authorities as proposed in the American Jobs Plan, DOE and its National Laboratories could also play a key role in assisting states, regional grid operators, and the Federal Energy Regulatory Commission identify and help to address interregional transmission needs.

When it comes to modernizing the nation’s power grid for the net-zero economy that is our future, the American Jobs Plan of course goes further, with bigger investments that we believe will deliver greater benefits, including jobs and energy affordability. The discussion draft includes a number of promising clean energy grant programs for entities including states, schools and nonprofits. The American Jobs Plan proposes a more flexible state block grant program that would enable the Department to work with states to address these needs and more, tailoring programs to create jobs and address energy needs customized for each state. The American Jobs Plan also proposes a clean energy standard that would further leverage private-sector investment, creating jobs and delivering a locally tailored mix of clean energy. The discussion draft also includes a program to retain the existing nuclear fleet, a critical priority the American Jobs Plan also supports. A clean energy standard would also support this goal. Additionally, the committee could consider extending the credits for longer than the five years in the discussion draft.

One key tool the Department has to unlock investments in clean energy technology is the Loan Programs Office. The draft makes important revisions to the existing authority including clarifying the eligibility of the Title XVII program to include projects that increase domestic supply of critical minerals and expanding the ATVM program to include medium- and heavy-duty vehicles, trains, and marine transportation.

This draft proposal also provides critical funding to help enhance the energy efficiency of our homes, buildings, and schools and to spur local jobs and industries by providing $550 million for the Energy Efficiency and Conservation Block Grant Program (EECBG), and $3.5 billion for the Weatherization Assistance Program (WAP).

DOE stands ready to work with the committee on these programs and expanding their reach. For example, as currently authorized, 98 percent of the EECBG funding would be allocated by
formula, and only 2 percent would be available for competitive grants. Given the varying needs and interests of communities across the country, a more targeted approach may be warranted, including giving greater consideration for communities going through energy transitions and those that have been historically disadvantaged. WAP is a foundational building block of DOE’s vision for a clean energy future for all, delivering on a national objective to increase the energy efficiency of dwellings owned or occupied by low-income persons, reduce total residential energy costs, and improve health and safety. Expanded weatherization funding could allow addressing repairs that typically delay weatherization by, for example, patching a roof. The American Jobs Plan proposes a significantly larger investment in weatherization and in modernizing our homes and building stock with both rebates and, as discussed earlier, flexible state block grants.

**Conclusion**

As a nation, we stand poised at a generational opportunity to invest in our infrastructure, capitalize on a $23 trillion global clean energy market, and create millions of good-paying careers that make our grid, our homes, our communities safer, cleaner, and more resilient. This opportunity requires us to invest at the scale required to meet the climate crisis, and ensure opportunities for the communities who have built this country and who have long been left behind.

The Senate Energy and Natural Resources infrastructure discussion draft is an important step in advancing the dialogue to help modernize and protect critical aspects of our grid, unlock additional capital and resources, and help launch some of the key technologies needed to transform our economy. But in order the fully realize this generational opportunity to Build Back Better, we believe Congress must enact the American Jobs Plan.
The CHAIRMAN. Thank you, Dr. Hogan. Next, we are going to have Ms. Trujillo.


Ms. TRUJILLO. Thank you. Good morning, Chairman Manchin, Ranking Member Barrasso, and members of the Committee. Thank you for providing the Department of the Interior with the opportunity to testify on the discussion draft of the Energy Infrastructure Act. In addition to my testimony today, Interior will be happy to provide the Committee with additional views and assistance as the bill moves forward. We are very happy to be working closely with our colleagues at the Department of Energy and the Department of Agriculture on these important programs.

Many of the provisions in the draft bill complement the Administration’s American Jobs Plan and fit well within the Department of the Interior’s priority goals. Addressing the challenges of climate change and America’s aging infrastructure are priorities for the Department as we continue to invest in measures to increase climate resilience and manage our public lands for the benefit of the American people. In my role at Interior, I work closely with the Bureau of Reclamation and the U.S. Geological Survey, but all parts of the Department are united in tackling these important challenges. Faced with unprecedented drought and record-setting temperatures, Interior is working closely with our sister agencies and with state and local entities to provide assistance to farmers, tribes, and other water users to help respond to the severe drought conditions we are facing. Providing additional capabilities to respond to drought and meet water supply needs are some of the many examples in the draft bill that are complementary to the Administration’s proposals in the American Jobs Plan and to our ongoing work at Interior. For example, with respect to the provisions in Title II, we are utilizing the best available science to help ensure that we can meet the Administration’s recently announced goals to strengthen American supply chains and to promote economic security, national security, and good-paying union jobs here at home.

With respect to critical minerals, the USGS (United States Geological Survey) is responsible for mapping, characterizing, and quantifying the nation’s geologic resources, including critical minerals. The Department will work very closely with other federal agencies, tribal nations, and state and local entities to ensure we can meet the goals for sustainable production, refining, and recycling capabilities for critical minerals here at home through environmentally responsible, appropriately sited, critical mineral production from our public lands. We look forward to working with this Committee to achieve those goals.

In Section 6001, relating to orphaned wells, that section establishes a program to plug, remediate, and reclaim orphaned wells through grants to states and new programs for tribes and federal lands. The Department recently testified before this Committee in strong support of that section’s goals and for remediating the thousands of orphaned oil and gas wells on federal and nonfederal
lands. Those wells and abandoned mines pose serious safety hazards while also causing ongoing air, water, and other environmental damage. Reclamation of orphaned wells helps to ensure that any impacts on the land and resources are not permanent, and the additional reclamation creates jobs.

Section 7001 would provide additional funding for the Abandoned Mine Reclamation Fund to address legacy abandoned coal mine sites throughout the nation. The Administration supports reauthorization of the Abandoned Mine Land Fee Authority before its expiration on September 30th in order to continue this important work.

Title VIII of the draft bill highlights the magnitude of this year's severe heat and drought to emphasize the need to improve our wildfire management capabilities before, during, and after the fires occur. We agree with the draft bill's provisions that there is an urgent need to focus equally on wildfire prevention and mitigation efforts while continuing to carry out our core wildfire response activities.

With respect to western water provisions, as I mentioned earlier, the Department recognizes the drought impacts facing the West. I work on them every day. Drought resilience projects, water efficiency projects, and other water management improvements provide critical support for our communities and stakeholders as they continue to prepare to respond to the drought.

We would also like to see the addition of additional provisions relating to other priorities, such as Indian water right settlements, rural water projects, and critical dam safety improvements.

Thank you for the opportunity to present the Department's views on this discussion draft. The President has made clear that this is a top priority, and we welcome the opportunity to work with the Committee. This concludes my statement, and I will be happy to answer questions. Thank you very much.

[The prepared statement of Ms. Trujillo follows:]
Statement of
Tanya Trujillo
Assistant Secretary for Water and Science
U.S. Department of the Interior
Before the
Senate Committee on Energy and Natural Resources
on
The American Jobs Plan and the Discussion Draft of
The Energy Infrastructure Act
June 24, 2021

Chairman Manchin, Ranking Member Barrasso, thank you for providing the Department of the Interior with the opportunity to testify on the discussion draft of the “Energy Infrastructure Act” (“discussion draft” or “draft”). Interior will be happy to provide the Committee with additional views and assistance as the bill moves forward.

President Biden’s American Jobs Plan

Addressing the challenges of climate change and America’s aging infrastructure have been priorities for President Biden. The American Jobs Plan, which the Administration released at the end of March, is a long-term strategy to create millions of good-paying jobs with a free and fair chance to join a union, rebuild and add resilience to our infrastructure, and position our country to out-compete others on the global stage. Similar to the discussion draft before the Committee today, the $2 trillion American Jobs Plan (AJP) will invest in necessary brick-and-mortar infrastructure, climate response and resilience, clean energy infrastructure, and Tribal Nations. Among other things, the AJP will fix roadways and rebuild bridges; rebuild clean drinking water infrastructure, support a renewed electric grid, provide high-speed broadband to all Americans, and modernize homes and other buildings.

Key provisions of the AJP that impact Departmental programs and actions include:

Creating a Civilian Climate Corps. The AJP includes $10 billion to mobilize the Civilian Climate Corps, or CCC, which will put Americans to work conserving our public lands and waters, bolstering community resilience, and advancing environmental justice, while placing good-paying union jobs within reach of more Americans.

Investing in Climate Resilience. The AJP includes $50.0 billion to protect and, where necessary, restore nature-based and traditional infrastructure that will help to protect lives
and livelihoods from extreme wildfires, increase coastal resilience to sea-level rise and hurricanes, support agricultural resources management and climate-smart technologies, and better protect and repair major land and water resources like the Everglades and the Great Lakes. Examples of these investments include:

- Bureau of Reclamation’s (Reclamation) water efficiency and recycling programs, Tribal water settlements, and dam safety programs, which are all investments focused on and necessary to address the current western drought crisis;
- Additional investments in federal and Tribal hazardous fuels management. The increasingly severe wildfires we are experiencing, particularly in the west, come with negative consequences for community safety and public health, property, carbon storage, and biodiversity.
- Expanded digital, high-resolution elevation collection mapping within the U.S. Geological Survey’s (USGS) 3D Elevation program (3DEP), which is essential for hazard planning critical to future climate resilience actions, including informing flood and mudslide risk;

*Plugging Orphaned Oil and Gas Wells and Cleaning Up Abandoned Mines.* Orphaned oil and gas wells and abandoned mines pose serious safety hazards, while also causing ongoing air, water, and other environmental damage. Federal lands, particularly remote and rural locations, have a significant number of the hundreds of thousands of orphaned oil and gas wells and abandoned mines. The AIP includes an investment of $16.0 billion to put to work hundreds of thousands of Americans plugging oil and gas wells and restoring and reclaiming abandoned coal, hardrock, and uranium mines.

Other broader investments that are part of the AIP include investments in rural and Tribal communities, including expanded broadband coverage and improved roads, bridges, and water systems and a proposed $5 billion Rural Partnership Program to support economic development in rural regions, including Tribal Nations.
Discussion Draft Provisions

The Administration appreciates the Chairman’s efforts with this significant discussion draft, which complements the Department’s efforts to advance the President’s initiative and addresses a number of the Department’s priority goals. Below we offer a brief discussion and comment on several key provisions of the draft and provide the Administration’s views on provisions of the AJP that we believe should be included or strengthened as the draft moves forward.

Title II. Supply Chains for Clean Energy Technologies.

The USGS is responsible for mapping, characterizing, and quantifying the Nation’s geologic resources, and collects data on the global supply, demand, and trade of non-fuel mineral resources.

Section 2001, Earth Mapping Resources Initiative (Earth MRI), authorizes the USGS initiative of the same name. Earth MRI provides a better understanding of the subsurface and above-ground mineral resources potential of the United States. Earth MRI coordinates efforts across various USGS programs and with the Association of American State Geologists, and provides integrated topographic, geologic, geochemical, and geophysical mapping and mineral data interpretations which helps speed and enhance this understanding.

Earth MRI data are essential for delineating areas with critical mineral potential as well as for decisions on infrastructure, transportation, and land-use planning; hazard assessments for landslides, volcanoes, and floods and their mitigation; water resources management; geothermal resources and geologic carbon storage; and emergency response. The Department supports the goal of this section and would welcome the opportunity to work with the Committee on aligning these investments with other Administration priority mapping investments in the FY 2022 Budget.

Sections 2002 and 2003 address the National Cooperative Geologic Mapping Program and the National Geological and Geophysical Data Preservation Program, respectively. Section 2002 would extend the authorization of Geologic Mapping program through 2031 and would ensure that mine waste is catalogued and characterized for the occurrence of critical minerals. Section 2003 would direct the Geological and Geophysical Data Preservation Program to preserve samples to track geochemical signatures from critical minerals in order to provide for
provenance tracking. These programs, along with the 3D Elevation Program, are important components of the Earth MRI. While detailed data on geologic resources is essential to energy infrastructure development, less than 20 percent of the country has been mapped at the level of detail contemplated by the bill.

Section 2004 provides for the construction of a new USGS energy and minerals research facility. Modernizing USGS research facilities is an important priority for the Department, and we appreciate Congress’s attention to this issue. We would welcome the opportunity to work with the Committee on modifications that would include a revised cost estimate for the facility.

Section 2006 requires the Bureau of Land Management (BLM) to develop and implement clear standards for the permitting of critical minerals on public lands, including timelines associated with processing critical mineral plans and applications and it directs BLM to develop performance metrics that ensure continued processing of those plans and applications. The section contains an annual reporting requirement that includes the implementation of the BLM’s permitting standards and any associated results. It also requires BLM to engage with federal, state, and tribal partners and other stakeholders early and often during the critical mineral permitting process.

The Department recognizes the important role that environmentally-responsible and appropriately-sited critical mineral production from public lands can play in transitioning to a clean energy economy, and we appreciate the goal of improving the federal permitting process of critical minerals. However, the Department has significant concerns about the impacts of the provision as drafted on Tribal consultation and other important, and required, reviews and public processes. We look forward to continuing to work with the Committee to achieve the goals of advancing environmentally-responsible critical mineral projects.

Title III. Fuels and Technology Infrastructure Investments.

Sections 3301 and 3302 address the potential for the development of clean energy projects on former mine lands. Section 3301 amends the Energy Act of 2020 to require the Department of Energy to include in its strategic vision report on solar energy development the viability of siting solar energy projects on current and former mine land, as defined under the Surface Mining Control and Reclamation Act. Section 3302 would create a program within DOE to demonstrate
the viability of siting those projects on current and former mine lands. In both instances, the Secretary of Energy would be required to consult with the Department of the Interior, and others.

One of the major goals of the President’s American Jobs Plan is to create jobs through clean energy development and reclamation activities. While the authority in these sections is provided to the Department of Energy, and we defer to DOE on these provisions specifically, we are supportive of the general goal as it serves to highlight and advance innovative ways that the climate crisis can be addressed while creating jobs and economic development opportunity in current and former mining communities.

Section 3007 contains provisions giving the Department the authority to permit geologic carbon sequestration on the outer Continental Shelf. The Department has been reviewing its existing authorities for carbon capture and storage and is supportive of this authority, as we seek to ensure that overburdened communities are protected from increases in cumulative pollution. Both the USGS at the Department and the Department of Energy’s National Energy Technology Laboratory (NETL) have carried out studies characterizing potential offshore storage reservoirs, and NETL has studied best practices for offshore sub-seabed geologic storage.

Title VI. Methane Reduction Infrastructure.

Sec. 6001, Orphaned Well Site Plugging, Remediation, and Restoration, establishes a $4.7 billion program to plug, remediate, and reclaim orphaned wells through grants to states, and new programs for federal and Tribal lands.

The Department recently testified before this Committee in strong support of this section’s goal of remediating the thousands of orphaned oil and gas wells on federal and non-federal lands. Reclamation of oil and gas operations is an essential phase in oil and gas development as it helps to ensure that any impacts on the land and resources are not permanent and creates a foundation for community revitalization and economic diversification. Orphaned wells occur when an operator fails to properly plug and remediate an oil and gas well and no responsible party can be identified for cleanup activities.

A recent Government Accountability Office report (GAO-19-615) estimated the average cleanup costs for orphaned wells to be on average between $20,000 and $145,000 per well. The
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Department’s Fiscal Year (FY) 2022 budget request includes over $480 million to support programs that address orphaned well remediation and abandoned mine land reclamation, more than double the FY 2021 enacted discretionary level. That investment builds on the President’s American Jobs Plan calling for an immediate up-front investment of $16 billion to clean up abandoned mines and orphaned wells. This investment would also help create 250,000 good-paying jobs with a free and fair choice to join a union.

Section 6002, NEPA Review of Certain Pipeline Placement Activities, amends Section 390 of the Energy Policy Act of 2005, which established statutory authority for the use of “categorical exclusions” from further analysis under the National Environmental Policy Act for several types of oil and gas development activities. Specifically, it amends the existing provision allowing for the use of a categorical exclusion for pipelines in an approved right-of-way corridor. The revised language would add associated pipeline infrastructure to what may be categorically excluded from further NEPA analysis. The provision also adds an extraordinary circumstance review prior to using any of the five categorical exclusions.

The President has made clear his goal to reduce emissions from federal and non-federal sources. We note that the revision provided by this section would likely result in an expanded use of this particular categorical exclusion, and could potentially reduce permitting timeframes and result in a reduction of venting and flaring that occurs while certain operators seek pipelines and pipeline infrastructure permit approvals. The Department would like to work with the Committee to clarify certain terms used in this section.

The Department also recognizes the uncertainties and related litigation associated with the application of “extraordinary circumstances” to the Section 390 categorical exclusions and appreciates the effort in the draft to provide clarity and consistency on this issue. We support the inclusion of the “extraordinary circumstances” requirement that would ensure NEPA review, where warranted, even if the activity falls into a category that is generally excluded from such review.

Title VII. Abandoned Mine Land Reclamation.

The provisions in sec. 7001, Abandoned Mine Land Reclamation Fund Direct Appropriations, would provide additional funding for the Abandoned Mine Reclamation Fund to address legacy
abandoned coal mine sites throughout the nation. This proposal is consistent with the President’s American Jobs Plan which, as noted above, would spend $16 billion on remediation of abandoned coal mines and orphaned oil and gas wells. Such projects create jobs, eliminate safety and environmental hazards, and can provide new economic opportunities for communities by cleaning up polluted sites and making new areas available for recreation or development.

The Administration also supports reauthorization of the Abandoned Mine Land fee authority before its expiration on September 30, 2021. These fees are paid by coal companies on each ton of coal mined and continue the commitment the coal industry has made to contribute to cleaning up coal mine sites left un-reclaimed prior to the passage of the Surface Mining Control and Reclamation Act in 1977. Given cost increases, the continual discovery of new abandoned mine hazards, and emergency situations that arise, even the one-time infusion of funds provided by the legislation and the existing balance in the Abandoned Mine Reclamation Fund will not be enough to address the complete inventory of work that needs to be done.

Title VIII. Natural Resources-Related Infrastructure, Wildfire Management, and Ecosystem Restoration.

Sec. 8003, Wildfire Risk Reduction, appropriates $2,500,000,000 to the Department and to the USDA-Forest Service for wildfire risk reduction activities, including community wildfire defense grants, mechanical thinning, controlled burns, the Collaborative Forest Restoration Program, and firefighting resources. The Department supports the President’s American Jobs Plan goal of maximizing the resilience of our land and water resources and to restore nature-based infrastructure, including investments in protection against extreme wildfires now common in the west.

The conditions on the ground are leading to more frequent and severe wildfires. To date this year, more than 29,000 wildfires have burned over 1.1 million acres of land, and the national preparedness level (PL) is at 4, indicating significant wildfire activity across most geographic areas and a substantial commitment of firefighting resources on a national level. The average PL for this time of the year is PL2. The fire outlook continues to reflect warmer and drier conditions leading to the high potential for severe wildfire activity throughout the western United States through the summer and into the fall.
The Administration agrees there is an urgent need to focus equally on wildfire prevention and mitigation efforts while continuing to carry out core emergency wildfire response activities. Committing substantially more resources to addressing wildfire risk supports the long-term goals of the National Cohesive Wildland Fire Management Strategy—resilient landscapes, fire adapted communities and safe and effective wildfire response. Addressing wildfire risk at this scale is an important science-based step towards a long-term solution to the current wildfire crisis.

Section 8003 provides a total of $1.15 billion to reduce wildfire risk on Department and Tribal lands located in the wildland urban interface or areas located in drinking water source areas. Section 8004 of the draft provides $850 million for restoration initiatives conducted jointly with partners, through grants or contracts on federal and non-federal lands.

As noted above, the Department supports these provisions, but would like to work with the Committee on several technical adjustments to the draft language that we believe would facilitate implementation. With respect to section 8003(d), the Department of the Interior shares the Committee’s concerns about ensuring adequate pay for wildland firefighters and will be working with the Office of Personnel Management in seeking solutions that address those concerns. The Administration is studying the specific provisions of section 8003(d) and will be communicating its views at a later time. Additionally, the Department would like to collaborate with the USDA-Forest Service on the development of maps, reports and analyses that help inform wildfire risk. It is important that Tribal partners are equally considered in the availability of grants, particularly under the provisions of Section 8004.

The Department also notes the recurring funding needs associated with possible pay increases for employees engaged in wildland fire prevention and suppression. Maintaining this funding is key to achieving workforce success and the long-term objectives of the draft. Finally, certain additionally authorities will be necessary to maximize implementation of several provisions of this draft, including, for example, consideration of ensuring that the BIA, FWS and NPS are authorized to carry out the Good Neighbor Authority and stewardship contracting authority.
Title IX. Western Water Infrastructure.

Much of the Western United States is facing record drought. California is currently experiencing its third driest year on record, the second two consecutive driest years on record, and the driest year since 1977. In the Colorado River Basin, the period from 2000 through 2021 has been the driest 22-year period in the Basin in more than 100 years of record-keeping and one of the driest in the past 1,200 years based on paleohydrology data. The Pecos and Rio Grande Basins in New Mexico are entering their second consecutive year of extreme drought conditions in a drought cycle that has lasted more than two decades.

The Department recognizes the ongoing and future drought impacts facing the West, which we are working to address on multiple fronts. Drought resilience projects, water efficiency projects, and other water management improvements authorized by the SECURE Water Act, Cooperative Watershed Management Act, and Reclamation States Emergency Drought Relief Act provide critical funding to communities and stakeholders to prepare for and respond to drought.

But demand for these programs has increased as the West continues to be ravaged by the ongoing drought. In addition, ensuring continued progress on implementation of Indian Water Rights Settlements and the Department’s rural water projects are important to the health, safety, and economic development of tribal nations and many rural communities in the West.

Section 9001 of the Energy Infrastructure Act would appropriate $5 billion beginning in Fiscal Year 2022 through 2026 for eligible water storage projects, authorized regional rural water projects, grants authorized by the Secure Water Act, the Cooperative Watershed Management Act, 1991 Reclamation States Emergency Drought Relief Act, and the Reclamation Projects Authorization and Adjustment Act of 1992. Within the amounts provided, some additional integral programs that were included in the President’s American Jobs Plan could be added when considering an infrastructure package.

The Department welcomes the opportunity to work with the Committee to clarify language in Section 9001 and identify capabilities to utilize appropriated funding.
Additional Recommendations

The Administration appreciates that the discussion draft addresses several of the key provisions of the President’s American Jobs Plan. The Administration urges that a final legislative draft include the funding that President Biden has dedicated, $10 billion, to put in place the Civilian Climate Corps, which will provide jobs and training opportunities, connect underserved communities to Federal lands, and do important work on the landscape, like restoring lands, and improving campgrounds and trails.

While the Department is one of many agencies that would receive funds through the proposal, the Department has a long history of success with public service and conservation corps programs, such as this.

In addition, a significant portion of lands under the Department’s jurisdiction are in or near small, rural towns across the country, and the lands we manage are important to the local economy and the overall environmental quality of the area. The Administration believes this important program will benefit these communities in just those ways – resulting in healthier lands and waters where these citizens live and standing up new conservation jobs, providing work experience and training.

The Administration also urges that Congress include in any final bill investments proposed in the President’s American Job Plan for Tribal water settlements and dam safety improvements within the provisions of Title IX, Western Water Infrastructure. We believe that funding for these programs is essential to any infrastructure package.

In many places, water resources are now either fully appropriated or over-appropriated. These situations underscore the need for cooperative management of water supplies and highlight the important role that Tribal water rights settlements can play.

The Dam Safety Program continues to be one of Reclamation’s highest priorities. The program mission is to ensure Reclamation’s dams do not present an unreasonable risk to people, property, and the environment. The Reclamation Dam Safety Act of 1978 and subsequent amendments provide the authority for modification of Reclamation dams, as necessary, to address dam safety risks associated with new hydrologic and seismic data as well as issues related to changes in
state-of-the-art design and construction practices for dams. Two of these projects involve very high-cost modifications, with the larger of the two, B.F. Sisk Dam in California, scheduled to initiate construction in 2021.

Conclusion

Thank you for the opportunity to present the Department’s views on this discussion draft. The President has made it clear that this is a top priority for him and for the nation. The draft contains a number of priority provisions for the Department, and we believe that it is a positive start to this important process. The Administration welcomes the opportunity to work with the Committee to put in place necessary and comprehensive infrastructure investments that will create millions of good jobs, address the climate crisis, and clean our environment.

This concludes my statement and I am happy to answer any questions that you may have.
The CHAIRMAN. Thank you.
Mr. French.

OPENING STATEMENT OF CHRIS FRENCH, DEPUTY CHIEF, NATIONAL FOREST SYSTEM, U.S. DEPARTMENT OF AGRICULTURE

Mr. FRENCH. Chairman Manchin, Ranking Member Barrasso, and members of the Committee, thank you for the opportunity to appear before you today. The Energy Infrastructure Act discussion draft before us recognizes key investments critical to the USDA Forest Service and highlights areas detailed in the President’s American Jobs Plan. It offers thoughtful solutions to many of the issues our agency currently faces.

First and foremost, our greatest challenge is to address the wildfire crisis occurring throughout the nation. We must address it at the scale of the problem and bring long-term relief to our firefighters, our communities, and our forests. I am happy to see that the discussion draft addresses this crisis on several fronts. As you know, last year was one of the most devastating fire seasons on record. There were too many lives lost, more than 10 million acres burned, and more than 17,000 structures lost. We find ourselves facing another challenging year. Drought conditions exist in much of the West, and we are seeing record high temperatures. With more than 29,000 fires that have occurred so far this year, we have already raised our national preparedness level to level four, a level we have not been at this early in the season since 2002. We have already deployed more interagency resources and are experiencing more fires than we did at this same point last year. Again, we have a crisis.

To that end, the discussion draft recognizes the need to increase, recruit, retain, and compensate a professional federal firefighting workforce. It recognizes the need to make key investments in technology, predictive services, and state and local firefighting partners. And most imperative, it recognizes the need to reduce the risk of wildfires through restoring our forested landscapes through a variety of federal and state-based programs. As the draft recognizes, federal firefighters need to be properly compensated for their work and the risks they take. Federal wages for firefighters have not kept pace with wages offered by state, local, and private entities in many areas of the United States. I know this firsthand. Early in my career, I started as a GS–4 temporary firefighter. In 1992, I made $7.60 an hour. Thirty years later, that starting pay is $11.60 an hour, an increase of only $4. It is not enough for us to be competitive, to recruit and retain the firefighters, nor does it recognize the risk of the work they do. So we share the Committee’s concerns about the competitive pay and are engaging with the wildland firefighter community and the Office of Personnel Management to find solutions. I look forward to working with you on this important issue.

Next, the Forest Service carries out nearly three million acres of wildland fire treatments a year, but it is not nearly enough. To really make progress, our scientists show us that we need to accomplish two to four times these treatments per year, but they have to be in the right places, where the outcomes of those treat-
ments reduce the risk to our communities. In many cases, these are not the easiest and the cheapest acres to treat, but they are the right acres. President Biden’s American Jobs Plan, through initiatives such as the Civilian Climate Corps, calls for restoring nature-based infrastructure to increase resilience and reduce the risks associated with extreme wildfires. We believe the investments in wildfire risk reduction in Title VIII will make a significant start to reducing the threat of wildland fire communities across the West.

We also appreciate the provisions that invest in ecosystem restoration. We have a lot of work to do on our post-fire restoration needs. For example, wildfires right now create 80 percent of our reforestation needs and the Forest Service is only enabled to keep up with about six percent of that. We have a rapidly increasing reforestation backlog. Provisions in Title VIII that address restoration activities, post wildfire, invasive species, and stream restorations will help us accommodate critical work that often goes undone. It is also important that we remediate National Forest System lands significantly impacted by past use. The Forest Service has inherited more than 11,000 orphaned oil and gas wells, and we appreciate the Committee’s attention to this important issue and support the goal of Section 6001.

Finally, this past year, we saw 168 million users on our national forests, a new record and an increase of nearly 18 million people. We know that national forests and grasslands provide restorative experiences and natural connections that people needed during the pandemic. The Great American Outdoors Act addresses about 20 percent of our deferred recreation maintenance, but there is a need to provide facilities and services that match the surge in visitor demand and that reduce barriers for communities that are not served by our current infrastructure. I appreciate that Title VIII includes acknowledgement of and some additional funding for recreation sites experiencing use beyond their carrying capacity.

Thank you for the opportunity to appear before you today. I would be happy to take any questions.

[The prepared statement of Mr. French follows:]
TESTIMONY of
CHRISTOPHER FRENCH
DEPUTY CHIEF, NATIONAL FOREST SYSTEM
U.S. FOREST SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE
BEFORE THE
UNITED STATES SENATE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
JUNE 24, 2021
Concerning
INFRASTRUCTURE NEEDS, WESTERN WATER AND PUBLIC LANDS, AND THE
DISCUSSION DRAFT OF THE ENERGY INFRASTRUCTURE ACT

Chairman Manchin, Ranking Member Barrasso, and Members of the Committee, thank you for the opportunity to appear before you today to discuss the discussion draft of the Energy Infrastructure Act (EIA). My testimony today will discuss the role of forests as nature-based infrastructure, the threat wildfire poses to maintaining this infrastructure, and funding provided by the EIA to improve forest conditions and other natural resource-based infrastructure.

Forests as Nature-based Infrastructure

The USDA Forest Service manages over 193 million acres of national forests and grasslands across 44 States and territories. These lands amount to approximately 30 percent of all federally managed lands and comprise approximately 8 percent of the land area in the United States. Infrastructure forms a physical link between Americans and their National Forest System (NFS) lands, strengthening communities by providing safe access to the many ecological, economic, and social amenities NFS lands provide. Infrastructure on NFS lands affords access to ranching, farming, logging, outdoor recreation, tourism, and energy production, all of which support thriving small businesses, particularly in rural communities. In addition, people depend on the Forest Service road network to get to schools, stores, hospitals, and their homes.

NFS lands are themselves critical infrastructure supporting the nation’s drinking water supply. Approximately 20 percent of the nation’s fresh water originates on national forests and grasslands. An estimated 180 million people in over 68,000 communities rely on these lands to capture and filter their drinking water. Major U.S. cities that may seem distant from forests also rely on water flowing from NFS lands. Los Angeles, Portland, Denver, and Atlanta all receive a significant portion of their water supply from national forests.

National forests are also part of the nation’s network of public and private forests that serve as the most efficient carbon capture infrastructure mitigating the effects of climate change. Taken together, the nation’s forests and harvested wood products capture the equivalent of more than 14 percent of economy-wide CO₂ emissions in the United States annually.

Wildland Fire Threat to Forests

Devastating wildfires are the most critical threat to the ability of our forests to sequester carbon, support local economies, and provide clean water and other important resources upon which we rely. In the United States, there are over a billion acres at risk of wildland fire. This is, in part, a result of 110 years of fire suppression policies that have led to unhealthy forests. Forest Service research has identified hundreds of communities at high risk of wildland fire.
About 63 million acres, or 32 percent, of the NFS lands are at high or very high hazard for wildfires that would be difficult to contain. The Forest Service carries out approximately 3 million acres of fuels treatments annually. Unfortunately, this is not at the scale necessary to address the problem. Without a paradigm shift in the way we treat hazardous fuels on federal and non-federal land, and addressing the impacts of climate change, we will remain in this current wildfire crisis and destruction from wildfires will continue to threaten communities across the West.

Forest Service research indicates we need to dramatically increase the extent and impact of fuels treatments such as thinning, harvesting, planting, and prescribed burning across all landscapes. To make progress, we estimate that two to four times more acres than are currently treated each year need to undergo fuels reduction treatments. Our scientists have developed scenario planning tools to help target fuels treatments in strategic locations that will reduce fire size and severity. Our estimates suggest approximately 20 million acres of NFS land and 30 million acres of other federal, State, Tribal and private lands in the West need treatment over the next ten years in order to significantly reduce wildfire exposure to communities. USDA included these estimates among recommendations for decreasing the risk of severe wildfire in the Climate-Smart Agriculture and Forestry Strategy provided in response to Executive Order 14008: Tackling the Climate Crisis at Home and Abroad.

President Biden’s American Jobs Plan calls for restoring nature-based infrastructure to increase resilience and reduce the risks associated with extreme wildfires. USDA supports additional investments in wildfire risk reduction and ecosystem restoration. We believe such investments will help make significant progress in reducing the threat of wildland fire to communities across the West.

Section 8003: Wildfire Risk Reduction

Section 8003 of the EIA would provide $3.5 billion to USDA and the Department of the Interior (DOI) for activities that involve responding to and mitigating the threat of wildland fire. These provisions include increased funding for: salaries and expenses of hardworking and dedicated federal wildland firefighters; mapping hazardous fuels treatments and their relation to wildfires; technology related to detecting and managing wildfires; the Collaborative Forest Landscape Restoration Program (16 U.S.C. 7303); mechanical thinning and timber harvesting focused on small diameter trees; community wildfire defense grants; increasing use of prescribed fire and implementation of fuel breaks; modifying and removing flammable vegetation on Federal land; post-fire restoration; and other important provisions that would greatly assist federal agencies, States, and local communities in reducing the threat of wildland fire. If funding through these provisions is not obligated within five years of enactment it would be returned to the Treasury. USDA supports additional investments in each of these areas and would like to work with the Committee on technical suggestions related to this section.

This section also directs USDA and DOI, in coordination with the Office of Personnel Management, to establish a new “wildland fire manager” occupational series. The new series would not affect hazardous duty differential pay and would provide current wildland firefighters with the option to either remain in their current occupational series or convert to the new “wildland fire manager” series. Starting in Fiscal Year 2022, USDA and DOI will seek to convert no fewer than 1,000 seasonal wildland firefighters to permanent, full-time, and year-round wildland fire managers who hold responsibilities for reducing hazardous fuels on federal
land. Section 8003 also increases the base salary of wildland firefighters and wildland fire managers in cases where their hourly pay is below the state minimum wage or their position is in a location where recruitment or retention is difficult. The Forest Service shares the Committee’s concerns about ensuring competitive pay for wildland firefighters. We are engaging with the Office of Personnel Management and the wildland firefighter community in seeking solutions that address this need.

Section 8003(c) provides an additional $100 million for implementing Collaborative Forest Landscape Restoration Program (CFLRP) projects established under 16 U.S.C. 7303. Section 8003(e) requires USDA to solicit new proposals, allows planning costs to be included, discontinues funding of any proposal selected prior to September 2018, and creates new selection criteria for projects, including consideration of acres in the wildland-urban interface or a public drinking water source area and costs per acre to be treated. USDA supports additional funding for the CFLRP. We would like to work with the Committee, as the new criteria would likely affect projects that have been submitted and approved for funding, projects that were eligible for extension under the 2018 Farm Bill provision, and the types and locations of projects eligible for future CFLRP funding.

USDA supports the concept of a Community Wildfire Defense Grant Program, however we would like to work with the Committee to ensure that we don’t have duplicative and competing programs for community defense. Implementing community defense projects consistent with Community Wildfire Protection Plans (CWPP), in areas with high or very high hazard potential, that are low-income, or in a community impacted by a severe disaster is an important component of a national effort to reduce risk to life and property from wildfire.

Section 8003(g) amends Section 10 of the Cooperative Forestry Assistance Act (16 U.S.C. 2106) by limiting funding to any city, town, or unincorporated area that has a population of not more than 10,000 inhabitants. Further, this section changes eligibility for assistance by requiring States to seek to improve fire data submitted to the National Fire Incident Reporting System and requiring a county in which a volunteer fire department is located to adopt an ordinance or regulation that requires the construction of new roofs on buildings before State Fire Assistance or Volunteer Fire Assistance funds can be disbursed. USDA would like to work with the Committee to ensure there are no unintended consequences to existing program delivery should these provisions be enacted.

**Section 8004: Ecosystem Restoration**

Section 8004 provides $2 billion to USDA and DOI for various activities designed to improve ecosystem health. If the funding is not obligated within five years of enactment it would be returned to the Treasury. Of the funding provided to USDA, this section would be used to:

- Enter into landscape-scale contracts, including stewardship contracts, to restore ecological health on federal land;
- Provide funds to States for implementing restoration projects on federal land through the Good Neighbor Authority (16 U.S.C. 2113a);
- Provide financial assistance to establish or improve sawmills and wood processing facilities that process byproducts from restoration projects;
- Award grants to States to establish rental programs for portable skidder bridges that minimize stream bed disturbance on federal and non-federal land.
Detect, prevent and eradicate invasive species at points of entry and grants for eradication of invasive species on non-federal land and on federal land;
- Restore, prepare or adapt recreation sites that have or may likely experience use beyond their carrying capacity;
- Restore native vegetation and mitigate environmental hazards on federal and non-federal previously mined land; and
- Establish a collaborative-based, landscape scale restoration program to restore water quality or fish passage on Federal land.

USDA supports additional investments in each of these areas. We would like to work with the Committee on technical suggestions related to this section, and look forward to working with the Committee to explore other areas where further investment is warranted.

Other Natural Resources-Related Provisions

There are several other provisions in the EIA that relate to natural resources managed by the USDA Forest Service including:

Civilian Climate Corps

Section 8003(c)(15) of the EIA provides $200 million for removing flammable vegetation on federal land and, to the extent practicable, producing biochar through the use of the Civilian Climate Corps established pursuant to E.O. 14008. USDA supports the use of the Civilian Climate Corps under this provision, and also would like to work with the Committee to make further investments that will mobilize the next generation of new, diverse conservation and resilience workers in restoring our public lands as proposed in the American Jobs Plan.

Legacy Roads and Trails Program

Section 8001 would require the Secretary to establish the Legacy Roads and Trails Remediation Program. This program supports restoring fish passages, road decommissioning, preparing roads for long-term storage, relocating National Forest System roads, and converting NFS roads to trails. If enacted, the program will require the Forest Service to establish an annual process for selecting long-term storage and road and trail decommissioning projects, and to solicit public comment on these projects. The program prioritizes projects that: protect or improve water quality; restore habitat of threatened, endangered, or sensitive species; and maintain future access for the public, permittees and firefighters. In implementing the program, the Forest Service is required to ensure that the system of roads and trails is adequate to meet any increasing demands, provides for multiple use and sustained yield of products and services, does not damage adjacent resources, and reflects long-term funding expectations. USDA supports reestablishment of the Legacy Roads and Trails program.

Orphaned Well Site Plugging, Remediation, and Restoration Program

Section 6001 of the EIA includes the “Revive Economic Growth and Reclaim Orphaned Wells Act of 2021” (S. 1076). USDA provided written testimony to the Committee on S. 1076 on June 16, 2021. USDA appreciates the Committee’s attention to this important issue and supports the goal of S. 1076, the “Revive Economic Growth and Reclaim Orphaned Wells Act of 2021,” to remediate the thousands of orphaned oil and gas wells on federal and non-federal lands.
S. 1076 directs the Secretary of the Interior in cooperation with the Secretary of Agriculture to establish a program to identify and permanently plug and remediate orphaned wells located on federal lands. Additionally, the bill requires the DOI to establish a Tribal grant program administered by the Bureau of Indian Affairs and a State program administered by the DOI that would enable qualifying Tribes and States to undertake the same type of activities.

As noted in USDA’s June 16th testimony, most orphaned wells on NFS lands originated in areas of split estate and non-federal development before the federal government acquired the land. S. 1076 does not specifically address the issue of split estate and how non-federal development before the federal government acquired the land would be addressed under the federal program or under the State grant programs. If the intent is to manage these wells under the federal program, we would welcome the opportunity to work with the Committee to clarify the definition of federal land and the mechanisms for addressing these wells under the bill. In addition, the administration supports the strengthening of federal bonding regulations to ensure that proper financial assurances are in place before development occurs to avoid exacerbating the issue of orphaned wells in the future.

Tree Planting
Tree planting is a critical component of ecosystem restoration given its role in mitigating climate change, increasing carbon storage in forests, providing resilience in the face of invasive pests, and creating and maintaining ecological services vital to this nation. The National Forest System has planned reforestation activities on over 1.3 million acres of forestlands. These plans represent only about one third of NFS reforestation needs, which are estimated at four million acres. Wildfires create over 80 percent of reforestation needs, including approximately one million acres that burned with high severity in 2020 alone. The Forest Service currently addresses only 6 percent of post-wildfire replanting needs per year, resulting in a rapidly expanding list of reforestation needs from wildfire and other natural disturbances. To meet this challenge, we must dramatically increase the rate of reforestation on the national forests. Current funding, provided through the Reforestation Trust Fund, is capped at $30 million per year. Therefore, USDA recommends adding a provision to eliminate the cap on the Reforestation Trust Fund, as has been proposed in the REPLANT Act. This additional provision would close the funding gap and enable national forests to address reforestation needs now and into the future.

This concludes my testimony. I welcome any questions the Committee may have.
The CHAIRMAN. Thank you.
Dr. Eakin.

OPENING STATEMENT OF DR. DOUGLAS HOLTZ-EAKIN,
PRESIDENT, AMERICAN ACTION FORUM

Dr. HOLTZ-EAKIN. Chairman Manchin, Ranking Member Barra-rosso, members of the Committee, thank you for the opportunity to be here today to discuss this important and very timely issue. I think I would like to make three brief points and then I would look forward to answering your questions.

First, is that Congress and this Committee have the opportunity to do something very important by investing in productivity and long-term growth in the United States. The Administration’s budget, which is more optimistic than the CBO, shows long-term growth at two percent or a little bit below. Investing in core productive infrastructure of the type contemplated by this Committee is a way to raise that productivity growth and benefit Americans in all walks of life. It is the most important single economic indicator over the long term. The composition of the spending is the key there. This has to be things that raise productivity. And so, even though there are going to be other demands for taxpayer dollars, focusing on those core infrastructure areas and avoiding spending money on things which will not raise productivity, is probably a key design issue for this Committee and for the Congress.

The second thing is that it can do that without exacerbating the risk of higher inflation that we are experiencing right now. This spending would be very different than that in, for example, the American Rescue Plan (ARP), which is one of the things that has fueled the rising inflation. We have seen in the first half of 2021 an increase in inflation across the board. We saw the highest core CPI since June 1992 in the Mace statistics. We see supply chain price increases. We see producer price increases. Asset prices have been extremely high and volatile. All of this is a tribute to the kind of over-stimulus that came from the front-loaded $1.9 trillion that we saw in the ARP. This Committee and the Congress can backload this plan and pay for it in its entirety, avoiding the inflationary risks, but at the same time supplementing the pace of long-term economic growth and that, I think, would be a tremendous design opportunity for the Committee and for the Congress and I encourage you to take advantage of it.

The third point I would like to make about the programs that are in the jurisdiction of this Committee is that investment in energy infrastructure is what the private sector does. Over the past 10 years, if you look at Department of Energy and other government programs, they spent about $30 billion on investments in energy. In 2020, hardly a banner year for the U.S. economy and for investment, the private sector invested $85 billion in clean energy efforts. So in thinking about your policy goals, remember, it is the private sector that is going to provide the money, whether it is done through paying taxes, buying the bonds that the Treasury tries to sell, or investing their own dollars and giving them appropriate incentives, is what the market has done. We have seen the market apply profits tests to different projects and reward innovation in clean energy. That is at the heart of being successful in addressing
the climate goals that the nation has set out. And so I would en- 
courage you to take advantage of the private sector in the design 
to use it for project selection and innovation and to allow the econ- 
omy to continue to innovate and grow more rapidly. That would 
meet all the tests of improving the long-term outlook for economic 
growth, improve the long-term outlook for the planet and the cli- 
mate and avoiding near-term risks of inflation, which could be 
damaging to fixed-income seniors and low-income Americans. 
I thank you for the chance to discuss this today. 
[The prepared statement of Dr. Holtz-Eakin follows:]
Infrastructure Investment and the Economic Outlook

Douglas Holtz-Eakin
President, American Action Forum

June 24, 2021

"The views expressed here are mine alone and do not represent the position of the American Action Forum. I thank Ewelina Czapla for her assistance."
Chairman Manchin, Ranking Member Barrasso, and members of the committee. Thank you for the privilege of appearing today to discuss infrastructure investment and the economic outlook. I hope to make three main points:

- The federal government has a natural role in the provision of infrastructure, and an effective infrastructure strategy can raise trend productivity.
- At present, the economic risks tend toward over-stimulus and inflation. Care should be taken not to exacerbate these risks.
- The design of an infrastructure strategy should reflect the above two considerations and take advantage of the natural role for the private sector in broadband, energy, and other sectors.

Let me discuss these in turn.

**The Economics of Infrastructure Investment**

The basic economics of public infrastructure are straightforward. Highways, to take a concrete example, can be shared among many drivers and benefits everyone simultaneously. Once it is provided for one trucker or driver, will be available for all. For this reason, conventional private market methods often work poorly in providing the right amount of infrastructure, and the public sector becomes involved.

That does not change the fact that the infrastructure is valuable and provides benefits to the population. If a $100 infrastructure investment provides $B on average annually in benefits to the population over its lifetime, the social rate of return on investments is $B/100 or $b per year.

The resources to make this investment must be drawn from the private sector via taxes or borrowing. This reduces the funds available for private investment by (in the example above) a corresponding $100, which eliminates a potential investment by the private sector.

If the rate of return on the private sector investment is \( r \), then the economics of infrastructure investment can be reduced to the canonical question: Are the benefits greater than the costs? In this instance, is \( b \) bigger than \( r \)? If so, it makes sense for public policy to engender infrastructure investment. In particular, if there are productivity-enhancing infrastructure investments where \( b > r \), then the infrastructure will raise the productivity of the overall economy.

**The Near-Term Outlook**
The broad principle outlined above applies to the long-run, trend growth in the economy. This has hardly been the focus of recent policy discussions. Following the precipitous decline in early 2020, the economy began to recover. The chart, below, reproduces the outlook at the time of the passage of the American Rescue Plan (ARP) in March 2021. It shows recent quarterly growth rates of gross domestic product (GDP) and reproduces the recent economic projections of the Congressional Budget Office (CBO). The blue bars represent the quarter-by-quarter growth rates of GDP (at an annual rate), while the orange bars measure the “output gap” – the difference between the actual level of GDP and the potential for GDP when economic resources are fully employed – as a percentage of potential GDP.

The chart carries two lessons. The first is that the economy was growing and growing rapidly (over 6 percent in the first quarter) at the time of the passage of the ARP. Clearly, the economy was far from recession territory and certainly not a disaster. As a consequence of that growth, the output gap was expected to fall below 2 percent by the middle of this year and below 1 percent by the end of 2022.
In sharp contrast, the ARP was advertised as much-needed stimulus to reverse the course of the economy and restore growth. As noted above, the economy was not in recession and was expected to grow. Moreover, recall that the “theory” of stimulus is that when the economy is below full employment, government stimulus—tax cuts, checks, spending—will boost spending. This will, in turn, stimulate business activity, which will begin a virtuous cycle of additional income to workers, more spending, and more hiring. Because of the virtuous cycle, $1 of stimulus is expected to have (much) more than a $1 impact—the “multiplier effect.”

That’s the theory; it just has nothing to do with the current situation and policy debate. Taking the stimulus theory at face value, the $1.9 trillion size of the package eclipses the economic need. As noted above, currently, real GDP is below potential GDP with the output gap somewhere in the vicinity of $450 billion (in 2012 dollars). The $1.9 trillion proposal is a bit over $1.6 trillion in 2012 dollars. Thus, the ARP was over three times the size of the output gap that was needed to be closed to get the economy back to potential at the time of its passage.

Based on any reasonable economic theory of stimulus, $1.9 trillion was far too large. It was an especially egregious policy error given that Congress had just passed $900 billion in stimulus in December 2020. The result will be overheating that will lead to inflated asset prices, inflated prices for goods and services, and an increased risk of economic turmoil.

**The Inflation Outlook**

Due to the unique circumstances of COVID-19, stimulus will enter the economy in stages. Initially, a large amount will be saved as households are unable to make purchases in large swaths of the service sector, especially leisure and hospitality. Thus, the initial impact will be on the prices of assets such as equities, housing, and other savings vehicles. Indeed, the first half of 2021 to date has experienced sharp rises in the stock markets, housing values, commodities, crypto-currencies, and a wide array of asset prices.

These pricing pressures are now showing up in the markets for goods and services. Shown in the chart below are the year-over-year growth rates of the “core” (non-food, non-energy) Producer Price Index and Consumer Price Index (CPI). It is quite clear that since the start of 2021 inflation has been rising and rising sharply.

This raises the question: What next?

I don’t think sustained high inflation is by any means automatic. In the late 1960s policymakers ran the economy very hot—averaging actual GDP 3 percent above potential GDP— for 24 straight quarters, and the result was 15 years of inflation that the Fed ultimately tamed. The ARP is a big mistake, but (thus far) a one-time error. Nevertheless, the data are giving me pause.
In the latest (May) report, year-over-year CPI inflation was 5 percent, the highest in 13 years, while year-over-year core inflation was 3.8 percent, the highest since 1992. Unfortunately, looking over the full years masks the recent, sharp moves in inflation. Core CPI inflation has averaged 6.0 percent in 2021, and much more recently: It rose at an annual rate of 10.4 percent in April and 8.8 percent in May. Things are heating up.

That said, the only way for inflation to become sustained is for wages to start rising as well, producing a wage-price spiral. There is nascent evidence of this as well. Average hourly earnings (for non-supervisory and production) workers averaged 5.5 percent growth in 2020, but rose 9.4 percent and 6.8 percent in April and May, respectively.

So, there are early signs of rising inflation. What would it take to transform it into a lasting phenomenon? Well, for starters, inflation expectations will have to rise, so that people start asking for wage increases in advance to cover anticipated inflation. Expected inflation, as reported in the Michigan consumer sentiment data, has shifted up recently. If this continues, the wage-price spiral can become cemented in the economy.
But the greatest risk is that policymakers continue excessive fiscal stimulus, which would replicate the failure of the late 1960s.

**Key Issues in Designing an Infrastructure Strategy**

The discussion thus far suggests two important criteria for designing an infrastructure program: focus and timing. Consider first the focus of any program. There are a multitude of potential infrastructure investments, and it is not a matter of some of them being “good” and the others “bad.” For example, the administration’s American Jobs Plan contains $400 billion for “creating jobs and raising wages and benefits for essential home care workers.” This will be alluring in some quarters but will not raise overall productivity in the economy. As noted above, the key is to generate better trend growth.3

Similarly, the AIP’s $328 billion to “Improve Housing Stock, Modernize Schools and Child Care Facilities, and Upgrade VA Hospitals and Federal Buildings” is hardly economy-wide, productivity-enhancing infrastructure. Despite any well-intentioned efforts to the contrary, Congress should focus closely on core, productivity-enhancing infrastructure.

The second issue is the timing of the investment program and the associated payoffs. As noted above, the greatest risk is for fiscal policy to be too stimulative early in the 10-year budget window. Thus, the investment program should focus the spending in the final eight years. And in designing the budgetary offsets, emphasis should be on making sure the initial years are paid for (or more) to reduce the risk of dangerous overheating.

A final consideration is the role of the private sector. This discussion is about the use of (substantial) taxpayer resources to increase infrastructure investment in the United States. But that does not mean that the federal government should be making direct investments across the economy. For example, the importance of expanding broadband infrastructure to bridge the digital divide has become a clear national priority. The existing evidence is that private-sector internet service providers are far more nimble, innovative, and dynamic than the municipal broadband efforts singled out by the administration, however.

**Energy-Sector Infrastructure**

As another example of the importance of the private sector, consider energy infrastructure. In 2020, global energy investment declined by about 10 percent due to COVID-19 but is expected to rebound in 2021 to nearly the same levels as 2019, about $1.9 trillion annually. Global investment in the power sector, in particular, is expected to be $820 billion in 2021, according to the International Energy Agency’s World Energy Investment 2021 report. The vast majority of this is undertaken by private-sector entities.
Investment in the deployment of low-carbon technologies has grown over the past two decades as technologies have matured and become more cost effective. According to BloombergNEF, investment in low-carbon energy infrastructure (the development of renewable energy sources, carbon capture and sequestration, and electrified transport, among other facilities) has grown globally from just $31 billion in 2004 to over $500 billion in 2020. Despite the impact of COVID-19, there was a 9 percent year-over-year growth in 2020. Investment in the United States, which totaled $85 billion in 2020, is second only to China.\(^5\)

Government investment in energy infrastructure, in the form of grants and loans, has consistently been significantly smaller than the private sector. The Department of Energy’s (DOE) Loans Program Office provides direct loans and loan guarantees to incentivize private investment for innovative energy and advanced vehicle technology manufacturing projects. It has disbursed a total of $30 billion during the past decade, which resulted in 18 operational projects.\(^6\) The DOE’s grant programs for improved energy efficiency and the reduction of energy waste, administered in cooperation with state, tribal, and local governments, received $375 million in funding in 2020.\(^7\) Government programs tend to provide funds to those who would not otherwise receive them, but they do not match the scale of annual private-sector investment in the low-carbon energy transition.

In addition, the private sector supports investment in the companies seen to be innovating in the energy sector. In 2020, market confidence in the energy transition led to a 142 percent increase in the value of clean energy shares while oil shares fell.\(^8\) Private investment afforded to companies and projects alike in the United States is unmatched. It has efficiently led to the growth of low-carbon technologies on a national scale rather than supporting a handful of projects perceived to be too risky.

Thank you, and I am happy to answer your questions.
Notes

1 I adjusted the CBO projection because the actual GDP for the fourth quarter of 2020 is below the CBO projection. I raised the growth rates of GDP in the first half of 2021 to reach the projected level in Q3 of 2021.

2 https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/


4 https://www.iea.org/reports/world-energy-investment-2021


7 https://www.energy.gov/eere/wipo/about-weatherization-and-intergovernmental-programs-office

OPENING STATEMENT OF COLLIN O’MARA, PRESIDENT AND CEO, NATIONAL WILDLIFE FEDERATION

Mr. O’MARA. Thank you, Chairman Manchin. Good to see you, Senator Barrasso, and members of the Committee. I cannot think of a better Committee to be having this conversation with than the Committee that last year in the previous Congress managed to pass the Great American Outdoors Act public lands package, as well as the Energy Act of 2020. And the work that this Committee did over those two years has laid the foundation for so many of the items that you are proposing for investment today. So I just want to thank you for the great bipartisan leadership that we see in this Committee.

Now, the time in which we are talking about these investments, coming back to where Senator Wyden started just a few minutes ago, the landscape is rough right now. You know, we are looking at wildfires—at least 39 major fires across the country—already at half a million acres burned across the West, 40 million acres burned over the last five years, and that is on top of the challenge we are having with drought conditions that are at record levels all over the West, as well as an above-average hurricane season they are anticipating in the East. To have an infrastructure package that is so well climate-informed is truly historic. I am greatly appreciative of all the language in this bill that does conform, in great ways, with the American Jobs Plan that President Biden put out, but also showing that some of these investments are bipartisan. I just wanted to use my few minutes today to highlight five areas that I think are important to keep in the package, maybe a few ideas for tweaks and improvements, but again, just thanking all of you for coming together to show that we can work across the aisle on these important issues to both advance our climate goals and our economic competitiveness and productivity goals.

In the energy innovation and industrial sector, thank you for including the level of funding that you are proposing—for carbon capture and sequestration and the nuclear investments. We do think there are opportunities to go bigger on the renewable side and the energy efficiency side, but again, these are wildly popular proposals—75 percent of the American people support energy innovation deployment of these technologies. We would encourage you to plus-up Title X. I think there are more opportunities to reduce criteria pollution in the carbon capture space and that is something we would like to work with you on because there are concerns about the pollution that comes from some of these technologies. The technology is actually showing that you can achieve significant reductions in sulfur dioxide, particulate matter, and mercury as you are applying these technologies, not so much on NOx, but it is an area for potential bipartisan work to make sure those technologies are both capturing carbon as well as other pollutants.

We are incredibly excited about Chairman Manchin’s leadership on abandoned mines and orphaned wells, also working closely with folks like Senator Cramer, Senator Luján, so many others, Senator Hoeven, Senator Heinrich, on cleaning up our mines and wells. The
funding levels are fantastic. Proposing them at the same level of the American Jobs Plan is a great start. We strongly support Senator Manchin’s call for AML reauthorization, an incredibly important program because, as the Chairman said, $11 billion, as big of a number that is, it is not going to clear the backlog. We have much more there. The $4.7 billion proposed for orphaned wells—again, a great start—but we have tens of billions of dollars in need there.

We would also encourage the Committee to look at hardrock cleanup costs, as well as abandoned uranium mines. That backlog is just getting bigger and bigger. We need to look at 1872 as part of the conversation, but this is a huge opportunity to make a down payment and, frankly, put people to work in the places where we need them most right now. I would also encourage the Committee to complement this conversation with conversations around 1872—the General Mining Act, as well as oil and gas binding requirements, so we are not in the same mess 20 years from now as additional wells and mines go offline and require cleanup, so we do not wind up in the same place again.

The third place is on the forestry piece and kind of picking up on my friend Chris’s comments, it is fantastic that the forestry language is in here, the fire language, the ecological restoration. It is not nearly enough. You know, we estimate we need an almost $60 billion investment in our forests over the next five years, at least $33 billion of that should go to the Forest Service. And we also need a lot more resources for the Bureau of Land Management (BLM). We estimate more than $6 billion of need for the Bureau of Land Management. A lot of the fires that are starting right now are not starting in our forests, they are starting in our grasses. It is our buffalo grasses. It is our cheatgrasses. These invasive grasses that are growing like crazy when it is wet and then all of a sudden when the drought comes, you know, all of a sudden, they are tinder for everything. A huge opportunity to put people to work and frankly, protect a lot of other assets and communities.

Two last quick ones on critical minerals. We are really excited that we are having a serious conversation. The idea of having a supply chain that is controlled by the Chinese or in the Congo or other places is unacceptable. We want to do it safely. You want to make sure that we are recycling more and we appreciate Senator King’s leadership on recycling. We think there is a big opportunity there. We also think there are some places we should protect. And again, there is some language around 1872.

And also, we are just very supportive of the language around transmission and carbon pipelines. Some of those innovative parts of this package are in the transmission space. We strongly encourage you to keep them. We appreciate Senator Heinrich’s leadership and Senator Cantwell’s leadership about the things around regionalism, around regional planning, loan authority. Bolstering the authority is absolutely important work. And finally, with my last few seconds, we would encourage this Committee to continue working with other committees on things like the Civilian Conservation Corps, the Clean Energy Standard, working lands, and the Clean Energy Tax Credits.

And with that, Mr. Chairman, I will yield back my one second.
Laughter.

[The prepared statement of Mr. O’Mara follows:]

Testimony of Mr. Collin O’Mara
President and CEO of the National Wildlife Federation
United States Senate Committee on Energy and Natural Resources
June 24, 2021

Chairman Manchin, Ranking Member Barrasso, and members of the Committee, thank you for inviting me to testify today. I am here on behalf of the National Wildlife Federation, the nation’s largest member-based conservation group representing more than six million wildlife and outdoor enthusiasts and 53 state and territorial affiliates across the country.

The work the Committee is undertaking to forge 21st century infrastructure solutions is critical and life-saving. We of course need such investments for economic competitiveness and job creation, but such investments are equally important to our safety and health. A recent report released from a panel of international scientists earlier this month makes another clarion call to put the planet on a path toward a sustainable, healthy future by significantly reducing greenhouse gas pollution—or pay a disastrous price through extreme weather events, devastation of agricultural production, and international conflict over natural resources. The authors suggest that our human well-being relies upon both tackling the climate crisis and the biodiversity crisis.

The two are intertwined in both the causes and solutions. This is not an intellectual problem in the abstract. It is an urgent problem. We are inextricably tied to nature. Consider just one example: one-third of our food comes from wild pollinators. It makes for a simple deduction—what befalls nature befalls us. That’s why your work both in this Committee and across Congress is so crucial now. By saving nature, we save ourselves.

As the Committee’s discussion draft of the bipartisan Energy Infrastructure Act of 2021 illustrates, we have two allies in the critical work ahead: technological innovation and restoration of natural systems. The first, technological innovation: humans have shown over and over again how to solve problems. Innovation is at the core of what must drive the solutions to rebuild our nation’s crumbling infrastructure, reduce the vulnerability of our grid, adopt cleaner sources of energy, revitalize communities, reduce pollution, restore degraded ecosystems, and avert the climate crisis. Our second ally is nature—natural infrastructure has delivered services for millennia: it protects communities from extreme weather and provides the air we breathe, the clean water we drink, the food we eat. Until the industrial era, it kept the carbon cycle in check. It is an elegant, engineering marvel and supports all life as we know it.

Through innovation and natural infrastructure, we can and must set ourselves on the path to a livable, sustainable future. It won’t be easy but it will be full of opportunity. Investment in clean energy, manufacturing, innovation, natural infrastructure restoration, resilience, and reclamation will create millions of good-paying jobs across the country and launch new small businesses, while making our communities safer, healthier, and more prosperous. Doing this in a way that creates well-paying, family sustaining jobs through prevailing wage jobs, is essential to ensuring that more American families benefit from these essential investments.

Just as we need a whole-of-government approach to solve the climate and biodiversity crises, we will need all of Congress. It’s appropriate that this particular Committee, with its long history of
bipartisanship and comity, is leading this conversation. This Committee’s inspired work during the last Congress on the Great American Outdoors Act, the John D. Dingell, Jr., Conservation, Management, and Recreation Act, and the Energy Act of 2020, showed that significant bipartisan solutions can be forged for both our natural resources and technological advancement.

The bill before you today, the Energy Infrastructure Act, represents a solid foundation and the broad suite of tools available to the committee to help us transition to a clean energy economy. We believe it provides numerous critical investments in clean energy and infrastructure projects that will put Americans back to work, support the transition to clean energy solutions, and ensure our public lands and waters help drive climate and biodiversity solutions. We also believe that many parts of this bill are entirely consistent with the parts of the President’s American Jobs Plan that are within this Committee’s jurisdiction. This bill alone cannot solve all of the challenges we face, but it’s a critical first step and we look forward to working with this Committee and other Committees to ensure the sum of all the parts rises to the moment.

**Clean Energy**

This bill represents the most significant investment in our committee’s history to address the 20 percent of greenhouse emissions that come from the industrial sector, as well as advancing significant investments to reduce pollution in the power sector—and it does so in ways that support the creation of good-paying jobs, advance domestic manufacturing, reduce criteria pollution, lower energy bills, and build a competitive advantage developing technologies to export around the globe.

By funding critically important research and deployment programs, providing decarbonization assistance to states and manufacturers, and directing planning for modern transmission and electrification of the transportation sector, the bill puts forward a thoughtful approach to readying the grid for the future we need. That future requires a massive expansion of renewable and other clean sources of electricity, deployment of carbon capture, utilization, and storage, and smart technology to improve industrial and building efficiency. The bill also recognizes the threats posed to our energy systems by climate change itself, and invests in strategies to improve resilience and reliability in the face of increasingly severe weather events.

**Innovation**

We are excited to see all of the authorizations that were thoughtfully developed as part of the incredible bipartisan leadership from then-Chairman Murkowski and Senator Manchin in the Energy Act of 2020 being fully funded through this bill. The bill’s emphasis on funding critical studies, pilot projects, and demonstration, are each essential to accelerating the development and commercialization of energy storage, carbon capture, utilization, and storage, hydrogen, advanced nuclear, rare earth elements, renewables, and direct air capture technologies. We appreciate the countless synergies between these sections and the President’s American Jobs Plan.
Industrial Sector
We are pleased that the bill emphasizes the importance of reducing emissions in the industrial sector through carbon capture, utilization and storage, and other process improvements. To meet our 2030 and 2050 climate goals, we will need to capture, remove, and store more than a gigaton of carbon dioxide annually through technological and natural means, even while cutting emissions at the source. And, early research is showing that carbon capture retrofits can also achieve significant reductions in criteria pollution from particulate matter, sulfur dioxide, mercury, and heavy metals (we still have more work to do to reduce oxides of nitrogen) that are currently harming the health of too many Americans, particularly frontline communities.
Ensuring that carbon capture technologies also achieve demonstrable improvements in air quality is going to prove essential to building the public support necessary for widespread deployment.
We appreciate the leadership of Senators Manchin, Barrasso, Cassidy, and so many other in this area.

We’re also encouraged by the Energy Infrastructure Act’s proposed investment in the buildout of infrastructure to carry carbon dioxide from where it is captured to where it can be used or stored. We urge that these investments prioritize and incentivize reuse and expansion of existing infrastructure and existing right-of-ways, as envisioned by the SCALE Act.

Transmission
We greatly appreciate all of the Committee’s attention to transmission expansion. Strengthening the Department of Energy (DOE) authority to enact a national transmission plan that is optimized across states and regions is critical to meeting our national needs, as we’ve seen in recent months. The transmission loan authority for DOE in Section 1007 is particularly thoughtful and could be expanded, because it solves the long-standing chicken-or-egg problem of undersized transmission or delayed projects due to the traditional user pre-pay model. We also encourage further simplification of FERC backstop siting authority, as well as additional resources for cost-sharing interregional transmission lines and the Smart Grid Investment grant program to facilitate greater collaboration and engagement.

We would also encourage that, similar to the SCALE Act, transmission and carbon pipeline projects prioritize buildout of existing infrastructure and existing right-of-ways wherever possible, instead of breaking new ground and further fragmenting wildlife habitat. We believe there are financial and permitting incentives that could drive infrastructure to places that make the most sense economically and ecologically. We also urge the committee to include requirements that the Department of Energy analyze local environmental impacts of new infrastructure and encourage early community engagement.

Renewable Energy
Wind, solar, and geothermal are being deployed at scale today, but could be adopted even more quickly to meet climate goals with additional direct investment and incentives. We urge the committee to work closely with Chairman Wyden and the Finance Committee on these direct incentives to accelerate clean energy deployment, while also considering enhancements to the Department of Energy’s various loan programs and grants for renewable energy resource deployment to help speed the transition, particularly in disadvantaged communities and those on the frontlines of climate change and harmful pollution. Further, we encourage the Committee to
continue working with your colleagues on Environment and Public Works to develop an emission-based clean energy standard and with Finance on carbon pricing mechanisms that would complement these critical infrastructure investments and further accelerate deployment.

**Critical Minerals**

In order to transition to a clean energy future, this country will rely on a variety of critical minerals and we would much rather safely secure these minerals here than face the national security risk and environmental degradation that will continue if the supply chain is primarily abroad. It’s unconscionable that we currently depend upon cobalt mined by children in the Congo and other minerals sources largely from unstable or antagonistic nations. We appreciate this Committee’s attention and Senator Murkowski’s commitment to this issue.

We applaud the bill’s requirement to assess existing closed and abandoned mines for the potential of sourcing these critical minerals and rare earth minerals. We urge the committee to complement this effort with significant incentives to increase the recycling and reuse of these minerals. Today, less than one percent of rare earth elements are recycled. It’s essential that we drive more private investment and emphasis on the importance of recycling as a means of curing supply shortages of not just critical mineral and rare earth elements, but also materials like copper that are necessary for a range of renewable technologies. We encourage the Committee to build upon the existing Section 2008 on battery recycling and consider adding Senator King’s Battery and Critical Mineral Recycling Act of 2021 to the package.

We’d also like to continue to work with the Committee on several other provisions related to mining. We’d urge caution on some of the permitting provisions, as the GAO has found that federal mine permitting averages two years which is consistent with other nations and that most delays are usually due to a failure of the mining company to provide sufficient and timely information to the permitting agency.

We also believe that as part of a larger conversation about increased domestic mining that there are additional places worthy of permanent protection, such as the Boundary Waters, Greater Grand Canyon, Bristol Bay, Chaco Canyon, Oak Flat, etc., and that there are bipartisan conversations to be had on modernizing the 1872 General Mining Act to ensure companies pay royalties on the shared public resources they extract from the ground, as well as establishing a formal hardrock mine reclamation program.

**Natural Infrastructure Restoration & Resilience**

Protecting and restoring natural systems is often the most cost-effective and efficient solution for bolstering resilience to extreme weather, fires, droughts, floods, and hurricanes, while also enhancing biodiversity. Natural infrastructure, like wetlands and forests, also provide communities with additional benefits like pollution filtration, carbon sequestration, wildlife habitat, and recreational opportunities. Investing in pre-disaster mitigation through natural defenses demonstrates a benefit-cost ratio of 6:1 for every federal dollar invested. Better still, restoring natural infrastructure is a particularly cost-effective for job creation, because most funding goes towards labor.
Orphan Well and Abandoned Mine Reclamation

We greatly appreciate that the committee addresses the festering issue of orphaned oil and gas wells and abandoned mines on the landscape. The economic recession created by the pandemic, coupled with oil and gas and coal markets that have trended downward for years, provides a critical moment to address the issue, as skilled workers in energy-dependent communities seek good-paying jobs that can sustain families, while confronting long-standing environmental injustices harming local communities.

The need is acute for abandoned mine lands. Tens of thousands of abandoned coal mines pose risk to human and wildlife health. We can put tens of thousands of people to work in communities affected by the boom and bust cycles of these mines. We thank Chairman Manchin for his tireless leadership to secure this critical funding, as well as for his leadership of the RECLAIM Act, which would help revitalize distressed communities through reclamation and restoration of natural resources—all of which would go a long way toward addressing these pressing environmental, health and energy transition issues in coal country. Significant investment in the Abandoned Mine Lands (AML) program would also provide much-needed support to coal workers suffering long-term health effects of underground mining.

In addition to abandoned coal mines, there are approximately 57,000 documented orphaned oil and gas wells on federal, state, tribal and private lands and up to 745,000 undocumented orphaned oil and gas wells, according to the Interstate Oil and Gas Compact Commission, that were drilled and abandoned before modern regulation. Many of these sites leak methane, a greenhouse gas that is 84 times more potent than carbon dioxide in the first two decades of its release. Quite simply, there is an overwhelming need to fix this problem. Properly plugging these sites will reduce methane emissions, increase economic productivity of agricultural lands, reduce invasive species, protect groundwater and restore connectivity of native habitats. Investing $4.7 billion in fixing the problem would put tens of thousands of people to work immediately in energy-producing states, a critical job lifeline. We estimate that this investment could plug over 150,000 documented and undocumented wells. We are grateful for the leadership of Senators Cramer, Luján, Hoeven, and Heinrich on this important issue.

We also encourage the Committee to address the underlying problem that bonding has been chronically low for oil and gas wells. If we invest taxpayer dollars today in cleaning up the problem of abandoned wells, we should assure taxpayers that we won’t repeat the problem. A September 2019 GAO report indicates that at least 84 percent of collected bonds are insufficient to fully recover reclamation costs in a low-cost scenario; the number jumps to 99 percent in its high-cost scenario. Either way, this leaves a remarkable liability for taxpayers. We urge this committee to take up bonding reform efforts, such as the bill proposed by Senator Bennet just this week.

We would also urge the Committee to consider adding at least $5 billion to clean up the nation’s abandoned hardrock and uranium mine sites and related pollution problems. There are roughly a half-million abandoned hardrock mines across the United States. Of those, the Government Accountability Office identified at least 140,000 sites on lands under federal jurisdiction, 67,000 of which may pose dangers of injury or death. About 22,500 pose risks to human and wildlife health. There is no national cleanup fund to address this massive problem—only an inadequate...
patchwork of funding sources, such as Superfund, for which many hardrock sites would not be
eligible. As President Biden proposed in the American Jobs Plan, we encourage this Committee
to invest in hardrock and uranium mine reclamation, which will also deliver economic, health,
and environmental benefits as those generated by coal mine and oil and gas well reclamation.

Confronting Escalating Wildfires
Megafires—wildfires that reach over 100,000 acres—were once a rarity on the landscape, and
now they are becoming the norm. A combination of historic fire suppression, cycles of wet
springs followed by record drought, invasive species, and other climate-fueled changes on the
landscape have created a tinderbox. We must address this problem head-on to protect the
millions of Americans that live within the wildland-urban interface and this bill provides an
elegant start.

We deeply appreciate the significant down-payment of funding in the bill for urgently needed
forest restoration work, including hazardous fuels reduction, prescribed burning, and watershed
health projects—and we urge the Committee to go even further. To effectively restore our forests
and reduce fire risks over the next five years, we need at least $60 billion of investment in the
National Forests, State forests, Tribal forests, private forests over the next five years, including at
least $33 billion for the U.S. Forest Service. We urge this Committee to work with Chairwoman
Stabenow, Ranking Member Boozman, and the Committee on Agriculture to significantly
increase the level of forest and fire resilience investments across landownership types. Both
Senator Wyden and Senator Bennet have proposed thoughtful legislation that we would
encourage including in the final package.

We also encourage the committee to increase the level of restoration ambition. The bill calls for
treating at least 10 million of the 46.8 million acres of federal and tribal land identified as “very
high” for wildfire hazard potential by 2027. Given the cascading risks of catastrophic fire, we
need to accelerate the pace of restoration significant and aspire to eliminate restoration backlog
within a decade, fully acknowledging that this is a significant undertaking that will require
greater investments in the agency staffing, infrastructure, planning, and collaboration.

We would also encourage the Committee to be less prescriptive in Section 8003. For example,
we applaud the inclusion of Collaborative Landscape Forest Restoration Program (CFLRP) in
the bill, but believe that the requirement to focus on lowest overall cost and cost per acre could
be counterproductive and would undermine the collaborative, community-based decision making
that is at the heart of the CFLRP program. We recommend that CFLRP projects should be
funded based on projects that have the most benefits for public safety, watershed health, fish and
wildlife habitat, and to local communities instead.

We urge the Committee to leave assessment of the trade-offs between ecological and risk-
reduction objectives in our National Forests to the agencies. By prioritizing climate-informed,
ecologically appropriate, and adaptive management practices—and not merely cost—we will
ensure that actions related to wildfire risk reduction and forest restoration will not only protect
the most vulnerable communities, but also increase the resilience of forest ecosystems in the face
of rapidly changing climatic conditions.
We also thank the Committee for including funding for the Forest Service’s Legacy Roads and Trail Remediation Program, which fixes roads that contribute to water quality problems in streams and other bodies of water that support species recovery and community water sources. It prioritizes roads that need to be relocated, decommissioned, or updated located near streams or wetlands or on sensitive soils. In addition to the critical funding in this bill, we recommend Congress codify the Legacy Roads and Trails program to continue protecting habitat, improving water quality, and creating jobs.

Reducing Fire Risks on Rangelands and Grasslands

We greatly appreciate the bill’s focus on restoring healthy forests and reducing fire risks. We urge the committee to place much greater focus on restoration of the 247 million acres managed by the Bureau of Land Management. Today, invasive cheatgrass covers 100 million acres of land in the United States, largely on BLM lands, a serious problem for both wildlife and cattle and a catalyst for catastrophic fire and ecosystem degradation on both public and private land. Rangeland fires are increasing in intensity as invasive grasses are a ladder fuel, making fires burn hotter and farther. Grassland bird populations have declined by 40 percent in our lifetimes, and some indicator species, like the greater sage-grouse and lesser prairie chicken, are teetering on the edge of listing under the Endangered Species Act.

We urge the Committee to include an additional $6.5 billion for forest restoration and hazardous fuels management, and reduction of fire risks on Bureau of Land Management lands and an additional $6 billion for rangeland management and restoration of sagebrush steppe and grasslands, removal of invasive vegetation, water resources resilience, and research on Bureau of Land Management and Tribal lands. (We are also working on a North American Grasslands Conservation Act, modeled after the highly successful North American Wetlands Conservation Act, that would complement these efforts on private lands that is under EPW’s jurisdiction.) This investment would significantly reduce fire risks, increase water resources and mitigate drought conditions, improve range management to benefit livestock and wildlife—including reversing the downward spiral of grassland bird populations, and enhance carbon storage—all while creating jobs in rural communities.

Hurricane Resilience

While much of the jurisdiction for hurricane resilience resides in other committee, it is a significant infrastructure need similar to the threats we face from megafires. We encourage the committee to work with Senator Cassidy and Senator Whitehouse on strategies within this Committee’s jurisdiction to invest in the restoration of coastal defenses, such as wetlands, dunes, and living shorelines, that can save billions of dollars in avoided damage from extreme weather.

Moving Forward

The Energy Infrastructure Act of 2021 provides a critical foundation to ensuring our nation has 21st century infrastructure that enhances our economic competitiveness, creates well-paying jobs, expands domestic manufacturing, and moves us one step closer to having the technological and natural infrastructure investments necessary to avert the climate crisis. This bill addresses many of the critical investments that are within this Committee’s jurisdiction and we urge this Committee to work with other key committees on priorities where jurisdictions overlap.
Several Senators, such as Senator Wyden, Senator Coons, and Senator Casey, have introduced legislation to create or enhance a Civilian Climate Corps that would largely work on the lands under this Committee’s jurisdiction. We encourage this Committee to work with the Committee on Health, Education, Labor and Pensions to convene a robust conversation about how these proposals intersect so that people, especially youth, can quickly be put to work repairing natural infrastructure and restoring our forests, wetlands, and degraded ecosystems.

When combined with the other pillars of an infrastructure package from the Senate Environment and Public Works Committee, Finance Committee, and Banking Committee, this bill would achieve significant progress in the fight to address climate change. This discussion draft pairs well with complementary efforts from other committees. This bill’s innovation investments pair well with Finance Chairman Wyden’s clean energy incentives. The resiliency grants, funding for wildlife crossings, and emissions-reduction provisions developed by EPW Chairman Carper and Ranking Member Capito through Surface Transportation Reauthorization Act of 2021 complement the investments of this package. Agriculture Chairwoman Stabenow has developed an incredibly thoughtful package of infrastructure investments on working lands to bolster productivity, resilience, and carbon sequestration through Farm Bill conservation programs and forestry programs, particularly as envisioned by legislation like Senator Bennet’s Outdoor Restoration Partnership Act (S. 1248) and more robust Natural Resource Conservation Service programs are key to the work ahead, where Americans are a part of charting our sustainable future in the jobs they do each day. We’re also working to ensure inclusion of the bipartisan Recovering America’s Wildlife Act, which would complement many of the natural resource provisions of this bill by investment in proactive, collaborative restoration of our natural infrastructure to save thousands of imperiled species.

Conclusion

Chairman Manchin’s bipartisan Energy Infrastructure Act of 2021 and the work of the entire Committee on Energy and Natural Resources could not come at a more critical time. We look forward to working with the Committee to strengthen the bill during the markup process on its way to the Senate floor. As our nation recovers from a deadly pandemic and as the twin climate and biodiversity crises reaching tipping points, there is not a moment to waste. Passing a bold, ambitious infrastructure bill would not only help secure our economic future and equitably create well-paying jobs, but would avert disasters that would otherwise have devastating consequences for generations. We urge the Committee to act boldly. Thank you.
OPENING STATEMENT OF MARK P. MILLS, SENIOR FELLOW, MANHATTAN INSTITUTE

Mr. Mills. Chairman Manchin, Ranking Member Barrasso, this hearing is focused on draft legislation regarding the infrastructure implications of shifting the nation’s energy supply toward lower carbon systems. So I think it is prudent to consider the full range of options, especially those that could be implemented rapidly and cost effectively, but first, permit me to offer a global context because this is, after all, a global issue.

The International Energy Agency (IEA) has laid its roadmap to net zero and proposes a 1,200 percent increase in the global production from wind and solar in just 20 years. It took the global oil industry, for context, 50 years to expand that much in energy-equivalent terms. So it is the net-zero roadmap that everyone is chasing that expects a twofold faster growth rate in physical infrastructures of energy machines and one that will require using 1,000 percent more materials to build. The latter is the physical reality of building wind and solar technology. It is, to paraphrase, not “a feature, not a bug,” it is both a feature and a bug. This is the kind of scale and velocity for infrastructure expansion that is truly breathtaking, and frankly, I have to go on record as saying I do not think it is actually possible. But in the spirit of seeking means to reduce global hydrocarbon use, one might consider five energy options that do not appear to be on the currently favored roadmap.

So first—greater, faster, and more certain reductions in carbon dioxide emissions would happen if the U.S. ensured liquid natural gas exports increased as much in the future as has already happened. If it were not for the epic increase in global natural gas supply and the drop in prices that occurred at the same time, the world today would be burning about two billion tons more coal per year. That dynamic was driven in large part by American production, where in Pennsylvania, Ohio, and West Virginia, for the record, collectively accounted for nearly two-thirds of that domestic expansion. America’s Appalachian region is one of the world’s biggest producers of natural gas and could be far bigger yet. No incentives are needed to get America’s gas producers to supply more. The key to facilitating more exports rests in the infrastructures of pipelines and ports where Congress certainly can play a constructive role.

A second, obvious low-carbon energy option would be to accelerate next generation nuclear energy deployment, which is profoundly superior in physical infrastructure terms. The energy in a pound of nuclear fuel matches 60,000 pounds of oil or 100,000 pounds of coal or one million pounds of Tesla-class batteries. The impediments to grid-scale nuclear power have been well-documented, as this Committee well knows. There are exciting options now in the form of mini-reactors that could power even small cities to small towns. The key to unlocking this technology is com-
mmercial validation and production scaling. We could consider converting a large share of the Federal Government’s electric supply to microgrids powered by mini-reactors, possibly focused on military bases. A program could be modeled on the military’s competitive procurement process, wherein one or two winners are awarded multi-billion dollar, multi-year production contracts.

A third option for reducing oil use is simple, even if it is unpopular—encourage greater use of next generation internal combustion engines. The world will have hundreds of millions of conventional cars for decades to come, even in the most optimistic electric vehicle scenarios. The advanced combustion engines could yield more oil savings over the coming decade than the expansion of electric vehicles. New, superefficient designs for internal combustion engines already exist. Some have as few moving parts as an electric motor. Federal assistance could be useful here, particularly the DOE’s advanced manufacturing program.

A fourth action to consider is the domain where I have earlier testified. Because the increase in the use of wind, solar, and batteries increases the imports of critical minerals and materials—this is a critical area, and decades of bipartisan proposals have all reached the same obvious conclusion—decreasing import dependencies requires increasing domestic mining. Any path to net zero passes directly through critical infrastructures of mining and minerals processing.

Finally, a fifth policy action we should consider—it does not seem to be on the table at a fulsome level—is pursuit of lower carbon energy technologies will require capabilities and technologies that are often deemed critical, but do not exist. This is something both the IEA and Microsoft, for example, have acknowledged. Truly radical innovations and advances will need new science that can only be addressed through foundational discoveries in physics and chemistry and biology. This, again, is a domain where Congress can play a role.

In summary, given the $100 billion and change of spending being contemplated in the legislation under consideration, the scale and the long lead times inherent in civilization’s energy infrastructures require a long-term vision and I think it calls for caution to avoid launching short-term initiatives that not only would fail to achieve stated goals, but could damage the U.S. economy and geopolitical stature.

Thank you.

[The prepared statement of Mr. Mills follows:]
Testimony of
Mark P. Mills
Senior Fellow, Manhattan Institute
Before
U.S. Senate Committee on Energy and Natural Resources
On
The Infrastructure Needs of the U.S. Energy Sector
June 24, 2021
Dirksen Senate Office Building, Washington D.C.

Good morning. Thank you for the opportunity to testify again before this Committee. I’m a Senior Fellow at the Manhattan Institute where I focus on science, technology, and energy issues. I am also a Faculty Fellow at the McCormick School of Engineering at Northwestern University where the focus is on future manufacturing technologies. And, for the record, I’m a strategic partner in a venture fund dedicated to energy software.

Since the purpose of this hearing is to considering draft legislation that addresses the infrastructure implications associated with shifting the nation’s energy supply towards lower-carbon options, I believe it would be prudent to consider the full range of options that could achieve such goals, especially those that could do so rapidly and cost-effectively. But before outlining some options to consider, I think it’s important to begin with the global framework within which we are necessarily operating. It is obvious that the United States U.S. is far from alone in aspirations to “de-carbonize” national energy systems. This has critical implications because all infrastructures have supply chains, and the U.S. will be in global competition for the resources, hardware and machines needed to build the kind of lower-carbon systems being proposed.

The International Energy Agency’s (IEA) has issued a very useful, recent report that provides a sense of perspective on where policies are attempting to take the world in terms of a global “roadmap” to “net zero.” Specifically, that path envisions over the coming two decades a 1.200% increase in global energy production from wind and solar machines. In the IEA’s roadmap, those two energy systems alone account for about three-fourths of all forecast growth in energy supply to the world.

It bears noting that the IEA roadmap also envisions, for example, bans on the sale of cars with internal combustion engines and thus forecasts hundreds of millions of battery-only cars that will further increase demand on infrastructures for both electricity generation and battery mineral. In addition the IEA “net zero” roadmap envisions, for example, policies that will induce or force what the IEA terms “behavior changes” such as, for example, a doubling of the number of global households without a car of any kind.

Setting aside issues associated with achieving the kinds of “behavior changes” that the IEA—and others—propose for reducing energy use in order to implement the “net zero” path, consider instead the physical challenges for producing energy. It is a truism that’s often lost in debates over different visions for energy production, but all energy systems require building physical infrastructures and machines. This reality has salience for plans to expand the use of wind, solar and battery technologies because building those energy systems, compared to conventional hydrocarbon technology, entails using roughly 1,000% more materials to deliver a unit of energy to society.

In addition to a radical increase in the use of the usual class of construction materials, such as concrete, steel and glass to building, there is also the separate but related matter of a radical increase in the use of critical “energy minerals” needed to build key components needed for the wind, solar and battery hardware. Relevant to this particular issue, the IEA has recently issued another massive report, one that reveals confirmatory data regarding the materials and minerals challenge for the “net zero” path. That report documents a 700% to 4,000% increase needed in mining for critical energy minerals. If such a path is in fact pursued, it will require an unprecedented expansion in the associated scale of infrastructures for mineral and materials processing, not just mining.
Without regard to the economic, environmental, and other implications of such an astounding increase in materials used to supply energy to society, there is the very practical challenge in actually building the new lower-carbon infrastructures. Start with the fact that all the world’s current solar and wind hardware produces energy equivalent to 5 million barrels per day of oil. The IEA’s path to “net zero” requires that energy production increase to the equivalent of 65 million barrels within 20 years. For context, it took the world 50 years to build an oil infrastructure that went from 5 million barrels per day in 1930 to 65 million barrels per day by 1980. Thus the proposed “net zero” path will require a construction program that expands more than twice as fast and do so using 1,000% times more physical stuff. This scale of infrastructure expansion is truly breathtaking. It is also unlikely to be possible.

Consider an infrastructure analogy. The total number of lane-miles built in the United States increased by 300% in the 100 years since 1921. Imagine proposing incentives to build that many more lane-miles again but expecting to do so in less than half the time, and while using a different road ‘technology’ that requires 1,000% more materials per mile built. The world of mining and construction machines have certainly improved over the decades, but there is no evidence that suggests such ambitious expansions are possible for either the infrastructures of roads or energy systems.

Given all of that and, given that this Administration and many in Congress are seeking means to reduce the use of hydrocarbons in the world, one might consider five energy options that don’t appear to be on the favored roadmap. These are options that are more likely to be physically possible to implement and demonstrably more cost-effective means for achieving the stated goals.

First, far greater, faster and more certain reductions in carbon dioxide emissions would happen if the U.S. were to ensure that liquefied natural gas (LNG) exports increased as much in the future as happened (without subsidies) in the past. It is indisputable that global electrification will continue, regardless of policies to accelerate that century-long trend, and consequently nations will necessarily seek means to meet that demand.

While the IEA’s aspirational “net zero” path projects a ten-fold drop in coal use over the next two decades, it bears noting what is in fact happening. There are some 300 GW of new coal-fired power plants on the global drawing boards or under construction; that represents more new capacity than the entire current U.S. fleet of coal plants. Similarly, an early 2021 survey found that the new coal mines planned, or under construction, will add over two billion tons per year of new coal production – that’s double the peak U.S. coal production of a decade ago. And the data also show that global coal use increased in the first quarter of 2021 as economies fired back up and as global LNG prices increased. The fact that global gas prices had earlier in the decade been trending down, thereby increasing its use for electricity generation, was almost entirely a consequence of the unexpected and enormous increase in U.S. gas production.

U.S. shale technology was responsible for nearly one-third of all the world’s increased production of natural gas over the past decade. Middle East production growth was only slightly ahead. More than a dozen states are significant producers of natural gas, with Pennsylvania, Ohio, and West Virginia collectively accounting for nearly two-thirds of the increased supply in the past decade. America’s Appalachian region is one of the world’s biggest producers of natural gas and could be far bigger yet. Absent the epic increase in global natural gas supply, and the drop in prices—again driven in large part by America’s increased production—the world today would almost certainly be burning about two billion tons more coal per year.

Increasing U.S. LNG exports to the world would not only help displace existing and increased coal use on a purely economic basis, but it would also benefit consumers everywhere as the American abundance holds global prices down. No incentives are needed to convince America’s natural gas producers to supply more to the world. The key to facilitating export of that gas rests in the infrastructures of pipelines and ports. Here Congress can certainly play an important role in ensuring that there aren’t regulatory impediments, never mind incentives, for permits to build that infrastructure.

A second, obvious, energy option for a lower-carbon future would be to accelerate next generation nuclear energy deployment. Nuclear fission offers a foundationally superior advantage in terms of its infrastructure. That advantage rests on the simple fact that fission-based energy requires a
trivial amount of land and material. The energy in one pound of nuclear fuel matches 60,000 pounds of oil or 100,000 pounds of coal. Or consider a comparison with batteries, which are now frequently proposed as means to fix the unreliability of wind and solar: it would take 1 million pounds of Tesla-class batteries to hold the energy in 1 pound of nuclear fuel.

But despite its astounding promise, today barely 10% of the world’s electricity comes from uranium on this the 65th anniversary of the world’s first commercial nuclear plant. (That was England’s Calder Hall, inaugurated in 1956 by Queen Elizabeth II.) The impediments to building more grid-scale nuclear power plants have been well-documented and are, in the main, associated with precisely the same regulatory impediments that kept “shovel ready” infrastructure from expanding quickly a decade ago the last time Congress enacted “recovery” spending.

There are now some exciting technology options for expanding the use of nuclear energy beyond gigawatt-class grid-scale power plants. More than a dozen companies are at various stages in developing innovative designs for very small nuclear power plants offering inherently safe features, and are at a scale appropriate for powering a small city or even a town. A key challenge with unlocking the technology of this new class of mini-reactors is in providing both commercial validation and scale of production. Congress can play a role. Much as the administration proposes to convert the federal vehicle fleet to battery-power, we should consider converting a large share of federal government electric supply to microgrids powered by mini-reactors, perhaps focused on military bases. No government R&D funding is required. Instead, a program could be modeled on the military’s well-tested competition and procurement process used to stimulate access to a new generation of aircraft, for example, wherein the one or two winners are awarded multi-year multi-billion-dollar production contracts.

A third option for reducing future oil use is a simple even if unpopular one; encourage greater use of next generation internal combustion engines. Again, to the extent that the goal is to find cost-effective and rapid means to reduce oil use, the data show that a dollar spent on subsidizing more efficient engine choices would save far more oil than the same dollar subsidizing batteries. Innovative designs for internal combustion engines continue to emerge, some with as few moving parts as an electric motor, and many with the potential for as much as a five to 10-fold gain in power-to-weight ratio. That is a far greater level of improvement than is possible with batteries, for example. The IEA has also noted in another, earlier, analysis that advanced combustion engines could yield far more oil savings over the coming decade than the expansion of electric vehicles. Even the most optimistic scenario for EV growth leaves the world with hundreds of millions of conventional cars for many decades. Here again, aside from subsidy and tax issues, the government, perhaps the Department of Energy’s advanced manufacturing program, can play a constructive role in building and facilitating the infrastructures needed to fabricate such advanced engines.

Then, a fourth category of actions that could be directed at energy options intended to reduce future carbon dioxide emissions entails a domain I’ve offered in earlier testimony relating to the U.S. mining industry. The increased use of wind, solar and batteries technologies in America will increase imports of critical minerals and materials with negative implications for the balance of trade, the economy, and geopolitics. This is not news, even if it is often ignored. There have been over the decades many studies, congressional hearings, and bipartisan policy analyses, pointing to the same two facts. The United States contain vast mineral reserves including all the elements relevant to green energy machines, not to mention those critical for computers and the military. But America’s share of domestic and global mineral supply continues to shrink.

We’ve seen decades of bipartisan proposals reaching back to the Strategic Materials Act of 1939 regarding action needed in this area. Every single one has included the same central and obvious

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5 DOT and USGS, "Mineral Commodity Summaries 2020."
conclusion: the primary means for decreasing import dependencies is to increase domestic mining.\textsuperscript{4} As the National Academies of Sciences pointed out in a 1999 report on mining: “lack of early, consistent cooperation and participation by all the federal, state and local agencies involved in the NEPA process results in excessive costs, delays and inefficiencies.”\textsuperscript{5} The U.S. has one of longest permitting processes for mines in the world.\textsuperscript{6} It can take up to three decades to get a new mine into production.\textsuperscript{7} At the same time, policymakers and U.S. presidents over the years have substantially decreased access to federal lands for mineral exploration. The U.S. has regulated its way into far greater mineral import dependencies.\textsuperscript{8}

Congress enacted legislation more than 40 years ago, on a bipartisan basis, signed by President Carter—the National Materials and Minerals Policy, Research and Development Act of 1980—specifically directed at the coequal pursuit of mineral production and environmental protection.\textsuperscript{9} If we are to have a path to “net zero” energy production, that path passes directly through the critical infrastructure of a mining and minerals processing industry. It’s being left out of the equation.

Finally, a fifth policy action to consider, in the spirit of the goal to pursue foundationally more efficient and lower-carbon energy technologies, emerges from the fact that many of the capabilities and technologies imagined for a “net zero” path do not yet exist. This reality is acknowledged in numerous serious analyses including from the IEA. And Microsoft, for example, in its lengthy and candid 2020 climate policy position, specifically notes that “net zero” energy plans “will require technology that does not exist today.” This means we need truly radical inventions or, in effect, we need what could be termed “new science.” Such a goal of course can only be addressed through foundational discoveries in the sciences, in physics, chemistry and biology, a domain where Congress can certainly play a role. Increased support for fundamental research, rather than just subsidizing or mandating existing technologies, will be essential.

In summary, regarding the $100 billion or so contemplated in the legislation under consideration, the scale and long-lead times inherent in all of civilization’s energy infrastructures essentially demands a long-term vision. It also suggests caution is in order regarding the risk of putting into place short-term incentives that would not only fail to achieve the stated goals, but also damage the U.S. economy and geopolitical status.

\textsuperscript{4} Ned Marmol and Jim Bridger, \textit{Groundbreaking America’s New Quest for Mineral Independence} (Round Rock, TX: Terra Dynamics, 2019).
\textsuperscript{6} Matthew Rooda, \textit{“Demand A Compassion Foreign Minerals Dependence,” RealClearEnergy, Feb. 21, 2010}.
\textsuperscript{7} Peter Coy, \textit{“India’s New Remarkable, the Mineral Ecosystem: Why It Matters,” Bloomberg Businessweek, Aug 20, 2019}.
\textsuperscript{8} 1985, \textit{“Risk and Reliance: The U.S. Economy and Mineral Resources,” Apr. 12, 2017}.
\textsuperscript{9} Ned Marmol, \textit{“Balancing America’s Environmental, Mining and the Green New Deal,” The Hill, Mar. 1, 2019}.
The CHAIRMAN. Thank you, Mr. Mills, and thank all of you. Now we will start with questions.

My first question will go to Dr. Hogan. Dr. Hogan, the International Energy Agency has recently found that one of the most cost-effective options available to reduce emissions while maintaining reliability is to ensure continued long-term operation of nuclear power plants. As you know, one reactor has been shut down in New York, four are on the chopping block in Illinois, and we have a goal by 2035 of being net zero. Is that possible without nuclear staying online? Do you think the only way to meet that is going to be reducing fossil altogether or finding technologies that will help make it cleaner?

Dr. HOGAN. Thank you. The Department of Energy is very supportive of maintaining the existing fleet of nuclear power plants for many of the reasons that you just mentioned. Maintaining that fleet has been part of the nuclear energy program mission for many years. We certainly are interested in the additional provisions that you provided in this infrastructure draft.

The CHAIRMAN. It would help with the financing to keep them competitive so they will stay open?

Dr. HOGAN. Exactly.

The CHAIRMAN. Can you save the four in Illinois? Because they put a moratorium on closing. Can you save the four nuclear plants in Illinois?

Dr. HOGAN. We can certainly look at anything we can do based on the ability that you give us to take a look.

The CHAIRMAN. Sure. I have sent the President a letter basically asking him to intervene on this moratorium on closing any more. And also, on your answer on the fossil fuels—elimination or basically innovation?

Dr. HOGAN. We are all about innovation and certainly we know there are a number of ways to reduce the environmental impacts of fossil fuels that also you are calling out important investments in, in this discussion draft, that we find very promising.

The CHAIRMAN. Ms. Trujillo, the Department of the Interior estimates that the cost to complete the AML Reclamation work is $10.6 billion. According to recent reports at Ohio River Valley Institute, there could be as much as $18 to $20 billion in unfunded Reclamation across the U.S., and roughly 84 percent of remaining damage is concentrated in Appalachian states, which is not a surprise—West Virginia, Pennsylvania, Ohio, Kentucky, Alabama, Virginia, and Tennessee. Can you explain the discrepancy in these figures—what you all come up with, 10 versus 18—with the Ohio Valley River Institute? Why is there such discrepancy?

Ms. TRUJILLO. Thank you, Senator Manchin. I would have to consult with some experts on the exact rationale, but I know there are a number of different inputs that are coming in. We are receiving information from states, from other agencies, and trying to work to incorporate that information. What we know is the number is very large and we have to take action to try to address the concerns.

The CHAIRMAN. At the beginning of the 21st century, most of our energy for fossil came from that region and that is why we have so many properties that need to be attended to.
To Dr. Holtz-Eakin, it is clear clean energy technologies will require more mineral resources, but some projections falsely claim that we will run out of these critical minerals, let alone the challenges of being able to get a permit to even get what we need out of the ground. So that foreign supply chain is what we are depending on right now and we are willing to change our whole transportation mode based on foreign supply chains. What are your thoughts on that and how do you expect us to be able to meet market demands? I am understanding the demand is going to grow by over 70 times in the very near future.

Dr. Holtz-Eakin. I think what we heard is that the expectations—the enormous demands for electric vehicles, for solar panels, for all sorts of things that require critical minerals—the only way to do that and not rely on the Congo and China is to have domestic supplies. And that means public policies that permit those to be safely mined in the U.S. and processed in the United States and we are behind the curve on doing that.

The Chairman. How do you look at other energy sources such as hydrogen—green hydrogen and blue hydrogen—that basically would provide us with carbon-free energy? Should we be going down that path too, which does not require foreign supply chains?

Dr. Holtz-Eakin. I do not see any reason why we should be picking among fuel sources and energy sources. We should be trying to develop those which are cost effective and must meet market tests and which deliver energy in a reliable fashion.

The Chairman. And that can be supplied basically by U.S.—

Dr. Holtz-Eakin. Yes.

The Chairman [continuing]. Supply chains, foreign supply chains.

Dr. Holtz-Eakin. Yes, I think——

The Chairman. Does anybody else want to comment on that?

Dr. Holtz-Eakin [continuing]. I think the general—what I would emphasize is, U.S. energy policy has been most successful when it has been good economic policy, when it has provided adequate market incentives and we should continue to do that.

The Chairman. Mr. Mills.

Mr. Mills. The challenge with hydrogen as an energy source is obvious. It is a carrier, like electricity. It has to be produced from something. Proposals to make hydrogen by using—let’s say wind turbines and solar arrays—increase the foreign mineral dependency, they don’t decrease it. If you make hydrogen from natural gas, which is how almost all of it is produced today, you eliminate foreign mineral dependencies.

The Chairman. Thank you.

Collin, real quick.

Mr. O’Mara. The only thing I would add is that right now we recycle less than one percent of rare-earth minerals. And the numbers are equally bad for the critical mineral list that the, in the last Administration, this Administration, put together. We talked a lot about lithium recycling. We need to be talking about all of it because if we do that together, we can actually meet a lot of our domestic needs.

The Chairman. So you are saying, basically with recycling we can put those back into productive use again?
Mr. O’MARA. Yes, I mean, some elements degrade and some do not.

The CHAIRMAN. Sure, sure.

Mr. O’MARA. We are still only recycling a third to half of copper, right? So we need to be much better as a country at this.

The CHAIRMAN. We know about recycling. Thank you very much.

Senator Barrasso.

Senator BARRASSO. Thank you, Mr. Chairman.

Dr. Holtz-Eakin, I want to follow up with what you just said—good energy policy is when it is good economic policy.

Dr. HOLTZ-EAKIN. Yes.

Senator BARRASSO. So I have a couple short questions within the legislation before us today.

Will funding energy-efficiency programs at say, 10 or 20 times their annual appropriated levels, will that help or hurt the U.S. economy?

Dr. HOLTZ-EAKIN. That will hurt.

Senator BARRASSO. Do you want to explain exactly why that would be?

Dr. HOLTZ-EAKIN. I am deeply concerned about this notion of scaling up by multiples of 20 times and 30 times programs. We have seen this before, notably in the Recovery Act, where we did, for example, on a broadband program. We got terrible results, wasted a lot of taxpayer money, and efficiency standards are a cost that—we do it for their benefits, but if we do not get the benefits, then we have just imposed a cost on the economy.

Senator BARRASSO. So will buying electric transmission capacity, which the private sector is already prepared to purchase, will that help or hurt our U.S. economy?

Dr. HOLTZ-EAKIN. That will hurt. It makes no sense to displace what the private sector is already doing.

Senator BARRASSO. How about closing roads and hiking trails and therefore eliminating public access to our national forests? Will that help or hurt the U.S. economy?

Dr. HOLTZ-EAKIN. Hurt.

Senator BARRASSO. How about expanding Davis-Bacon? Will that help or hurt?

Dr. HOLTZ-EAKIN. That will hurt.

Senator BARRASSO. So Mr. Mills, the draft bill includes very little permitting reform. In your view, how urgent it is that Congress include meaningful permitting reform in the infrastructure bill? And I am going to ask you, Dr. Holtz-Eakin, if you would prepare.

Mr. MILLS. I think it is critical, and we can come back to the energy minerals and critical minerals issues, which are gratefully coming to the top of consideration. The average permitting time in the United States to open a mine is something on the order of 20 to 30 years. It is half that in the world on average and it is half that again in many jurisdictions. It is entirely a permitting issue and a regulatory issue. It is not because we do not have the resources or the technology.

Senator BARRASSO. And Dr. Holtz-Eakin.

Dr. HOLTZ-EAKIN. I think it is very important, but we have some real insight into this from Congress’s most recent surface transportation bill, where it got some information gathering requirements,
and if you look at the monitor, the dashboard for that, it shows that the paperwork associated with the infrastructure financed by that bill—the paperwork takes about 30 million hours annually and costs $2 billion to comply with. So there is a real permitting problem that needs to be addressed.

Senator BARRASSO. Mr. Mills, unlike roads and bridges, most energy infrastructure in the United States is privately owned and privately funded. In fact, even most of the publicly owned energy infrastructure is financed through bonds sold to private investors. Would passing this bill with close to $100 billion in direct federal spending, would that chase private investment out of the energy sector?

Mr. MILLS. Well, I think the short answer is yes. When the government does direct spending on projects, they do chase private investment out. That is well documented. The broader question is, how does the government spend money constructively to encourage private-sector spending to get leverage? That is the proverbial devil in the details, but as we go to one end of the spectrum, we do something, to put it in unkind terms, you run the risk of Sovietizing our infrastructures.

Senator BARRASSO. Dr. Holtz-Eakin.

Dr. HOLTZ-EAKIN. That is my concern as well. One of the things you get is not just the adequate level of spending from the private sector, you get better project selection because you are picking the most productive and most sufficient investments.

Senator BARRASSO. Let me follow with the—in terms of as Congress is considering how to pay for the infrastructure bill—would the U.S. economy be better off if we used some of the unspent COVID stimulus funds rather than spend additional new money?

Dr. HOLTZ-EAKIN. That would turn non-investment spending into investment spending, which is exactly what you need for growth.

Senator BARRASSO. So the infrastructure, following up, the infrastructure proposal before us today—nearly $100 billion in direct spending. In the past, you have explained how expensive infrastructure bills, which are designed to stimulate the economy, often end up creating economic headwinds instead. Could you expand on that for the Committee?

Dr. HOLTZ-EAKIN. My concern is that when you attach stimulus to infrastructure investments you get the incentives wrong. That incentive is get the money out the door as fast as possible, that leads to excessive demand in the near-term and inflationary pressures. We are seeing that right now from the recovery program—American Rescue Program—among other things. You also tend to run past the project selection criteria and invest it poorly and that, as a result, has long-run headwinds in your productivity growth and the combination is something that I think this Committee and the Congress can avoid this time. There is plenty of stimulus out there. There is no need to worry about that. What we need to worry about is the quality of our investments in long-term productivity and the climate objectives of the nation.

Senator BARRASSO. Great. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator.

Senator Heinrich.

Senator HEINRICH. Thank you, Mr. Chairman.
I think it is helpful to take a step back and ask, you know, why are we here? We are here because I have wildfires raging early and hard in New Mexico and I thought it was hot, because we have been in triple digits for a few weeks, but NASA satellites confirmed on June 20th that surface temperatures in Siberia, North of the Arctic Circle, were 118 degrees. Our forests cannot maintain themselves if we keep baking the planet like this.

I want to thank you for the investments in this legislation in transmission, in hydrogen, in weatherization, and orphaned wells and in mine cleanup. I would suggest we need for the mine cleanup money to apply to hardrock as well. I think we need to look hard at a clean energy standard to meet the scale of time that is necessary in this transition.

I want to talk for a second about hardrock. We all acknowledge the need for critical minerals in these new technologies, but I will say, our hardrock mining legislation framework was written in 1872, and we will produce a lot more critical minerals if we actually have safeguards for local water supplies, if we have robust public involvement, and if we cleanup the hundreds of thousands of abandoned hardrock mines that litter the West. I first met former Governor John Hickenlooper on the phone because the Animas River and San Juan River were running yellow because we did not cleanup that mess and it makes it hard to get communities to embrace a mine if you have not reformed that fundamental law. So 1872 Mining Act reform should be a prerequisite to give communities the confidence to actually mine these materials.

Mr. O'Mara, I wish I could talk as fast as you. You indicated the need for an additional $6.5 billion for forest restoration, hazardous fuels management on BLM lands, another six for rangeland management, water resources, resilience and research on BLM and tribal lands. Talk to us about the necessity of these efforts in order to break the current fire cycle, which is releasing carbon, and talk a little bit about the relationship to a potential 21st century CCC program that can help us scale-up fast enough to actually turn this around.

Mr. O'MARA. Yes, thank you, Senator Heinrich and even on your previous comment, those abandoned mines could be a very rich source of the minerals that we need. So I mean, the work that yourself—

Senator HEINRICH. Absolutely.

Mr. O'MARA [continuing]. And Senator Murkowski have been doing, it is incredibly important to harvest what is still in those mines.

Look, I mean, very honestly, right?—we, for decades, have not invested in our Bureau of Land Management lands, and the decades of disinvestment have led to invasive species on the vegetation side just running wild. We have 100 million acres right now of cheatgrass that is basically just tinder. And so, we have a wet spring. We have all the vegetation growing. We have a dry summer, huge heat, all that becomes tinder. And you know, whether it is the Great Basin or other places, it is not just public lands, it is private lands too, and there is some work we have to do on private grasslands, but grasslands and tribal lands are—the rate of fire growth is some of the fastest in the country. And so we talk about fire as
a forest problem, but we have to talk about tribal lands and grasslands. And that is why having both investments on the wildfire side is important, but also making sure investing in the restoration, because it is also one of the best ways to prevent drought—by having better storage, naturally, in the system, or more storage in the headwaters as a way to restore these systems and help downstream states like New Mexico.

Senator Heinrich. And I would add that cheatgrass is not exactly forage for anything, right? It is not for livestock. It is not for wildlife.

Dr. Hogan, if we were to simply, you know, we talk a lot about innovation on this Committee, but I like to talk about implementation on this Committee. And if we were to simply electrify everything that we can today, all of the things that we could swap out in our homes and businesses where we have superior technology today—replacing gas furnaces, stoves, water heaters with electric heat pumps, with induction stoves, with air-source heat pump water heaters—what kind of an emissions impact would we see if we did that throughout our economy?

Dr. Hogan. I mean, certainly there are a number of great electric technologies out there and we see them being adopted in different parts of the country at different rates. As we clean the grid where you can get to—with electrification and a cleaner grid from a CO₂ standpoint—you can get close to a zero-carbon world from the energy that you use in the built infrastructure.

Senator Heinrich. Thank you, Chairman.

The Chairman. Thank you.

With that, we have Senator Lankford.

Senator Lankford. Chairman, thank you. Chairman, I also want to thank you that you included the Title XVII loan program changes that I have encouraged as part of the draft that is in this. Dr. Hogan, you also mentioned the importance of those program changes in some of your written statements. I appreciate that as well. We have to get back to actually handling our critical minerals, as all of you, I think, have mentioned at some point, to figure out how we are going to actually get to them.

Mr. Mills, I want to follow up on a statement that you just made though. You made the statement that it takes 20 to 30 years to open a mine at this point. Can you go into greater depth on that?

Mr. Mills. Well, yes, I will confess that I look at an extraordinarily large body of research done by many agencies, both federal and state, on the challenge of opening mines in America and I would—to some of the comments, the hazards of opening mines. Mining is difficult. I worked for a mining company in Canada early in my career. I have been at mine sites. I may be the only one in the room that has gone to the bottom of a 5,000-foot vertical hardrock shaft. I like mining. I know mining is hard. I know communities are challenged by the physical infrastructure. I would say that the fact that the U.S. has seen the barriers in all the senses—not just public barriers, regulatory barriers, state—has chased mining out of the country, fundamentally.

I do not see any evidence that we are going to be able to change that in any of the proposals, anywhere, I think. I am delighted that we are now paying attention to it. It is critical. We are enormously
dependent on imports of critical minerals for all purposes. The path of chasing wind, solar, and batteries will have an astonishing increase in mineral dependency imports and the speed with which we increase the demand for these minerals is far faster, it is astronomically faster than any proposals to do anything that is being discussed right now to open up U.S. mines. We will increase imports and the balance of trade deficit and depend on nations we do not like very much for a lot of minerals. That is just locked into these plans.

Senator LANKFORD. So the United States figured out pretty quickly during the beginning of the pandemic, when the Communist Chinese government decided to hang on to PPE—that was American companies that were producing in China that were destined to be able to come to the United States—that from the earliest days, the earliest moments of the pandemic, we could not get PPE from American companies manufacturing in China. We learned pretty quickly that if they want it, they are going to keep it and they are going to turn that on and off. They have used leverage already for rare earth minerals, rare earth elements, and critical minerals with Japan and others to be able to use leverage against them to be able to ship that out.

You made a statement saying that if we transition to net-zero emissions, we would need to increase minerals mining by 700 to 4,000 percent.

Mr. MILLS. Yes, that is correct. It is not my data. That is the IEA's data. Other studies—UN studies, IRENA studies—have all looked to these issues. The physical demand for not just rare earths, but for common minerals, like copper and nickel are astronomically large. I completely endorse the need for creative, innovative ways to recycle these minerals. We under-recycle many relatively easy-to-recycle minerals, like copper, but the irony here is the rate of velocity of increase and demand for the net-zero path would overwhelm. If we recycled 100 percent of the copper and nickel and manganese and cobalt that we now use, it would not come close to supplying the needs for the growth paths that are being put in place.

Senator LANKFORD. So the TransWest electric transmission lines, I have referenced in this Committee before, moving power from the Northwest into Wyoming. That process of permitting started in 2007. They have yet to break ground on it and that is an electric transmission line. So I come back to this issue to say I really believe that in this legislation anything we talk about on increasing our capacity to go net zero, we have to deal with the permitting issues. If we cannot build a transmission line in 15 years and we cannot build or start a mine in 20 years, how long does it take right now to be able to permit one nuclear power plant? What is the number? Does anyone know right now if you are going to permit a nuclear power facility?

Mr. MILLS. Certainly measure it more than a decade. There is no one who has managed to beat that record.

Senator LANKFORD. Dr. Hogan, do you have a good guess on if someone wants to start a nuclear power plant, how long it takes before they can actually break ground right now in permitting?
Dr. HOGAN. I am not going to hazard a guess, but I do think we have a next generation of nuclear plants for which the permitting issues will be more straightforward.

Senator LANKFORD. So it may be eight years rather than ten? Again, we will need a guess because we are trying to figure out—if we are planning for a net zero by 2035 or 2050 and it takes us 15 years to be able to put transmission lines up, 20 years to be able to do that, we are in the process of heading straight toward total dependency on China and we cannot actually get all this online.

Again, I am not an opponent to any of this. We have to figure out what are realistic timelines on how we are going to handle the permitting and how to be able to solve that or all this is good theory and we will still be discussing it in 2060.

Mr. Chairman, I yield back.

The CHAIRMAN. Thank you, Senator.

Now we have Senator Cortez Masto. Oh, she is not there. We have Senator King.

Senator KING. Thank you, Mr. Chairman. I find myself in the uncomfortable position of agreeing almost entirely with Senator Lankford.

[Laughter.]

Senator KING. When I was Governor, I did a lot of work on environmental permitting in Maine, and what I said was I want the highest environmental standards and the most timely and predictable permitting process. And quite often, the problem is the process, it is not necessarily the standards. So I agree that I think that is something that we need to attend to. One thing that we did in Maine that perhaps we should be talking about here is one-stop shopping. You go to one agency that handles all the permitting and they coordinate the activities of the other agencies. So I do think that this is something that we need to discuss because we are going to have to—as we move away from fossil fuels, which, by the way, is a kind of mining, to a different kind of mining—we are going to have to deal with this problem. We cannot wish it away and we cannot just say, “Oh, we are going to build lots of windmills”—which I used to do, by the way—or solar panels, but we have to think about where these minerals are going to come from and as Senator Lankford pointed out, the pandemic taught us we should not be dependent upon our pacing adversary or potential adversary to supply minerals that are critical to the development of our economy.

So I think that is an important point.

Mr. French, I want to change the subject entirely. We had your boss—I am not sure she is your boss—the head of the Forest Service, Ms. Christiansen, was here earlier this week.

Mr. FRENCH. She’s my boss.

Senator KING. So okay.

Well, some significant data came out in that hearing. In 1988, we harvested 13 billion board feet off of federal land in this country. Today, it is three billion. She testified that that dramatic cut in the harvesting of timber in our federal lands has contributed substantially to the fire problem. Do you agree with that?

Mr. FRENCH. What I would say is——

Senator KING. Remember, she’s your boss.
[Laughter.]

Mr. FRENCH. She and I talk about this and work on this all the time. The issue is that to reduce wildland fire risk, we have to remove understories and small-diameter trees from areas that have no value.

Senator KING. Which, in Maine, we call pre-commercial thinning.

Mr. FRENCH. Absolutely. We have to pay for that most of the time.

Senator KING. But that involves working the forests in a productive way in order to—if you have greater harvesting, you have more pre-commercial thinning because that makes the timber more valuable and that lowers the fuel load on the floor of the forest. Is that correct?

Mr. FRENCH. In some places, yes.

Senator KING. But will you confirm that this dramatic drop from 13 billion to three has contributed to the fire risk, along with, of course, climate change, drought, heat and all of those elements.

Mr. FRENCH. Senator, it has been a contributing factor in some places, but not everywhere. So if you look in and around, let's say southern California, in some of those forests there that are non-commercial type areas, it is a very different scenario.

Senator KING. Well, and the grasslands that you testified, that is a separate issue, I understand, but I think this is—we cannot ignore though—this is one of these things, we cannot ignore the fact that we are not clearing out the understory and then we are going to have fires.

Let me move on for a minute. Dr. Hogan, I found myself, again, in the uncomfortable position of agreeing with Mr. Mills. Research is critical and I hope that in all of this practical application, we do not neglect the importance of basic research. For example, I believe one of the greatest barriers to a carbon-free future is storage. It may be batteries. It may be molten salt. It may be other technologies, but if we can beat the storage problem to deal with the intermittency of solar and wind, that is a big deal and research is where that needs to take place. So is that a commitment of your Department?

Dr. HOGAN. It is a tremendous commitment of our Department. We totally agree with you.

Senator KING. On the mining, I just want to touch quickly. I agree, I think recycling, Mr. O'Mara, we have to do a lot better job with that. We can mine our dumps instead of digging holes in the ground. There is a tremendous resource there.

One problem, one place I do disagree with Mr. Mills is on, well, I just want to raise a red flag about LNG (liquefied natural gas) exports. Two problems that I am concerned about. One is effect on domestic prices. We cannot repeal the supply and demand, even this Committee cannot do that. And as supply is distributed across the globe, it is taken away from domestic, and I am just gravely worried about effect on domestic prices. Australia did a huge export step and their domestic prices went through the roof. So that is a concern.

Number two is, it's true, and I have always been an advocate of natural gas as a transition fuel, that it does burn cleaner than coal, oil, and other fossil fuel alternatives. The problem is, when you
count the methane attributed to the extraction of natural gas, natural gas actually comes out right equal with coal. And so, if we do not deal with the methane issue that is connected with the transportation and mining of natural gas, we are not going to gain anything environmentally. That is a critical part of a clean-energy future, or particularly a short-term clean-energy future as we move to natural gas, but if that natural gas has the methane-implicit content, we are not going to gain anything in terms of effect on the atmosphere because, as we all know, methane is about 80 times as potent a greenhouse gas as CO$_2$. So this has to be something that we pay attention to.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Senator MARSHALL. Yes, well, thank you, Mr. Chairman, again, for holding this hearing. Certainly, there is lots of agreement here on our goals. Our goals of leaving this world cleaner, healthier, safer. The goal of using more affordable, cleaner energy. The goal of taking traditional energies and making them cleaner. That is the great news, is that we agree on these goals and then the question is “How do we best get there?” And I was interested by Dr. Eakin’s comments about raising productivity as we take American taxpayer dollars and invest money, especially in infrastructure, we want to know, does it raise productivity? And I certainly never studied the economy growing up or in school or much since then, but as I understand, GDP increases when we increase efficiencies.

And if we are not going to increase the efficiency, we need to figure out what is the cost for making the environment cleaner, right? What is the return of that investment? As you look through the plan before us, were there any red flags that you were really concerned that the investment was not raising productivity and there was not much of an environmental impact—a return on investment, so to speak?

Dr. HOLTZ-EAKIN. Well certainly, in the Administration’s American Jobs Plan, there are large amounts of resources committed to things that are unlikely to raise productivity—schools, you know, spending $300 or $400 billion on schools is not going to raise the productivity of the American worker. $400 billion on Medicaid expenses—

Senator KING. Are you serious?

Dr. HOLTZ-EAKIN. It will not.

Senator KING. Education?

Dr. HOLTZ-EAKIN. No, no, I didn’t say education. I said just the school buildings. The education is crucial and I would concur with you on that because we are failing America’s youth. We have 25 percent to a third of fourth and eighth graders who cannot read at grade, and that’s been true for 10 straight years. So do not label me as someone who doesn’t think education is important, but we’re not doing anything about that.

Senator KING. Sorry, Senator.

Senator MARSHALL. I think—

The CHAIRMAN. We will add that to your time, sir.
Senator MARSHALL [continuing]. More specifically as we invest in energy, were there some concerns here that it was not a good return on investment?

Dr. HOLTZ-EAKIN. My major concern is that moving from a model where you rely on private investment in energy——

Senator MARSHALL. It is more efficient.

Dr. HOLTZ-EAKIN [continuing]. You get some natural efficiencies because risk capital is used in the process and if you override that, you are unlikely to pick projects as successfully. That is less efficient.

Senator MARSHALL. Okay.

My next question is for Mr. French. Again, I am not a forest person. We do not grow many trees in Kansas, but whenever I turn on the news all the forest fires are in the western half of the country. The Southeast certainly has forest as well and I guess—why are there hardly any major forest fires in southeastern United States, but there are always more in the western half?

Mr. FRENCH. Thank you, Senator.

Different ecosystems, but there is a lot of fire in the Southeast. We have been able to maintain those through a lot of prescribed fire and through management. And so, when you look at the crisis we have right now, we need to both continue to maintain those in the southern United States and we need to thin and reduce the fuel loadings in those fire-adapted forests in the West to get them into a state that we can maintain them, like we are in the South.

Senator MARSHALL. I mean, again, I guess my frustration is this is not rocket science.

Mr. FRENCH. No.

Senator MARSHALL. Though what you are describing is something that the practice, so you are saying the practices in the Southeast have been successful because they have implemented them. There is no secret to what they are doing there. Why haven't we been implementing these in the past?

Mr. FRENCH. It is different. The topography is different. The resources haven't met the need and the systems are different. The topography is different. They do burn differently. We have been excluding fires for 110 years from those places and we have not had prescribed fire or mechanical treatments in those places so that now when we have fires, they are burning at levels we just haven't seen before.

Senator MARSHALL. And I guess I will go back to the why. I mean, I feel like we cannot see the forest for the trees, really. We are trying to conserve something, but in the end without using the prescribed fire, it costs us more in the long run. Why have we just ignored this obvious solution?

Mr. FRENCH. You know, quite frankly, Senator, we haven't had the resources to carry out that work at the scale needed.

Senator MARSHALL. Okay, thank you. I yield back.

The CHAIRMAN. Thank you, Senator.

Senator Hickenlooper.

Senator HICKENLOOPER. So this is the kind of lively panel that I was waiting for and I am going to try to resist the temptation to fan any flames.
First, Mr. Chair, I wanted to thank you for all the work on the infrastructure, as you walk out the door.

[Laughter.]

Senator HICKENLOOPER. Well, he is doing the real work, certainly there, the highest priority.

Let me start with Dr. Hogan, asking you a question here on the NREL, National Renewable Energy Lab in Golden, and the NREL has a Seam study. I am sure you have seen that they are building more transmission between largely disconnected parts of the grid. This would pay for itself, up to three times, and in so doing would provide immense benefit to those states that are energy-rich in renewable energy, but do not have the population centers to utilize that. Do you agree that building more high-voltage transmission would unlock significant resource potential? And we have heard a lot about permitting and I think that is a valid point—at a time when we have gone, we got a COVID vaccine permitted in record time. We had a vaccine that was out, ready to go in 300 days. Perhaps this is the time to have a bipartisan push on permitting improvement. What is your sense?

Dr. HOGAN. Well, thank you and yes, the country would benefit from more high-voltage transmission lines for the reasons that you point out and are well put forth in the NREL Seam study. I think, you know, there are a number of opportunities to move, as you say, energy from places that are energy-rich to urban populations and to go across areas where there is not too much activity going on. And you are absolutely right that being really thoughtful about the permitting and other-people parts of these conversations is really important. I think that is really one of the sets of objectives behind the American Jobs Plan proposal for a new grid development deployment authority at the Department of Energy, one where we could have the Department of Energy be a much stronger coordinating force on a lot of these issues as well as having access to some creative financing tools that can help leverage—not replace—private sector investment in transmission.

So again, a big part of that is in the infrastructure discussion draft, but we would also love to talk about some additional improvements there.

Senator HICKENLOOPER. I think you would find a lot of support in the Senate for that.

Ms. Trujillo, I wanted to ask, as you know, western water resource development management is somewhat unique. We have projects that serve agriculture, population centers, you know, things large and small, outdoor recreation economy. The $5 billion set aside in the discussion draft is a good start, but I will add that many western water providers in Colorado are urging that we do more. Do we need to prioritize additional infrastructure in terms of water storage?

Ms. TRUJILLO. Thank you very much, Senator.

The issues in the West are very concerning. We are dealing with drought on a daily basis and the provisions in the bill are a good start. They support many of the ongoing programs that we have in place to be able to address drought. We think we can include more programs such as Indian water rights settlements, rural water pro-
visions, and dam safety. There is an all-hands-on-deck approach right now to our water supply issues.

Senator HICKENLOOPER. Great, thank you.

Mr. French, when you testified last week before the Committee you spoke at some length about the protections that could be afforded to Colorado lands through the CORE Act. And this week, I would like to shift focus from lands that need protecting to the lands that the Forest Service is trying to help recover from wildfires. And I thought maybe you could speak a moment about the backlog of projects with respect to forest fire recovery, not just in Colorado, but across the West.

Mr. FRENCH. Yes, thank you for the question, Senator. There are at least 63 million acres of our National Forest System right now that are in need of a backlog of treatments that are in extreme condition to produce wildfire. Our scientists show that if you want to reduce 80 percent of the risk to communities, there is about 20 percent of those acres that we need to treat. Those are the most critical spaces for us to be in, and in order to do that we have to scale up our work by at least two to four times what we are doing right now. That is the backlog that we have to get up.

Senator HICKENLOOPER. Right, it is prodigious. Great, thank you all very much. I have other questions I will submit in writing. I yield to the Chair.

The CHAIRMAN. Thank you, Senator.

Senator Daines.

Senator DAINES. Thank you, Mr. Chairman.

Us Westerners love these conversations, don't we, Governor?

Senator HICKENLOOPER. We do.

Senator DAINES. Alright. Cleaner, reliable water is fundamental to human life. The Montana delegation has worked for over a decade to adjust the cost share for the St. Mary's-Milk River project so that much-needed reconstruction can take place, and any rural water package must ensure that folks in the Hi-Line of Montana get the help they need. This water system is over 100 years old and it is one of the worst cost shares in the nation, which is what led to the collapse of a drop structure this past summer, you see behind me.

[The photograph mentioned follows:]
Senator Daines. It was a catastrophic failure and it created huge problems for us. We rallied together and were able to get a fix put in place here and repaired by the end of the year, but it was tough.

If Congress does not move quickly to pass my bill, we could find ourselves in the same situation yet again. Ms. Trujillo, can you speak to the infrastructure needs on the St. Mary's-Milk River system and the risks posed by further inaction?

Ms. Trujillo. Thank you, Senator Daines. I turned my mic on the minute I saw that photo and I knew the question was coming this way, so I appreciate your attention and prioritization of that issue. We are also very concerned. We worked well in the context of the prior emergency and we are looking forward to providing testimony next week in the House on the provisions.

Senator Daines. Thank you and then, thanks again, how we came together truly——

Ms. Trujillo. Yes.

Senator Daines [continuing]. State, federal, local—just it was a great example of working together and getting a good result after the failure.

Let us talk for a moment about forest management. While I am glad that this bill, in relationship to the infrastructure, funds much-needed forest work, I believe strongly we have not had the paradigm shift that Chief Christiansen spoke about, in fact, when she was here. We need to include some common-sense management reforms. Region 1's litigation rate is higher than ever. Here is a startling statistic: 93 percent of these lawsuits are forest or fuel and vegetation management projects. They are projects that could actually reduce the wildfire risk. I just got off a phone call before I came to this hearing about Montanans very concerned about what is going on with the outlook on this fire season, which has already begun. Half the project area on the map behind me burned in wildfire while the project languished in the courts.

[The map mentioned by Senator Daines follows:]
Senator Daines. Because of the threat of litigation, agencies are discouraged from streamlining NEPA, based on past projects they know will not have significant environmental impact. A substantial time and cost savings could be achieved by litigation protections and streamlining these processes. Sixty-three million acres are at high risk of wildfire at the moment. We have to do just that, instead of just throwing more money at this problem.

Mr. French, will this $5.5 billion be more effectively utilized if paired with my litigation protections and streamlining provisions such as the efforts we were doing here to eliminate unnecessary consultation paperwork caused by the now infamous Cottonwood decision and to simplify environmental review for these collaboratively developed projects?

Mr. French. Thank you, Senator.

You know, if you look at our wildland fuel reduction projects and our broad-scale restoration projects, two-thirds of the effort and time that goes into those is usually through the environmental analysis, compliance, and design. An average project is going to take, at the quickest, eight months to a year and generally it is two years to two and a half years to get us through the environmental compliance side of things before we can actually start to implement, with litigation that could stretch on for years after that. And yes, we have seen in many cases where, you know, projects that we had planned to reduce fire are overcome by fire before we can implement them as we go through those phases.

I think any sort of collaborative, concerted effort that can help us do science-based, environmentally sound and public-supported approaches to do this work more efficiently and effectively, would make any investment like this better.

Senator Daines. It is so true, and these are collaborative projects. These are projects that just make so much sense for the vast majority of Montanans, and we have the very small, small group here that litigate these that are out of touch with where most Montanans are. In fact, Mr. Chairman, just last week in this Committee, I heard calls for management reforms on both sides of the aisle, and Chairman Manchin, thanks for your support in this area. I hope to keep working with you on the forest management provisions in this bill.

As I wrap up, I want to tell you, Mr. Chairman, I was very encouraged by the language that you added that requires agency review of critical mineral permitting. It is a big deal. I do believe, as the Chairman does, we need to take more robust steps to increase domestic critical mineral production in the United States. We are far too reliant on foreign countries for the minerals that drive our economy, especially since nearly all of them can be found and mined in the United States. It should not take decades to permit a mine, Mr. Chairman. So thanks for your support on that.

The Chairman. Thank you, Senator.

Senator Cortez Masto.

Senator Cortez Masto. Thank you, Mr. Chairman. Thank you to the panelists.

Ms. Trujillo, let me start with you. I so appreciate Senator Hickenlooper’s comments. As we are all aware, there is a historic drought happening in the West right now. The Colorado River
Basin is facing its worst hydrology on record, which could lead to its first-ever shortage declaration this year. I so appreciate your comments. It is all-hands-on-deck right now. Please let us know what the Administration needs from us as well to address this issue.

I just want to put something on your radar. Right now, I am working on the bill to establish a new competitive grant program under the Bureau of Reclamation for large-scale water recycling and reuse projects. The bill would also include measures that would provide greater clarity and expand eligibility under existing drought programs for eligible entities to receive federal financial assistance for drought planning and drought mitigation purposes. I look forward to working with you on that. So thank you.

Let me jump back to a conversation around critical minerals and battery recycling and manufacturing grants. Given all the exciting new technologies I see regularly in Nevada, I have been pushing what I call in my state, “the Innovation State Initiative.” This has allowed me, in Nevada, to promote the companies and technologies that, in some cases, have helped my state weather the current economic and health challenges posed by COVID–19. But one of those new, exciting areas is battery recycling—of all sizes—and that is why I am proud to be supporting Senator King’s Battery and Critical Mineral Recycling Act, and I agree with Mr. O’Mara’s written testimony that the entirety of that bill should be seriously considered for this package as well.

I am also working to put together a bipartisan effort on battery manufacturing grants, especially recycling, so we can be investing in a domestic supply chain and workforce that help us compete globally today and tomorrow. I have seen firsthand in Nevada where recycling is not only a future economic driver, but a necessity as we have more and more of the vehicle batteries on our roads and coming off of them and I am aware of industries in Alaska, Montana, Idaho—all over—who could benefit from DOE grant funds to establish more retrofit facilities for this purpose.

So let me start with Dr. Hogan and Mr. O’Mara. What are the broader implications of making investments in our domestic manufacturing capacity and would you agree that we need to be making strides in this space for global competitiveness and national security reasons?

Dr. Hogan, I will start with you.

Dr. HOGAN. Yes, we agree that the supply chain that goes with our batteries is a critical place for us to be taking important steps so that that build-out is happening in this country. As you pointed out, it is a growth opportunity for states like Nevada, but really the whole country, as we move toward a variety of battery technologies for electric vehicles and for the grid. So we absolutely agree that this is an important priority.

Senator CORTEZ MAStO. Thank you. Mr. O’Mara, I want your weigh-in on this, but let’s talk also about the critical minerals for these batteries as we talk about recycling, right? Lithium, lithium mining, we are looking at in Nevada right now, but cobalt—where is most of the cobalt being mined right now? Do either one of you know? Does anybody know? Mr. O’Mara?

Mr. O’MARA. Congo.
Senator CORTÉZ MASTO. Yes. And that is the challenge that we have in this country. And so, if we are really going to identify these critical minerals, bring that supply chain back from the extraction, through the production, through that whole process, we have to look at the mining piece of it as well. And so, Mr. O’Mara, if you could address this, I would appreciate it.

Mr. O’MARA. Yes, and I think Senator Lankford said it well earlier, I mean, like we have seen the problems when we do not have control over our supply chains and you know, I’ll be damned if we are going to spend the next 30 years buying everything from China, or offshore wind turbines from Germany, or electric vehicles from Japan, when we could do that all here. And there is an environmental piece of this. I mean, there has been NIMBYism around a lot of this. We have to be smarter. There have also been GAO analyses that show that incomplete permits are slowing down the process in some cases as much as government inefficiency. But I think combining the work that you are trying to do with the work that Senator Manchin has been trying to do around advanced manufacturing and thinking about everything in between is the best way to create good-paying jobs in every part of the country if we do it right.

Senator CORTÉZ MASTO. That is right. And I know I have just a few minutes left, let me just touch on the rangeland fires because I also appreciate this conversation as well. In Nevada, most of our fires are rangeland fires. We have cheatgrass everywhere and we have been talking about trying to address this. This is an invasive species. For all of the reasons that I have heard earlier, it is just not conducive or effective here in Nevada.

So the goal here is how to make sure that our federal agencies have the resources they need and the information they need to really address this invasive species and address what we see are the rangeland fires. Listen, we have forest fires, yes, but rangeland fires that I have seen in Nevada are some of the largest that we have ever seen and they have an impact on individuals, on the economy, along with the climate as well. So Mr. O’Mara, if you would touch on that very briefly, I would appreciate it.

Mr. O’MARA. Yes, and just building on Dr. Holtz-Eakin’s point, this is an area where, if you do not make investments, the downside on the economy slowing down our GDP is massive. This is like collective defense. If we have to invest in our natural infrastructure as a way to reduce the risk to community, to life, to property, to businesses, then we need to do it at scale. The challenge is that it is always an afterthought. It is always treated as discretionary spending, but I would argue this is as important to our economic future as anything else we are talking about right now.

Senator CORTÉZ MASTO. I agree. Thank you. Thank you to the panelists.

Senator BARRASSO. I have some second-round questions. Okay, thank you very much, Mr. Chairman.

Assistant Secretary Trujillo, water is the lifeblood of the West. It is critical that Congress fund water—western water infrastructure programs. As written, the bill before us today directs about $5 billion to the Bureau of Reclamation for water infrastructure. Does
the bill impose any restrictions on how the Bureau can spend this money or does the bill give the Bureau broad discretion?

Ms. TRUJILLO. Thank you, Senator Barrasso.

The bill as drafted, as I understand it, is a discussion draft, so it is an initial proposal that does give us broad authority in many of the categories that we already have on the books. So I presume we would use our existing authorities and the existing processes we have.

Senator BARRASSO. So can you speak about the importance of re-authorizing the expiring provisions of the WIIN Act to address issues such as building more water storage?

Ms. TRUJILLO. Thank you, Senator.

The WIIN Act has several different provisions and they are in various states of application and some of them are expiring, some of them are continuing, and we are in the process of reviewing all of those with Congress as they may be reauthorized or may not.

Senator BARRASSO. So would you agree that the infrastructure package should include reauthorizing these that are expiring?

Ms. TRUJILLO. Some of the provisions would be appropriate for a reauthorization.

Senator BARRASSO. Thanks.

Mr. Mills, the bill before us today seeks to “Ensure that the United States has a viable battery materials processing industry to supply North American battery supply chain, expand the capabilities of the United States in advanced battery manufacturing, and enhance national security by reducing our reliance on China for critical materials and technologies.”

Is a federal grant program, no matter how large, sufficient to achieve these goals?

Mr. MILLS. Senator, the short answer is no. And this is where I would like to say, I feel it is a point of privilege—not uncomfortable, but comfortable—in being in the same camp, it appears, as Senator King, with respect to regulations and the relevance here. I think it is possible to—I am not in the position to clarify—he anti-regulation. In fact, most businesses will tell you—particularly miners—they embrace regulations. They want consistency. They understand the goals. They embrace the goals. It is the process. And it is out of control and it is damaging America.

And I do not oppose more wind turbines or more electric cars. I think we will have lots more of them. We should have lots more of them. The challenge is the process of that and we won’t get to our goals that are being laid out in many of these plans by using American resources and labor, it’ll be importing a lot more material. And I don’t see a path out here yet. I want to just repeat again, I embrace the concepts of smart regulation with clear deadlines and a participation and a process that allows the private market to invest here. Private markets have made the decision to invest elsewhere and they’re doing it epically in very challenged areas, in Africa and in South America.

Senator BARRASSO. So do we need to add language to the draft bill to meaningfully increase American mining?

Mr. MILLS. I like the word “meaningfully.” I agree entirely, yes, sir.
Senator BARRASSO. So the bill before us today includes a $5 billion program that appears, in my opinion, to be designed to bail out the State of California and its failing electric grid. Now, I would note that the State of California has an unprecedented budget surplus of $75 billion. Will the new federal grant program for the benefit of the State of California and its electric utilities actually keep the lights on in California?

Mr. MILLS. I doubt it, Senator. But I guess I would make the point that I am not clear why the American taxpayer should fund California’s—won’t call them mistakes—they are experiments. We have this—our states have grand experiments that are underway in many respects in the energy markets. This is a good thing. I am not sure why we should fund it with taxpayer money.

Senator BARRASSO. In your testimony, you identify the most cost-effective ways for the U.S. to help reduce global greenhouse gas emissions. Your list includes facilitating the construction of natural gas pipelines, liquefied natural gas export terminals here in the country. Your list also includes encouraging the development of more efficient internal combustion engines. Do you see anything in this bill to encourage the construction of natural gas pipelines, liquefied natural gas terminals, or more efficient internal combustion engines?

Mr. MILLS. Well, first off, I confess I may have missed it if it is there, but it wasn’t in evidence to me and I just want to emphasize that the cost-efficiency metric of looking for ways to reduce carbon dioxide emissions, I think, should be paramount.

Senator BARRASSO. Thank you. Thank you, Mr. Chairman.

Senator HEINRICH [presiding]. Senator Kelly, you are next.

Senator KELLY. Thank you, Mr. Chairman.

Mr. Chairman, I commend Senator Manchin and any additional members of this Committee for embarking on this process to develop a bipartisan infrastructure proposal. The draft bill recognizes the urgent need to respond to the crushing drought, rolling brownouts, and wildfires engulfing the West. Mr. Chairman, I will state at the outset that I look forward to working with the Committee to build out the $5 billion western water infrastructure provision. Most of the dams, reservoirs, and irrigation canals that store and transport water to farms and cities in western states are more than 50 years old and they are failing and they are wasting water, a resource that we do not have enough of. Funding should be prioritized for the completion of authorized water storage projects, deferred maintenance for dams, and the recently established aging infrastructure account at the Bureau of Reclamation. Rural water—Title XVI water recycling and desalination programs are also a must. Conservation programs and WaterSMART grants to promote water efficiency, including lining canals must not be overlooked either.

I also appreciate the inclusion of a proposal that I authored to promote grid resiliency through the use of demand response technology. Extreme heat waves and polar blasts in some places can lead to surging demand for electricity that exceeds supply. The widespread deployment of network-smart appliances and batteries can help states keep their lights on during these peak periods. We saw the success of this in Arizona just last summer when smart-
thermostat programs were able to reduce the strain on the grid by significantly dropping the load. Big success story.

And finally, the draft bill recognizes that our national forests are infrastructure too. Forest watersheds funnel snowmelt into our rivers and lakes, but megafires, which are raging at this very moment—we have the worst fire season on record—they have a devastating and long-term impact on rural communities and water supplies.

So my first question is for Ms. Trujillo, and it is about water. The Interior Department is expected to declare its first ever water shortage on the Colorado River very soon, and Reclamation is part of an interstate agreement called the Drought Contingency Plan that involves adding 100,000 acre-feet of water to Lake Mead to avoid even steeper water curtailments. So Ms. Trujillo, what infrastructure will Reclamation need to meet this obligation?

Ms. TRUJILLO. Thank you very much, Senator Kelly.

It is no surprise that we are very much focused on trying to address the issues in the Colorado River Basin. The infrastructure needs we have can include well modernization, funding for system conservation projects, funding for support for tribal system conservation programs, and additional relief that will help build to what the other parties are working on as well.

Senator KELLY. Does any part of that include additional funding for dams to increase capacity?

Ms. TRUJILLO. Yes, Senator, there will be additional funding for increased storage. We also have funding for recycling projects and Senator Cortez Masto referenced an innovative project that involves large-scale recycling that can be beneficial to Colorado River Basin States and local communities in the area.

Senator KELLY. And on the WIIN Act, would you agree that the WIIN Act, which expires this year, helps Reclamation manage against drought?

Ms. TRUJILLO. Thank you, Senator Kelly.

The WIIN Act has several different provisions and some of them are definitely helpful with respect to our drought response efforts.

Senator KELLY. Thank you.

Dr. Hogan, in the remainder of time, I know we do not have a lot of time left, but what is the Department’s position on my provision to expand demand response programs to all federal buildings and in DOE energy efficiency grants to states?

Dr. HOGAN. We are very supportive of using the demand response tool as a cost-effective way to contribute to the energy grid. We all know that the last kilowatt that is provided can be an expensive kilowatt, and this is a way to get there more cheaply. We also believe that sending energy efficiency related dollars that are good investments in energy efficiency are a good way to lower costs and put dollars that would otherwise be used to pay bills to better purposes.

Senator KELLY. Thank you, Dr. Hogan.
Thank you, Mr. Chairman.

Senator HEINRICH. Thank you, Senator.

Senator HOEVEN. Thanks, Mr. Chairman.
Dr. Hogan, Dr. Fatih Birol, head of the International Energy Agency, has told this Committee that carbon capture and utilization technology is, “The most important technology that exists today.” Do you agree that carbon capture and storage is vitally important in meeting our climate goals?

Dr. Hogan. Yes, we have had a long program in carbon capture and utilization and storage and expect to continue to be working aggressively on that to reduce its costs throughout that entire chain.

Senator Hoeven. Yes, and isn’t it important that we, in essence, crack the code on it, because it is not just about what we do here in America, it is around the world, right? There are other parts of the country that are—or the world—that are emitting a lot of CO₂ and if we do not develop that technology to make it commercially viable, then we are not really addressing the problem from a global standpoint, are we?

Dr. Hogan. We agree that this is an important technology that will have a growth market associated with it and we want the United States to be there on the leading edge with being able to benefit from this technology in many ways, economically, as well as what it can do for carbon.

Senator Hoeven. Isn’t it also true that it is not just about fossil fuels, but that it also relates to things like, for example, biofuels, where we strip the CO₂ and sequester. We are working on that in my state as well as for our manufacturing industry.

Dr. Hogan. Absolutely.

Senator Hoeven. Does DOE stand ready to assist energy producers and manufacturers in meeting their goals to retrofit their operations because of the investment required?

Dr. Hogan. Yes, we would be ready to provide any assistance, given the authority and resources to do it.

Senator Hoeven. So it is safe to say you are committed to making it happen?

Dr. Hogan. Absolutely.

Senator Hoeven. Thank you, Doctor.

Ms. Trujillo, so the proposal being discussed today, which has many good aspects to it, would appropriate $5 billion in FY22 through FY26 for western water infrastructure, and I know the Ranking Member thinks that most of that should go to his state, but the Acting Chairman and I and some others are hoping that we will get a little bit of it as well. So tell me, what type of projects would be eligible for that proposed funding in the draft legislation?

Senator Heinrich. I would note for the record that Ms. Trujillo is from the state that really needs it.

[Laughter.]

Ms. Trujillo. Thank you, all. Thank you, sincerely, all the members of the Committee for recognizing the severity of the drought and the importance of trying to address the drought concerns. We work on it every day. The provisions in the draft are for discussion and they provide additional funding to many of the programs that we already have on the books. So we would utilize our existing authorities and our existing criteria to use those programs.

Senator Hoeven. Well, that is what I kind of want to drill in on a little bit is, how to determine the allocation, because I think it
is going to be very, I mean, it is a very good provision. It is going
to be very much sought after. So how do you kind of make that de-
cision in terms of what projects you fund and in what priority
order?

Ms. Trujillo. Thank you, Senator. The answer kind of depends
on which program we are talking about. There are criteria that are
in place for each of the various authorities. In the rural water con-
text, for example, Reclamation utilizes criteria to determine which
programs should receive which funding depending on how far along
they are, depending on the urgency of the needs. There are several
different factors that we would be working with.

Senator Hoeven. Okay, very good.

Thank you, Mr. Chairman.

Senator Heinrich. Thank you.

I am going to do a quick second round and then I know Senator
King has a second-round question as well.

Assistant Secretary Trujillo, talk a little bit about the role that
climate change is having on your ability to manage water west-
wide?

Ms. Trujillo. Thank you, Senator Heinrich.

The reality is we are seeing higher temperatures, which in and
of itself creates a dynamic situation for drier soils and more evapo-
ration. So our runoff numbers aren't what they used to be, frankly.
In addition, we see more variable snowpacks. We see rain instead
of snow in some cases, which causes many complex challenges for
what we used to see in terms of our reservoir supplies. So there's
a number of ways that the changing climate makes our world more
difficult.

Senator Heinrich. Does any of it make your world—your daily
water management—easier?

Ms. Trujillo. Well, it keeps me up at night, for sure, but I think
the reality is we have to be creative with all of the tools that we
have available.

Senator Heinrich. Talk about that, like, talk a little bit about
the whole suite of tools that we should be investing in now that are
maybe different than just, I mean, if you do not have water—more
storage does not get you more storage—if you do not have the funda-
mental water. So you talked a little bit about recycling, you
know, the people I know are now looking at underground storage.
We have done a little bit of that in New Mexico. I have seen it in
California as well. What is the whole suite of tools that we should
be embracing given the world that we live in today?

Ms. Trujillo. Thank you very much. I was going to bring up the
example of our home state, in Albuquerque, where we have conjunc-
tive management of our surface water and groundwater so
what we see this year—the surface water is very, very low so the
city has converted to utilizing its groundwater resources. And that
may be an example—I was speaking with Senator Cantwell ear-
lier—that may be an example of something to expand in other
areas.

Water recycling capabilities need to be expanded and we can pro-
mote that through these large-scale projects or small-scale projects.
The ability to try to utilize as many tools as we have available is
what we need to do, ultimately promoting more efficient use and more conservation.

Senator HEINRICH. Mr. French, I want to ask a related question. How much should we be paying our entry-level firefighters? Clearly, it is not 11. It is not 13. What should we be paying them?

Mr. FRENCH. Well, I think clearly enough to support a family and to compensate the risk that they take on behalf of the entire American public.

Senator HEINRICH. And enough to attract someone that would want to do this job in the first place.

Mr. FRENCH. Yes, I mean, at the end of the day we are training firefighters at an entry level then losing them to other firefighting organizations because they are paying double or triple the amount by the time we have trained them.

Senator HEINRICH. What is the delta between what you are paying and what Cal Fire, say, is?

Mr. FRENCH. Almost three times at times.

Senator HEINRICH. Yes. I have two minutes left on the clock. Mr. Ranking Member, is it okay if I yield my last minute forty-five to Senator King?

Senator BARRASSO. Or as much time as he would like.

Senator HEINRICH. There we go. Fantastic. Take it away, Angus.

Senator KING. Thank you.

I just want to compliment the Ranking Member and Senator Manchin and the staff for putting together this panel. This has been the kind of discussion that we should be having at Congressional hearings, with a variety of points of view, a variety of points of expertise. And I think it is been a very productive session, very helpful to me.

I just wanted to make a final point. A theme underlying our discussion today has been the role of public investment versus private investment. And there is no question private investment is what generally drives our economy. It has created the richest nation in the history of the world and that is the major focus.

On the other hand, there is no question that public investment has a role to play and I wanted to share with you an insight from some time ago. Here is what it says: “Time and experience have verified to a demonstration the public utility of internal improvements,” in other words, infrastructure, “that the poorest and most thinly populated counties would be greatly benefited by the opening of good roads and in the clearing of navigable streams within their limits is what no person will deny.” That was the very first political brochure written by Abraham Lincoln at the age of 23, when he ran for the legislature in Illinois in 1832. And my addition to that would be, although private investment has driven this economy, I would argue that the two most important economic development infrastructure investments of the 20th century were the GI Bill and the Interstate Highway System, both public investments which changed the face of the country. I am in a state which, if the Interstate Highway System had been strictly built on population or economic return, Interstate 95 would probably stop at Boston. And yet it has been critical to the economic development of my state.
So I commend our panel today and I think what we are striving to do here is to achieve the proper balance between proper incentives for efficient investment of private capital, at the same time, providing public investment in the image of the Interstate Highway System or the GI Bill, which can contribute in very significant ways to the development of the country, controlling of climate change, and economic development that is shared among all of our citizens.

So again, I want to thank our panel and thank our Chair and Ranking Member for, I think, a very productive hearing.

Senator HEINRICH. Thank you and with that, the hearing is closed.

[Whereupon, at 11:26 a.m., the Committee was adjourned.]
APPENDIX MATERIAL SUBMITTED
U.S. Senate Committee on Energy and Natural Resources  
June 24, 2021 Hearing: The Infrastructure Needs of the U.S. Energy Sector,  
Western Water and Public Lands, and Consideration of a Legislative Proposal  
Questions for the Record Submitted to Dr. Kathleen Hogan

QUESTIONS FROM CHAIRMAN JOE MANCHIN III

Q1. Buildings are responsible for about 40% of our energy use and account for about 40% of greenhouse gas emissions. The discussion draft infrastructure proposal includes $6 billion for a wide array of energy efficiency efforts, from weatherizing low-income housing, improving the efficiency of industrial facilities, reducing the energy footprint of the federal government, supporting new smart manufacturing practices, and training the next generation of energy auditors and building technicians and engineers.

Q1a. How important are investments in reinvigorating our aging buildings to make them more efficient?

A1a. The U.S. cannot build a carbon-neutral economy by 2050 without renovating a significant majority of the Nation’s 130 million residential1 and commercial2 buildings to make them more energy-efficient. Almost 80% of America’s buildings are over 20 years old, and around half of single-family homes3 and commercial buildings4 were built before model building energy codes were adopted to improve building efficiency in the 1980s.

The current pace of building renovations that reinvigorate aging buildings is insufficient to meet the Nation’s energy, environmental, and economic goals. The latest information suggests that only 1 to 2 percent of America’s buildings undergo efficiency-related renovations on average each year,5,6,7 while the energy performance of nearly every other U.S. building worsens over time as equipment degrades and updates are made primarily to address equipment failures. Additionally, the labor productivity of the U.S. construction sector that renovates buildings has not improved but declined by nearly 2% per year.

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1 There are 123 million housing units (incl. single-family, multifamily, and mobile homes) in the United States. Source: US EIA 2011 AEO Rev. Supp. Table 1.4
2 There are 5.9 million commercial buildings in the United States. Source: US EIA CBEC’s 2018.
3 A02.5 Years single-family homes were built: post-2000 (21%), pre-1980s (52%), 1980s (15%), 1990s (14%). Source: US EIA BECS 2015 R.2011 AIDS.
5 According to CBEC’s 2012, 14–19% of buildings are at least four years old and have had an efficiency-related renovation over the preceding 18 years for an average of 0.8–2.2% per year. Source: ACEEE 2020, “Mandatory Building Performance Standards: A Key Policy for Achieving Climate Goals.”
6 The states with the highest retrofit rates in the country have historically reached between 0.5 and 1.75 percent of homes per year and achieved between 20 and 35 percent savings. Source: Regulatory Assistance Project 2011, “Residential Efficiency Retros. A Roadmap for the Future.”
7 An estimated 2.2 percent of commercial floor space undergoes some type of energy retrofit each year, resulting in median energy savings of roughly 11 percent for these buildings relative to average building energy use intensity. Source: ACEEE 2017, “Unlocking Ultra-Low Energy Performance in Existing Buildings.”
since 1968, which makes renovations lengthier and costlier to conduct. These trends are unlikely to accelerate without government investments in the research, development, and deployment of energy-saving building technologies and construction practices that can renovate buildings more quickly and affordably.

Q1b. In addition to saving people money, what other benefits does energy efficiency provide for low-income households and small businesses?

A1b. Energy efficiency measures – also known as weatherization – not only help low-income households by saving money on their energy bills, but they also help revitalize communities by spurring economic growth and reducing environmental impacts. According to an independent evaluation conducted in 2014 of the Weatherization Assistance Program, weatherization returns $2.78 in nonenergy benefits for every $1.00 invested in the Program.

Nonenergy benefits (including improved indoor air quality and health outcomes) represent tremendous value for families whose homes receive weatherization services. After weatherization, families have homes that are more livable, resulting in fewer missed days of work (e.g., sick days, doctor visits) and decreased out-of-pocket medical expenses by an average of $514. The total health and household-related benefits for each home averages $14,148.

Beyond dollars saved, energy efficiency can directly impact a small business’s bottom line and enable them to be more competitive in today’s market. When compared to typical buildings, energy-efficient buildings may have higher sale prices by 1-31%, rental premiums by 2-16%, and occupancy levels up to 10%.

Measures that improve lighting or daylighting in a space can contribute to increased employee productivity and an improved customer experience, and investments in energy efficiency can positively differentiate a business from its competitors. Heating, ventilation, and air conditioning upgrades,

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especially when paired with improved insulation or building airtightness, can improve air quality and better regulate indoor temperatures, leading to an overall healthier and more comfortable environment for employees and customers alike.\footnote{Maximizing Energy Savings for Small Businesses, \url{https://www.nrel.gov/buildings/small-businesses.html}} These benefits can increase employee retention, encourage repeat business from customers, and reduce uncertainty for owners, investors, and the community supporting that small business.”

Q2. The Department of Energy, the Congress, and the American public rely on the Energy Information Administration’s accurate, timely and comprehensive reporting and analysis of energy data. This includes the private sector’s use of EIA data on the costs and performance of generating technologies and its forecasts in the Annual Energy Outlook.

Q2a. As a user of EIA’s data and modeling, can you speak to the importance of having access to timely and comprehensive data collection on the operations of the bulk power system and other aspects of our national energy system?

A2a. Timely data collection and open access to data sets on the operations of the bulk power system is critical for modernizing energy system tools, integrating new technologies, and maintaining and improving reliability and resilience. The Department uses Energy Information Administration (EIA) data in the development of new tools for situational awareness and system planning that explore interdependencies across multiple critical infrastructures. Data on the bulk system operations is needed to develop new tools with artificial intelligence (AI) and machine learning (ML). However, since well-labeled data sets in this space are currently lacking, DOE is working to develop new datasets that include measurements from advanced sensors to further spur grid-modernization technology development in the national laboratories, industry, and academia. Development of these datasets requires careful review to maximize their usefulness for ML and AI and to ensure access to the data does not jeopardize the security of the underlying systems.

Q2b. How do you think about the value of analysis and modeling in managing a transition in the energy sector that potentially involves entire new industries and large shifts in employment?
A2b. Analysis, modeling, and simulation are important for preparing the current workforce for changing system needs and to train the future workforce. Currently, the workforce already includes wide-ranging skills including power systems engineering, software and hardware development, mathematical modeling and simulation, and cybersecurity. With future retirements in the workforce, and with changing system dynamics from new technology entrants into the system, analysis and modeling are needed to develop the knowledgebase for the future workforce through training tools, simulation environments, and apprenticeships. Modeling and analysis of high impact low frequency (HILF) events are also needed to further prepare the workforce for future system conditions and contingencies. However, for system operators, the effectiveness of research into these areas may be limited without looking at and updating training requirements set by the North American Electric Regulatory (NERC) and the Federal Energy Regulatory Commission (FERC).

DOE recently commissioned a series of whitepapers exploring needed research and development (R&D) in the electricity transmission space. Relevant to this question are the following excerpts:

“DOE should support R&D to create educational tools for students and professionals in power systems. This can include virtual reality to simulate field conditions and open-source software and data for conducting planning studies. Educational materials that address engineering, economics, policy, and law would be particularly useful. Many decision makers in the transmission infrastructure process are not necessarily well versed in engineering and technical details, so it is important to enable communication of complex technical materials in a generally relatable and understandable format for all audiences.” 15

“In the United States, there has been no significant research on building improved simulators during the past couple of decades, and it is unlikely that any effort will be made to build better OTSs [operator training simulators] unless FERC/NERC require more rigorous operator training.” 16

QUESTIONS FROM SENATOR JAMES LANKFORD

Q1. Dr. Hogan, at the hearing on Chairman Manchin’s draft energy infrastructure proposal we had a discussion about the length of time it takes to get infrastructure projects permitted. I wanted to follow up specifically on permitting for nuclear power plants.

Q1a. Dr. Hogan, how long does it currently take to get a nuclear plant permitted in the US, on average?

A1a. The Department of Energy (DOE) understands that the Nuclear Regulatory Commission (NRC) has generally issued combined licenses for nuclear power plants in an average of approximately seven years. DOE also notes that, in accordance with the Nuclear Energy Innovation and Modernization Act (NEIMA), NRC has established generic schedules for each type of license or permit that involves issuance of a final safety evaluation, which can be found on their public website [https://www.nrc.gov/about-nrc/generic-schedules.html](https://www.nrc.gov/about-nrc/generic-schedules.html). In these generic schedules, NRC sets a target of issuing the final safety evaluation for a combined license application in no more than three and a half years, depending on the type of application submitted and the site or design information already approved. When each new application is submitted, DOE understands that NRC performs an acceptance review, which includes establishing a project-specific schedule.

Q1b. Are you supportive of reforming the permitting process to reduce this timeframe?

A1b. DOE strongly supports reform efforts designed to reduce the timeframes for advanced reactor permitting requests. DOE’s Office of Nuclear Energy (NE) understands that NRC continually works to both identify and address regulatory challenges, and streamline the licensing process to reduce the regulatory risks and timelines associated with licensing new nuclear power plants. Within the bounds of their statutory authority, DOE and NRC work cooperatively to ensure both agencies are ready to carry out their missions regarding new technologies. For example, the Nuclear Energy Innovation Capabilities Act (NEICA) of 2017 required DOE and NRC to enter into a Memorandum of Understanding (MOU) to coordinate DOE and NRC technical readiness and sharing of technical expertise and knowledge on advanced nuclear reactor technologies and nuclear energy innovation. Pursuant to this MOU, entered into in October 2019, together with its subsequent addenda, NE coordinates with NRC and industry to address and resolve key regulatory framework and technical challenges that directly impact the “critical path” to advanced reactor demonstration and deployment.
Also, NE’s Advanced Reactor Regulatory Development subprogram (established as part of NE’s Advanced Reactor Demonstration Program (ARDP)) focuses on regulatory modernization activities such as coordinating with NRC to support its efforts to develop regulations for non-LWR advanced reactors, finalizing the establishment of risk-informed and performance-based license application guidance, and establishing clear expectations for advanced reactor license application content and review criteria. These regulatory modernization efforts have the potential to facilitate efficient and timely reviews of advanced reactor licensing applications to meet industry stakeholder and commercial deployment timeline goals.

Further, NE’s National Reactor Innovation Center (NRIC) (another subprogram under the ARDP) provides NRC access to infrastructure and capabilities to observe and learn about the advanced technologies demonstrated through NRIC. Specific activities include: coordination on technology-neutral approaches to environmental assessments; engagement on advanced construction technologies; and collaboration on the application of digital engineering to future license applications.

Other relevant DOE/NRC activities include: coordination on the development of modeling and simulation tools through NE’s Nuclear Energy Advanced Modeling and Simulation (NEAMS) subprogram; NRC participation in NE program reviews for advanced reactor research programs; and NRC monitoring of the Versatile Test Reactor (VTR) Project (governed by a separate MOU). Continued coordination between DOE and NRC will help ensure that NRC has sufficient technical expertise to support regulatory reviews of advanced nuclear reactor demonstrations.
Senate Committee on Energy and Natural Resources
Hearing on Infrastructure Needs of the United States
June 24, 2021

Questions for the Record submitted to Tanya Trujillo from Chairman Manchin

The Department of the Interior estimates that costs to complete the necessary AML reclamation work is about $10.6 billion but according to recent reports, there could be as much as $18-20 billion in unfunded reclamation needs across the U.S and roughly 84% of remaining damage is concentrated in seven Appalachian states."

- **Can you explain the discrepancy in these figures and what your agency is doing to ensure we have accurate numbers that reflect the true cost of outstanding reclamation?**

**Response:** The Department of the Interior’s Office of Surface Mining Reclamation and Enforcement (OSMRE) estimated a cost of $10.6 billion necessary to complete the outstanding amount of abandoned mine land (AML) reclamation based on the data extracted from the enhanced Abandoned Mine Land Inventory System (e-AMLIS) as of September 30, 2020. This figure is limited to construction costs to reclaim AML problems entered into e-AMLIS and is based on data that has been field verified by states and Tribes, and verified by OSMRE before entry into e-AMLIS.

The figures reflected in the e-AMLIS database will differ from other reported sources for several reasons. First, the e-AMLIS system was never configured to be a project management tool. As a result, the data in e-AMLIS only reflects AML construction costs, and does not include other costs necessary to complete the reclamation work, such as project engineering, design, and administrative (e.g., environmental reviews, procurement activities, etc.) costs. Second, AML AML project costs are fixed at the time of entry into the inventory and therefore are not adjusted for inflation unless States and Tribes proactively revise their inventories. Third, e-AMLIS was not designed to predict or project the amount of future AML problems that will be added. Finally, long-term operation and maintenance costs for addressing acid mine drainage problems are not entered into the AML inventory. Most of these additional costs are captured either in the Department’s Financial Business Management System or tracked in the State/Tribal financial systems.

We recognize that while e-AMLIS only provides for the direct cost for AML construction, other indirect costs such as project engineering and design, and administrative costs are integral in reflecting the true cost for outstanding reclamation. It is OSMRE’s intent to continue working with the states and Tribes to understand the total cost for completing outstanding AML reclamation.
• How does your agency and the administration envision distributing any additional funding placed into the AML Fund outside of the traditional industry fees?

Response: In that event, we could continue to look to historic coal production, which is an indicator of where the greatest needs lie, as a factor for purposes of allocating and distributing AML grants. OSMRE anticipates that grants would be disbursed to states and Tribes to advance the restoration of AML issues in a manner that ensures the Federal investment is protected, and that states and Tribes respond to the needs most critical to their communities.
Questions from Chairman Joe Manchin III

**Questions:** The discussion draft infrastructure proposal provides the Forest Service and the Department of the Interior $3.5 billion for wildfire risk reduction and another $2 billion for restoring ecosystems, which I understand will also help to address the wildfires threatening our forests. It would provide you with this money, but also would require that you treat at least 25% of the very-high-risk forests and rangelands on Federal land.

- Can you tell us the impact of this investment on your ability to manage wildfires? Specifically, if we appropriate this large amount of money, what kind of difference on the landscape should we expect to see?

**Answer:** Devastating wildfires are the most critical threat to the ability of our forests to sequester carbon, support local economies, and provide clean water and other important resources upon which we rely. In the United States, there are over a billion acres at risk of wildfire. About 63 million acres, or 32 percent, of National Forest System (NFS) lands are at high or very high hazard for wildfires that would be difficult to contain. The Forest Service carries out approximately 3 million acres of fuels treatments annually. Unfortunately, this is not at the scale necessary to address the problem.

We appreciate that this draft bill would provide additional investment in hazardous fuels reduction. To address the highest risk acres at the scale needed, the Forest Service has established a team to lead efforts to ready the Forest Service to implement priority wildfire risk reduction treatments on the landscape. This team will ensure we do the right work, in the right place at the right scale to reduce wildfire severity, protect communities and improve forest resiliency. We are working collaboratively with States, Tribes, local communities, private landowners, and other stakeholders to strategically treat 20 million acres on priority National Forest System lands in the West over and above our current level of treatments; and strategically treat 30 million acres of other priority Federal, State, Tribal, and private lands in the West.

Without a paradigm shift in the way we treat hazardous fuels on federal and non-federal land, and addressing the impacts of climate change, we will remain in this current wildfire crisis and destruction from wildfires will continue to threaten communities across the West. Forest Service research indicates we need to dramatically increase the extent and impact of fuels treatments such as thinning, harvesting, planting, and prescribed burning across all landscapes. To make progress, we estimate that two to four times more acres than are currently treated each year need to undergo fuels reduction treatments.

Questions from Senator Steve Daines

**Question 1:** Mr. French, section 8003 provides funding for forest treatments but limits those projects to those occurring in the Wildland Urban Interface and public drinking water supply areas. Do you believe this will narrow the agency’s ability to undertake necessary landscape-level treatments and is there another criteria that would help the agency reduce the risk of wildfires?
Answer:
While treatments in the Wildland Urban Interface and public drinking water supply areas are important to reduce wildland fire risk, working in those areas alone will not allow us to fully reach our objectives. Forest Service research indicates we need to dramatically increase the extent and impact of fuels treatments such as thinning, harvesting, planting, and prescribed burning across all landscapes. To make progress, we estimate that two to four times more acres than are currently treated each year need to undergo fuels reduction treatments. Our scientists have developed scenario planning tools to help target fuels treatments in strategic locations that will reduce fire size and severity. Our estimates suggest approximately 20 million acres of NFS land and 30 million acres of other federal, State, Tribal and private lands in the West need treatment over the next ten years in order to significantly reduce wildfire exposure to communities.

Question 2: Mr. French, Title 8 of the discussion draft sunsets the availability of funds after five years. It is my understanding that stewardship contracts are typically ten years. Do you anticipate the five-year sunset on the use of funds creating any legal or contractual concerns for implementing Good Neighbor Authority, stewardship, or other account contracts?

Answer: As you note, above the Forest Service has been moving towards more large-scale, long term contracts using authorities such as stewardship contracting. While five years of additional funding is certainly helpful, particularly for accomplishing additional hazardous fuels work and we can obligate funds to longer term contracts during that time, it would be helpful to have additional time for obligation and expenditure beyond five years, as we will be using a variety of contract and agreement methods to accomplish this work.

Question 3: Since the 9th Circuit Cottonwood decision, there have been dozens of lawsuits and notices of intent to sue on related claims. I understand re-consultation on the Lynx Management Decision cost the Forest a quarter of a million dollars, 500 days of work, and resulted in no change to management. How would more work get accomplished if Congress were to codify that a Forest Plan is a completed action in this bill?

Answer: The Cottonwood Decision remains a source of litigation and continues to be an issue of concern for the agency. We look forward to working with you and this Committee on a long-term legislative fix.

Question 4: While I support the goals of the Forest Service Legacy Road and Trail Remediation Program to restore watersheds, fish passages, and illegal roads I worry that how this section is drafted could lead to the loss of Forest Service roads depended upon by rural communities. Is there anything in the bill that only permits the decommissioning of roads when there is broad consensus or were created illegally? How many roads have been closed within Montana over the last ten years and how do these road systems assist with wildfire evacuations, land management, and public access?

Answer: Section 8011 of the discussion draft would require the Secretary to establish the Legacy Roads and Trails Remediation Program. This program supports restoring fish passages, road decommissioning, preparing roads for long-term storage, relocating National Forest System roads, and converting NFS roads to trails. If enacted, the program will require the Forest Service to establish an annual process for selecting long-term storage and road and trail decommissioning projects, and to solicit public comment on these projects. The
program prioritizes projects that protect or improve water quality, restore habitat of threatened, endangered, or sensitive species, and maintain future access for the public, permittees and firefighters. In implementing the program, the Forest Service is required to ensure that the system of roads and trails is adequate to meet any increasing demands, provides for multiple use and sustained yield of products and services, does not damage adjacent resources, and reflects long-term funding expectations.

The Forest Service does not define roads as closed or open; instead, we use a variety of categories to accurately capture the intended use of a road. A Forest Service road may be decommissioned, stored, or restricted to administrative use. We make every effort not to decommission roads that are important for emergency egress or to access areas for wildfire and forest management.

**Question 5:** Section 8003 authorizes landscape level projects. I introduced legislation last Congress to simplify the review process and provide certain litigation protections for similar projects. Would the agency benefit from pairing Section 8003 with similar provisions?

**Answer:** Section 8003 contains funding for a variety of activities that will increase the scale of wildfire mitigation, so we can better manage our forests. We would be happy to work with you and the Subcommittee on any proposed language additions to the bill.

**Question 6:** Section 8003 appropriates $500 million for mechanical thinning and timber harvesting in a manner that focuses on small-diameter trees. Do you foresee this focus limiting the Forest Service’s ability to do treatment work in Montana? Do you foresee this limiting the Forest Service’s ability to treat those acres at truly the highest risk?

**Answer:** Devastating wildfires are the most critical threat to the ability of our forests to sequester carbon, support local economies, and provide clean water and other important resources upon which we rely. In the United States, there are over a billion acres at risk of wildland fire. About 63 million acres, or 32 percent, of the National Forest System lands are at high or very high hazard for wildfires that would be difficult to contain. The Forest Service carries out approximately 3 million acres of fuels treatments annually. Unfortunately, this is not at the scale necessary to address the problem. While many of our treatments involve removing small diameter trees, working in those areas alone will not allow us to reach our objectives.

**Question 7:** The draft bill appropriates $200 million for states to implement restoration projects under Good Neighbor Authorities but divides the funding evenly between the Department of the Interior and the Forest Service. How many Good Neighbor projects were completed last year by the Forest Service and how much total acreage was treated?

**Answer:** In FY2020, the Forest Service had 242 active Good Neighbor Authority agreements across the country. The Forest Service doesn’t have a mechanism to track the number of projects completed through the Good Neighbor authority or the individual footprint of those projects. Instead, the agency tracks the acres of accomplishment of various land management activities such as timber sales, hazardous fuels treatments,
timber stand improvements and tree planting, some of which occur on the same acre of land. In FY2020, Good
Neighbor authority agreements led to the completion of approximately 47,000 acres of those types of
treatments.

Questions from Senator Mark Kelly

Question 1: How important are Forest Service roads in landscape-scale restoration projects and how much
funding is needed to address the road maintenance backlog at Forest Service?

Answer: The Forest Service uses roads to carry out important landscape-scale treatments, including much
needed hazardous fuels treatment. The Forest Service has an estimated backlog of $5.9 billion in critical
defered maintenance. $3.85 billion of this is transportation needs.
The Great American Outdoors Act (G AOA) (P.L. 116-152), enacted in 2020, will allow the Forest Service to
repair and upgrade vital infrastructure and facilities in the national forests and grasslands through the National
Parks and Public Land Legacy Restoration Fund. Projects funded through the Public Lands Restoration Fund
and Land and Water Conservation Fund (L WCF) will enrich the lives of current and future generations by
improving landscape resiliency and increasing access.

Question 2: What funding would be needed in roads management to advance forest restoration projects?

Answer: In addition to the funding provided through the Great American Outdoors Act, the President’s FY 22
budget proposes a $8 million in funding to re-establish the Legacy Roads and Trails program. The funding will
be used to protect investments and decommission and repair roads and trails to mitigate detrimental impacts to
sensitive ecosystems and watersheds.
Questions from Senator Joe Manchin III

**Question 1:** In addition to provisions already included in the discussion draft infrastructure proposal, are there any other provisions that we should evaluate to improve construction and siting of transmission?

Significantly more funding could be directed to the expansion of transmission infrastructure, to enhance readiness for incorporating burgeoning renewable energy generation. Section 1007 of the Energy Infrastructure Act provides $2.5 billion for a Transmission Facilitation Program to give DOE borrowing/loan authority as an anchor tenant for new transmission lines. This is a welcome investment, though we strongly encourage the committee to provide $25 billion for this program. A [Net Zero America study](#) estimates the need for about $175 billion in total new transmission investment to support new renewable capacity additions, perhaps less if more solar is deployed than wind. Assuming half of that would be large, long-distance 'common carrier' lines that would qualify for this program (about $70-90 billion in total investment), DOE would spend $35-40 billion to buy up 50% of those lines. If the funds revolve twice (buying up capacity, selling rights to projects as they come online, and then using funds again for new projects), then $15-30 billion would be needed for the program.

The Federation also recommends giving FERC authority to allocate the costs of major transmission projects regionally (possibly adding to Section 1006 or 1007 of the Energy Infrastructure Act). A solution on cost allocation is needed to address interconnection queue backlogs in numerous regions of the country where renewable development is booming. We urge the Committee to consider adding Rep. Kathy Castor’s Efficient Grid Interconnection Act, which directs FERC to allocate network upgrade costs among all beneficiaries, and to direct FERC to require grid operators to study grid-enhancing technologies to defray the cost of traditional transmission upgrades.

**Question 2:** Can you elaborate on the cost-effectiveness of restoration and resilience activities, particularly to mitigate the impact of disasters like hurricanes and wildfires?

For every $1 that we spend on pre-disaster mitigation, we will save $6 to $8 in avoided damages and taxpayer costs. Because of our archaic budget rules, it’s easier to spend hundreds of billions of dollars after a disaster through a supplemental appropriation than it is to invest in the ounce of prevention that could have mitigated the damage in the first place, because we score the $1 of mitigation, but do not account for the long-term cost avoidance on disaster relief and recovery. As a result, we’ve spent nearly $300 billion in disaster supplements over the past decade and that number will only grow. There is a wide body of literature demonstrating how investing in nature before and after natural disasters reduces costs to taxpayers, landowners, and insurers while also saving lives and protecting property. For instance, coastal ecosystems represent a critical buffer against hurricanes and other storms. One acre of wetlands can typically store 1-1.5 million gallons of floodwater.

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According to a 2008 study, coastal wetlands in the U.S. provide an estimated $23.2 billion per year in storm protection services, or as much as $5 million per square kilometer of wetland. Living shorelines, such as marshes enhanced with oyster reef breakwaters, hold up better than bulkheads during major storm events. This protection also comes at lower cost than traditional protective infrastructure. For example, reviving reefs and mangroves can be an order of magnitude more cost-effective than installing seawalls or breakwaters. Moreover, residents with bulkheads in coastal North Carolina report paying double the cost to repair their property and four times the cost for annual shoreline maintenance when compared to residents with more natural shorelines. Living shorelines also protect against coastal erosion on a day-to-day basis, while maintaining connectivity of shoreline habitat.

In coastal Louisiana, investments in wetland restoration generated 28 times as much flood protection, dollar-for-dollar, than a similar investment in 6-meter high dikes. In Florida, it has been estimated that comprehensive restoration of the Everglades would yield a 4-to-1 return on investment. And, wetlands can also help industry meet regulatory requirements at lower cost than by constructing costly water treatment facilities.

Beach restoration and dune nourishment can provide protection from major storm events, boost the local economy through increased recreation, and provide habitat for migratory birds. When Superstorm Sandy hit the U.S. East Coast in 2012, Cape May Point, NJ had recently completed a project to widen two miles of the beach, build an 18-foot tall dune, and restore nearby freshwater wetlands. Cape May Point suffered virtually no damage, while surrounding areas sustained $640 million in losses. A host of birds have flocked to the restored wetlands and beach, and ecotourism from birders is estimated to add more than $310 million per year to the county’s revenue.

Floodplain acquisition projects have been effective in reducing flood risk, bringing down flood insurance premiums, and creating green spaces for recreation. Along Mingo Creek in Tulsa, Oklahoma, local property owners and businesses have not suffered property losses due to flooding since a voluntary buyout program was

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[^9]: Economic Analysis Predicts Minimum 4:1 Return on Restoring the Everglades Ecosystem.
U.S. Senate Committee on Energy and Natural Resources
June 24, 2021 Hearing: The Infrastructure Needs of the U.S. Energy Sector,
Western Water and Public Lands, and Consideration of a Legislative Proposal
Questions for the Record Submitted to Mr. Collin O’Mara

implemented in 1984. Additionally, residents have received up to a 35% discount on their flood insurance premiums, which reflects their reduced flood risk.  

Inland, reforestation, climate-smart forest management, and watershed restoration all have the potential to bolster natural carbon sequestration, benefit wildlife, and provide economic benefits including job creation. In Oregon, each dollar of public investment in forest and watershed restoration is multiplied in economic activity between 1.7 and 2.6 times as it cycles through Oregon’s economy.  

It was estimated that the first year of the Abandoned Mine Land Reclamation Economic Development Pilot Program alone, would cost less than $30 million but generate more than $140 million in revenue while creating 3,000 jobs and attracting more than 600,000 visitors to the region in Kentucky.  

The need to address greater risks from wildfires in many grasslands and forested areas has also grown considerably in recent years due to climate-related increases in extreme heat and drought, combined with higher fuel loads due to nearly a century of over-reliance on fire suppression. Indeed, the cost of wildfire impacts has grown considerably as more people have moved in to the so-called “wildland urban interface” (WUI). A 2015 study estimated that at least 1.1 million homes are at the highest risk from wildfire in the western United States, with a reconstruction cost of $208 billion dollars. In turn, land management agencies such as the U.S. Forest Service have had to spend significantly larger portions of their budgets on fire suppression, eroding their ability to fund restoration and management activities to improve ecosystem health and resilience.  

Ecological forest management has emerged as an important concept for addressing wildfire risks as well as enhancing the health of forest systems. Specifically, ecological forest management may include a combination of strategic thinning, prescribed fire, and managed wildfire to reduce the risk of high-severity wildfire and promote healthier, more-resilient forests. Done thoughtfully, the approach can help balance tradeoffs between short-term costs and impacts of treatment with long-term benefits of reduced risks of large, high-severity fires. For example, a combination of thinning and prescribed fire in eastern and southern California was found to have significantly reduced burn severity in trees during 12 wildfires that occurred between 2005 and 2011.  

Further, improved community planning and collaborative risk management efforts, including both targeted codes and ordinances and voluntary, incentive-based approaches, have significantly reduced risks from wildfires. For example, the Firewise USA ® recognition program, a collaborative effort between state and

12 Naturally Resilient Communities: Case studies: Mingus Creek, Tulsa, OK. White Paper
federal agencies and nongovernmental organizations, has been working with communities across the country to reduce wildfire risks by encouraging homeowners to improve defensible space in their neighborhoods. Recent fires have demonstrated the program’s success. For example, two consecutive fires in the community of Indian Lakes Estates, Florida, spared numerous homes and structures due to risk reduction preparations that homeowners made under the program. Such programs are likely to be increasingly important as insurance companies continue to assess the risks from worsening wildfires and adjust rates and coverage accordingly.

Questions from Senator John Hickenlooper

**Question 1:** Direct air capture (DAC) technologies are among those with the greatest potential to help us address climate change, but scaling up the technology will require careful coordination between government and industry. That’s why I was very pleased to see robust funding for DAC in the bill, as well as the inclusion of the bipartisan SCALE Act, which will help us build out the infrastructure we will need to transport and securely store carbon in the ground. Do you see a role for federal procurement, such as through purchasing carbon removal credits or setting aside land for DAC projects, to help us get DAC to market and meet our carbon goals?

We have very little time to reorient our economy towards net-zero emissions. Therefore, as the federal government has helped spur demand for and deployment of renewable energy, it can and should also help commercialize direct air capture quickly and leverage its purchasing power to increase demand for innovative new products utilizing carbon captured via DAC and other means. Significant investments in DAC research and development, plus facilitation of hubs for ease of capture, storage, and use of carbon, necessitate active vital federal roles in partnership with the private sector. The federal government will also be essential in monitoring the environmental impact – both positive and negative – of direct air capture technologies. While DAC powered by renewable or zero-carbon energy sources should avoid added criteria air pollution, more study is needed on the effects of DAC solvents/sorbents on the local environment. Land and habitat impacts should also be studied in association with DAC and related infrastructure construction. This information should be accessible to the public to increase trust in project development and use of taxpayer dollars.

The federal government should also take steps to begin identifying products and materials it can purchase to boost demand for carbon-embodied goods. As Carbon 180 reports in *Paving the Way for Low-Carbon Concrete: Recommendations for a Federal Procurement Strategy*, concrete made using anthropogenic carbon dioxide is a particularly promising opportunity. Concrete is the most used building material in the world, and carbon dioxide can be used both to create solid aggregate, and in curing concrete. In other words, concrete can sequester carbon dioxide, permanently locking away emissions that would otherwise contribute to climate change. Federal demand for low-carbon concrete could help build a market and expand its availability and affordability to other customers.

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We encourage caution about the use of DAC in a federal emissions trading scheme, or to satisfy the requirements of a clean energy standard. While DAC would result in carbon dioxide removal from the atmosphere, it should be used primarily to help erase legacy climate emissions and enable a future net-negative emissions economy, rather than to offset ongoing emissions elsewhere that can be reduced at their source. However, in sectors where carbon emissions will be difficult to eliminate, such as in aviation, allowing companies to purchase credits for carbon removal via DAC could be beneficial for both the climate as well as bringing DAC to scale.

**Question 2:** Direct Air Capture may ultimately be what allows us to remove much of our historic emissions and return our climate to a more safe and stable state, but so long as we continue to actively emit, we can save on cost by capturing the carbon at the source, where it is most concentrated. And nowhere is doing so more important than in the industrial sector, where we produce high volumes of emissions-intensive products like steel and cement for which we do not have ready substitutes. Can you speak to the particular importance of focusing our carbon capture RD&D dollars on industry? Do you believe the bill would benefit from an increased emphasis on industrial carbon capture?

As a member of the Industrial Innovation Initiative (I²), the National Wildlife Federation endorses a number of policies to help drive emissions down in industry, which currently makes up one-third of U.S. GHGs. We agree that applying carbon capture in industrial settings will be a vital approach for mitigating emissions in sectors where other decarbonization options are scarce, such as in cement, steel, and the manufacture of other goods that are inherently carbon-intensive. Given the diversity of potential applications for CCUS in industry, including the “recycling” of waste carbon in industrial processes and products, we believe significant RD&D dollars are needed to test methods and bring promising approaches to market quickly. We appreciate increased funding in Section 10004 of the Energy Infrastructure Act for the Carbon Capture Demonstration Projects Program. However, we strongly encourage the committee to amend the Energy Policy Act of 2005 to increase the total number of demonstration projects and designate ten specifically for industrial facilities, and to dedicate funding of at least $500 million annually in FY21-25—roughly double the bill’s current total program authorization—in support of these industrial projects. These investments should be paired with significant support for DOE’s Carbon Utilization Program as well. Given the potential trillion dollar global market in products using captured carbon, we appreciate the committee’s increased funding for this program and encourage even greater investment to ensure innovative technologies are realized commercially.

Finally, the Federation urges the Energy and Natural Resources Committee to work with the Finance Committee and others in Congress to pair these important RD&D investments in industrial sector CCUS with enhancements to federal tax credits, such as under Section 45Q. Congress can maximize the impact of the 45Q credit on industrial project deployment by extending the commence-construction window, allowing a direct payment option, and eliminating size thresholds so that smaller projects can qualify. Importantly, Congress should also consider increasing the 45Q credit level to at least $85 per ton for CO2 captured in industry and stored in saline formations and at least $60 per ton for beneficial carbon utilization. And, Congress should require DOE to work with private industry to evaluate the environmental impact of these projects beyond their benefit to the climate.
June 29, 2021

The Honorable Chairman Joe Manchin  
Committee on Energy and Natural Resources  
United States Senate  
304 Dirksen Senate Building  
Washington, DC 20510

The Honorable Ranking Member John Barrasso  
Committee on Energy and Natural Resources  
United States Senate  
304 Dirksen Senate Building  
Washington, DC 20510

Dear Chairman Manchin and Ranking Member Barrasso,

Thank you for holding this hearing to examine the infrastructure needs of the U.S. energy sector and for your work on the Energy Infrastructure Act of 2021. We welcome that this bill includes important energy efficiency and demand management measures that will create jobs, save money for low-income and other consumers, improve industrial competitiveness, strengthen the electric grid, and reduce greenhouse gas emissions. We especially would like to highlight investments that strengthen low-income weatherization, building codes implementation, Industrial Assessment Centers (IACs), smart manufacturing, industrial research, and state energy work. These and other measures in the bill are essential as we move forward to strengthen and decarbonize the economy, and I commend the senators of both parties who worked together to draft this legislation.

However, for energy efficiency it is only the first step towards achieving the savings needed to meet the challenge of the climate crisis, and we look forward to more ambitious action to achieve major reductions in energy use and greenhouse gas emissions. In order to set the stage for larger consumer savings, economic growth, and emissions reductions, ACEEE also recommends the following provisions:

- **HOPE4HOMES** – Existing homes are one of the hardest sources of energy waste to address. We can help homeowners invest in energy efficiency upgrades by providing them rebates targeted at real savings. We urge you to authorize language for the HOPE and HOMES programs and include at least $100 million for several pilot state training and rebate programs around the country to efficiently retrofit homes – cutting CO₂ emissions and creating jobs.

- **High Impact Industrial Assessments and Measure Implementation** – ACEEE is encouraged by the increase in funding for IACs and for new grants that will help small manufacturers cut their energy use and emissions. Even larger savings are available at larger plants. We urge you to authorize measures that would help medium and large manufacturers cut down on carbon. A state-run FlexTech program would co-fund project assessments and work with banks to help finance energy-saving measures for mid-sized manufacturers. New York State already operates such a program that serves as a model for proposed federal legislation. ACEEE also proposes a U.S. Department of Energy Save Energy and Carbon Now initiative, based on the earlier successful Save
Energy Now program, to conduct assessments for the 3,000 largest plants in the United States with a focus on both energy and greenhouse gas reductions.

As Congress continues to move forward with plans to invest in American infrastructure, ACEEE strongly urges you to consider the tremendous cost, energy, and emissions savings presented by energy efficiency. The bill the Committee is considering is an important down payment on that promise. But there are more steps that should be taken now to enable much larger savings with associated benefits for consumers, the grid, the economy, and the environment.

Sincerely,

[Signature]

Steven M. Nadel  
Executive Director  
American Council for an Energy-Efficient Economy (ACEEE)
July 6, 2021

Ms. Darla Ripensky, Chief Clerk
U.S. Senate Energy and Natural Resources Committee
304 Dirksen Senate Office Building
Washington, D.C. 20510

RE: Statement for the Official Record for the June 24, 2021 Hearing on The Infrastructure Needs of the U.S. Energy Sector Before the U.S. Senate Committee On Energy & Natural Resources

Dear Chairman Manchin, Members of the Senate Committee on Energy & Natural Resources, and Ms. Ripensky:

An Introduction to American Lithium Corp.

On behalf of American Lithium Corp. (American Lithium), I am respectfully providing this statement and request that you please accept it for the official record for the June 24, 2021 hearing before the U.S. Senate Committee on Energy and Natural Resources on The Infrastructure Needs of the U.S. Energy Sector.

American Lithium is a diversified lithium development company with projects in Nevada and Peru. Our focus is to become a secure, stable, sustainable and environmentally-friendly source of domestic battery-grade lithium products for the North American battery and electric vehicle (EV) markets. We are headquartered in Canada, where we are listed on the TSX Venture Exchange, trading under the symbol (TSXV):LI and have offices in Tonopah, Nevada as well as in Lima, Peru. This year, the TSXV selected American Lithium as number one of the top ten companies in the mining sector by listing as a TSX Venture 50 2021 Company. In the U.S., we trade on the OTC under the symbol “LIACF.” We are also listed on the Frankfurt exchange with symbol “SLA1.”

About the Tonopah Lithium Claims Project in Nevada

Our Nevada lithium project, the Tonopah Lithium Claims (TLC) Project, is located roughly six miles northwest of Tonopah, NV in Nye County, where we own unpatented lode mining claims covering

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1 The TSX Venture 50 is a ranking of the top performers on the TSX Venture Exchange over the last year. The ranking is composed of 10 companies from five industry sectors, selected on the basis of three equally weighted criteria. The companies on the Venture 50 have demonstrated ability to access capital for growth and scale up their businesses.

American Lithium Corp. Suite 1507-1030 West Georgia Street, Vancouver, British Columbia, V6E 2Y3
americanliithiumcorp.com
roughly 7,520 acres of public lands administered by the U.S. Bureau of Land Management (BLM). The TLC Project is exploring and developing a recently discovered near-surface sedimentary (claystone) lithium deposit that can be mined with low-cost conventional surface mining techniques like those employed at easy-to-excavate clay operations and sand and gravel quarries.

The TLC Project is located in mining-friendly Nye County, NV, home to the famous Tonopah Silver Mining District, which was discovered and mined in the early 1900s. Mining and mineral exploration are still an important part of Nye County’s economy. The TLC Project has excellent paved road access, nearby power transmission facilities, and other proximate infrastructure. American Lithium has already secured the water rights that it anticipates will be needed to support its planned mining of the claystones and lithium processing operations.

This advance-stage mineral exploration project currently has a large Measured and Indicated resource of 5.37 million tonnes of lithium carbonate equivalent (LCE) and an inferred resource of 1.76 million tonnes of LCE. The geologic setting of the project holds great promise for further expanding and upgrading this resource with additional exploration drilling.

American Lithium is currently seeking a permit from the BLM Tonopah Field Office/Battle Mountain District Office to expand our exploration drilling program to drill an additional 95 holes, to excavate five trenches to obtain bulk samples for detailed metallurgical testing, to establish laydown/staging areas, and to develop a five-acre area for pilot-scale tests of our lithium processing and recovery techniques. The BLM has recently accepted this Plan of Operations as complete; timely acquisition of this permit – hopefully in the next few months – will be important in advancing the TLC Project to support completion of a preliminary economic assessment, fine-tuning of the project’s processing flow sheet and then the move into the feasibility stage and pilot-scale production.

Based on the metallurgical testing work done to date, the TLC deposit has excellent leaching characteristics, with rapid leaching of in excess of 90 percent of the lithium in as little as ten minutes, which is a much faster leaching time compared to other claystone lithium projects. The unique mineralogy of the TLC deposit facilitates rapid leaching and high recovery rates, which could lead to lower processing and production costs. We are working with Minviro Sustainability Consultants to provide a lifecycle assessment to optimize battery-grade lithium production while minimizing environmental impacts.

The TLC Project is located in a very favorable environmental setting with no identified environmental sensitivities or issues of special concern. The baseline studies for the area confirm there are no species or habitat protected under the U.S. Endangered Species Act. The project area is sparsely vegetated and outside of the area designated as suitable Greater Sage-grouse habitat in Nevada. There are no unique buckwheat species or special-status wildlife species. The cultural resources survey of the project area did not identify any significant archaeological issues.

In March 2021, the U.S. Department of Energy (DOE) Advanced Manufacturing Office selected American Lithium and our partners, American Battery Technology Company (ABTC) and DuPont Water Solutions, American Lithium Corp. Suite 1507-1030 West Georgia Street, Vancouver, British Columbia, V6E 2Y3 americanlithiumcorp.com
to receive 50% funding on a $4.5 million project ($2.25 million grant) to evaluate a new processing technology to produce lithium hydroxide from a lithium claystone project.\textsuperscript{3} The grant provides funding to complete a field-based, pilot-scale demonstration project using ABTC’s proprietary selective oxidative leaching, brine purification, conversion, and crystallization process to produce a low-cost, battery-grade lithium hydroxide monohydrate product that meets high energy density battery cathode material specifications.

The unique mineralogical and metallurgical characteristics of TLC claystones make it an exceptional deposit to test this new lithium hydroxide processing technology.\textsuperscript{2} We are very pleased the DOE selected the TLC Project as the best lithium claystone project in the country to study this new technology to improve domestic lithium hydroxide production.

**Comments on Section 2006 of the Discussion Draft of the Energy Infrastructure Act**

American Lithium fully supports Section 2006 “Critical Minerals Supply Chains and Reliability” of Senator Manchin’s Energy Infrastructure Act. We applaud Chairman Manchin for recognizing the importance of critical minerals to the U.S. economy, competitiveness, and security and the need to obtain critical minerals from domestic sources to the maximum extent possible.

Developing domestic sources of critical minerals is a win-win for the economy and the environment. It will create high-paying jobs for American workers, benefitting the states and local communities where the mines are located. Because U.S. mining operations must comply with comprehensive and effective environmental protection and worker health and safety laws and regulations, U.S. mines are among the cleanest and safest mines in the world. Additionally, it makes absolutely no sense from a greenhouse gas emissions perspective to ship minerals from across the globe, significantly increasing their carbon footprint, when the U.S. has domestic resources of critical minerals.

We concur with Sec. 2006(b)(4) that “the Federal permitting process has been identified as an impediment to mineral production and the mineral security of the Unites States.” In fact, permitting delays, uncertainties, and costs represent the biggest risk American Lithium faces in developing the TLC Project. We are thus hopeful that enactment of the Energy Infrastructure Act will result in significant improvements to streamline and de-risk the permitting process. Addressing concerns about the length of time required to secure permits to develop domestic mineral supplies would significantly enhance investment in U.S. mineral exploration and development, which is essential in reducing U.S. reliance on foreign countries for critical minerals.

American Lithium strongly supports the Federal Permitting and Review Performance Improvement directives in Sec. 2006(c). We are confident that the permitting process can be significantly streamlined without compromising or reducing environmental protection standards and requirements.


\textsuperscript{3} Lithium hydroxide monohydrate commands a slightly higher premium compared to lithium carbonate, the product produced at many lithium projects.
As a couple of the witnesses at the hearing explained, the mining industry vigorously embraces environmental protection and is not seeking any relaxation of environmental standards. What the industry needs is an improvement in the time-consuming and costly environmental permitting process, which is fraught with uncertainties and delays and creates numerous opportunities for litigation challenging Federal agencies’ permitting decisions. These costs and uncertainties significantly deter investment in the U.S. mineral sector.

American Lithium supports the measures enumerated in Sec. 2006(c) directing the Secretary of the Interior and the Secretary of Agriculture to:

- Complete the Federal permitting and review processes with maximum efficiency and effectiveness;
- Establish and adhere to timelines and schedules in reaching final permitting and licensing decisions;
- Set clear, quantifiable, and temporal permitting performance goals;
- Develop a permit tracking system to measure progress in achieving permit performance goals;
- Minimize delays by engaging in early collaboration with project sponsors, agencies, and stakeholders;
- Use cost-effective information technology to disseminate information to ensure transparency and accountability;
- Avoid conflicts or duplication and resolve concerns through early and active consultation with state, local, and tribal governments;
- Allow concurrent rather than sequential reviews;
- Achieve demonstrable improvements in the Federal permitting process, including lower costs and more timely decisions;
- Expand and institutionalize effective Federal permitting and review processes; and
- Develop communication mechanisms to articulate priorities and resolve disputes among Federal, regional, state and local agencies.

American Lithium would very much appreciate the opportunity to work with Chairman Manchin, the Secretary of the Interior, and BLM on the review and report mandated in Sec. 2006(d) to identify measures to increase the timeliness of permitting activities for exploration and development of domestic critical mineral deposits. We respectfully suggest the TLC Project would be an ideal pilot project where BLM could work directly with us as the project sponsor to develop and field-test a
streamlined permitting process for a critical mineral project that will be designed to minimize environmental impacts of the mine and its mineral products throughout the lifecycle of the project.

Using the TLC Project as a prototype, BLM would have the opportunity to focus on responding to the Sec. 2006(c) directives at a project with no known challenging environmental issues. Starting with an environmentally benign project like the TLC Project in pro-mining Tonopah and Nye County, NV would allow BLM to develop a streamlined process that could then be applied to, and if necessary modified for, more complex projects in other environmental settings and local jurisdictions.

Conclusions

American Lithium very much appreciates the opportunity to present this statement for the official record for the June 24, 2021 hearing before the U.S. Senate Committee on Energy and Natural Resources on The Infrastructure Needs of the U.S. Energy Sector. We congratulate Senator Manchin on his visionary discussion draft legislation, the Energy Infrastructure Act. American Lithium would welcome the opportunity to work with Chairman Manchin, the Secretary of the Interior, and BLM on the urgent need to streamline the permitting process for critical mineral projects like our TLC lithium project in Nye County, NV.

Please do not hesitate to contact me if you have any questions or if American Lithium can help in any way.

Sincerely yours,

Simon Clarke, CEO and Director

Tel: 604 551 9665
Email: sclarke@americanlithiumcorp.com

cc: The Honorable Catherine Cortez Masto
The Honorable Jacky Rosen
The Honorable Steven Horsford
Statement for the Record of Robert Mumgaard, CEO, Commonwealth Fusion Systems

Submitted to the Committee on Energy and Natural Resources
United States Senate
for the
Full Committee Hearing to Examine Infrastructure Needs

Thursday, June 24, 2021 9:30 am EST
Rm. 366 of the Dirksen Senate Office Building

Chairman Manchin, Ranking Member Barrasso, and other members of the Committee,

I thank you for this opportunity to submit this statement for the record on this hearing to Examine Infrastructure Needs. My name is Robert Mumgaard and I am the Chief Executive Officer (CEO) of Commonwealth Fusion Systems (CFS). I am also a Board member of the Fusion Industry Association (FIA). CFS is a spin-off out of the Massachusetts Institute of Technology (MIT). Our work combines decades of research experience of MIT’s Plasma Science and Fusion Center, much of it funded by DOE, with the innovation and speed of the private sector.

The world fundamentally needs a new source of clean energy to meet our growing energy demands and combat climate change. Scientists have been studying fusion for decades and have made significant progress but have yet to achieve its potential as a commercial power source. However, its promise has continued to drive interest with the understanding that successfully deployed fusion power would transform the world’s energy landscape.

CFS is on track to bring fusion energy technology to market. Supported by the world’s leading investors in breakthrough energy technologies, CFS is uniquely positioned to deliver the fastest path to commercial fusion energy. CFS has assembled a world-class team to design and build fusion machines. This team includes experts in magnets, manufacturing, and plasma physics dedicated to the mission of delivering clean, limitless fusion power to the world.

CFS, in collaboration with MIT, is designing and building the world’s first net energy fusion device, SPARC, based on a combination of proven plasma physics and groundbreaking high temperature superconducting magnets. These magnets are the key technology that will enable SPARC and future fusion power plants around the world. This roadmap was validated through peer-reviewed research published in a leading scientific journal that shows SPARC will achieve net energy if the magnets work. A full-scale magnet demonstration is set to take place in Summer 2021.

Earlier this year, CFS announced it will build a 47-acre commercial fusion energy campus in Devens, Massachusetts. There, CFS will build and operate SPARC as well as a magnet manufacturing facility. After receiving the necessary permits and licenses from the state of Massachusetts, we have started ground clearing activities at the site already. We are planning an official groundbreaking ceremony at the site later in the Fall of this year.
With over $2 billion of private capital already invested in new start-up companies with the goal of developing economically viable commercial fusion power as soon as possible, these companies are aiming to streamline the pathway to a fusion power plant. The FIA is a collaborative effort, combining scientific, political, government and media expertise to support its member companies in this quest.

CFS and 23 other fusion companies have been working through the FIA to advocate for and support a public-private partnership program with DOE for the construction of fusion demonstration facilities. The FIA has reported that its member companies are capable of raising $1 billion of private capital to match an equal amount of federal funds. The partnership program was established and authorized by the Congress in the Energy Act of 2020 as the Milestone-based Fusion Energy Development Program for the purpose of supporting the development of a US-based fusion power industry. Furthermore, it would require certain technical milestones to be met before industry partners are awarded any funds by the DOE. Therefore, taxpayers find this would be at less risk of non-performance than other traditional programs at DOE.

The legislation for the fusion development program goes beyond just Congressional support. Earlier this year, the National Academy of Science issued a report, Bringing Fusion to the US Grid, recommending an aggressive plan to build a fusion pilot plant to ensure US leadership. DOE’s Fusion Energy Sciences Advisory Committee issued its report, Powering the Future: Fusion and Plasmas, for a long-range plan to deliver fusion and to advance plasma science. The report was the result of a two-year planning process for the fusion energy community. It, too, recommended a fusion pilot plant. Both the reports recommend a milestone-based fusion program for demonstration facilities to help the private industry.

The fusion energy community, the National Academies, the Fusion Industry Association, and the Congress are all aligned. The time to move forward on a fusion energy development program with both the public and private sectors working together is now.

This alignment forms the basis for which I urge the Committee to add $1 billion in appropriations for the already authorized milestone-based fusion energy development program to the draft infrastructure bill.

FIA and I believe that the program would be appropriate for the Committee’s infrastructure bill for five reasons:
(1) it is time limited, so it doesn't create an ongoing government commitment, 
(2) it is leveraged, so that government dollars bring in additional private dollars, 
(3) it is shovel-ready, with private companies ready to build today, 
(4) it will create thousands of high paying jobs as these companies construct and scale, and 
(5) it will increase the security, competitiveness, and stability of U.S. power generation over the long term.

We believe if the milestone-based fusion program is funded now, a US-based fusion power industry will be in a position to lead globally with the demonstration of multiple commercial fusion energy technologies. This advantage will last for decades and result in a clean, safe electric power grid for generation to come. Additionally, this new industry will generate significant
economic activity throughout the country and the world as the countries seek to further reduce their greenhouse gas emissions.

Attached below is a statement from the FIA with further details on how funding through an infrastructure bill such as this Committee’s draft bill could help to accelerate the commercialization of fusion energy.

Thank you.

[Signature]

Robert (Bob) Mumgaard
CEO
Commonwealth Fusion Systems
Accelerating Fusion Energy:
Creating a Milestone-Based Fusion Energy Development Program
to immediately accelerate fusion energy in the U.S.

President Biden has made ambitious and important commitments to deal with climate change. The twin goals of net zero carbon for electricity by 2035 and net zero carbon for the economy by 2050 are necessary to meet the global challenge of climate change. They are also incredibly challenging. The burgeoning fusion industry is ready to meet that challenge through bold immediate action.

Fusion is dispatchable, safe, clean power that could be essential in achieving net zero carbon energy generation for society in a practical and economically competitive manner. However, America’s global competitors are also racing to fusion power, which underscores the importance that the U.S. win the race to carbon-free commercial fusion power.

The Fusion Industry Association (FIA) is an association of 24 member companies working to commercialize fusion power on a timescale that matters for the climate crisis. Its membership consists of companies striving to build commercial fusion power plants, while its affiliate members are organizations that will build the broader fusion energy economy.

Private fusion companies have plans to build proof-of-concept machines, capable of breakeven carbon-free fusion power, within this decade. Commercial fusion power plants, using technology developed by FIA’s members, will deliver clean energy on the grid in support of these ambitious decarbonization targets.

As the incoming Biden Administration considers proposals to stimulate the economy, re-establish American global leadership, and meet the challenge of climate change, nothing would capture the public’s imagination more than an initiative to rapidly accelerate fusion energy research and development. The scientific basis to achieve breakthrough advances in fusion power are within our grasp: the time for investment is now and a $1 billion Milestone-Based Fusion Energy Development Program within the upcoming infrastructure legislation would support the effort to build a new US-based fusion power industry. The milestone-based development program was established in the recently passed Energy Act of 2020 and public funds would be leveraged by private dollars on a cost shared basis.

Building Momentum and Consensus for Fusion Energy Development
Over the last year, the American fusion community has completed a remarkable process of planning, prioritizing, and consensus building, all of which orients the American fusion program towards developing a new clean energy industry. The Community Plan for Fusion Energy and the Fusion Energy Sciences Advisory Committee report “Powering the Future: Fusion & Plasma,” both detail plans and priorities for how to achieve breakthroughs in fusion energy research, across different budget scenarios. Their approach was validated by the National Academies of Sciences report, “Bringing Fusion to the U.S. Grid”, that shows how the United States can build a fusion energy pilot plant by 2035.
These reports were completed at the request of Congress and the Department of Energy. Validating these reports, Congress enacted Section 2008 of the Energy Act of 2020 on December 27, 2020, “to effectively address the scientific and engineering challenges to building a cost competitive fusion power plant and to support the development of a competitive fusion power industry in the United States.”

A new Milestone-based Development Program was created by Section 2008 of the Consolidated Appropriations Act of 2021 (P.L. 116-260). It is authorized by Section 307, subsection (i) of the Department of Energy Research and Innovation Act (42 U.S.C. 18645).

Recommendation: A New Government Cost-Share Public-Private Partnership

In the upcoming infrastructure bill, the FIA supports funding a new public-private partnership program that incorporates best practices from other productive partnerships such as NASA’s Commercial Orbital Transportation System (COTS) and DOE’s Small Modular Reactor (SMR) Licensing Technical Support and Advanced Reactor Demonstration cost-share programs.

The purpose of this program is to support the development of a US-based fusion power industry by researching and developing technologies leading to the construction of new full-scale fusion demonstration facilities. Our goal is to build demonstration facilities capable of making significant improvements in the performance of fusion systems and leading to the establishment of a new clean energy source for the nation.

This new performance-based program will directly reimburse private companies for the development of new US-based fusion capabilities over a fixed program period. Government dollars would be leveraged with substantial private sector cost share. Payments from the government would not be made until jointly established milestones throughout each company’s trajectory have been completed by industry and verified by DOE; if industry participants failed to reach these agreed-upon milestones, no government payments would be made, and the government would have the option to redirect those funds elsewhere in the program. A simple application process would encourage a broad range of applicants and result in a portfolio of many participants with diverse technologies through a competitive process. Recent significant investments by the governments of China and the UK show their intent to be the first to commercialize fusion energy. A successful program launched now will ensure the U.S. takes the global lead in fusion energy with the demonstration of multiple commercial fusion energy technologies, an advantage that will last decades and result in a clean, safe electric power grid for generations to come.

Funding Request

In the upcoming infrastructure bill, the FIA requests $1 billion to establish and fund this new cost-share program. This fixed-length program would see outlay profile increase during the construction and operations phases, matched by the ramping up of capital spending over time from the private sector.

FIA members believe that this new public-private partnership program would be appropriate for stimulus funding for five reasons: (1) it is time limited, so it doesn’t create an ongoing government commitment, (2) it is leveraged, so that government dollars bring in additional private dollars, (3) it is shovel-ready, with private companies ready to build today, (4) it will create thousands of high paying jobs as these companies construct and scale, and (5) it will increase the security, competitiveness, and stability of U.S. power generation over the long term.

FIA member companies and staff are available to brief you further. Please contact FIA CEO Andrew Holland at AHolland@FusionIndustryAssociation.org for further details.
Building a Milestone-Based Public-Private Partnership

- The principles of the program are: limited government investment, with limited exposure to downside risk; broad-based portfolio approach to support many companies across the U.S. and diverse approaches; milestone payments; industry intellectual property rights; and minimization of government red-tape to allow for innovation.

- DOE and its national labs provide extensive knowledge and technical capabilities in fusion energy research and are recognized globally as leaders in R&D. This partnership program should provide for industry access to this national resource.

- The growing number of companies in the private fusion sector are demonstrating the ability to innovate and take ideas from the lab to the marketplace. They fully understand that not only must the technology work, it must also meet the market requirements for quality and costs. They will need to raise capital from energy investors to provide their cost share in this program. If the private sector doesn’t get market traction, then public funding will not flow.

- The partnership agreements would include specific milestones to be completed by the private sector partners throughout the program. Government payments under the partnership would be made based upon completion of jointly established milestones or for expenses deemed reimbursable according to terms negotiated for each partnership. Milestone achievement is to be verified by DOE expert review.

- The private sector partners would be responsible for all cost and schedule overruns. DOE would also have the option to terminate the partnership agreement in the event the agreed-upon milestones are not met. This approach will minimize risk to taxpayers and incentivize industry to minimize costs and schedule delays.

- Best practices for this sort of partnership should be incorporated from prior successful programs such as NASA’s Commercial Orbital Transportation System (COTS) and DOE’s Small Modular Reactor (SMR) Licensing Technical Support and Advanced Reactor Demonstration cost-share programs. The experience of both the government and private sector in these programs demonstrate the value of the proposed guiding principles.

- Based on a survey of its members, the Fusion Industry Association found that our companies can support a $1 billion cost-share program, leveraged with additional private capital, to build integrated fusion test and demonstration facilities.

- If successful, this program would rapidly advance the country towards global leadership in a new industry, creating a unique clean-energy economy with unlimited global export potential and many high-quality jobs in technological hubs around the country.
Clean Energy Innovation Is a Worthy Investment
An opinion piece on the value of additional funding for advanced energy technologies based on recent modeling from Resources for the Future.

Opinion piece by Daniel Shawhan, Fellow at Resources for the Future
First published by The Hill on May 20, 2021

In December, the Energy Act of 2020 passed into law with bipartisan support. The law authorized research, development and demonstration (RD&D) funding for advanced technologies that have the potential to make waves in our country’s energy infrastructure. The earmarked technologies, among them advanced nuclear, carbon capture and energy storage, have considerable potential to reduce electricity supply costs and pollutant emissions.

But these benefits could easily go unrealized, since many advanced energy technologies are currently not cost-competitive. Helping them become competitive depends, at least for the moment, on Congress providing the appropriations authorized for them in the Energy Act of 2020. Doing so could be a game changer, at least for the five technologies my colleagues and I have studied. Our rigorous research for Resources for the Future recently found that this additional RD&D funding would increase the estimated likelihood of future cost-competitiveness for each technology by an average of 20 percentage points.

We had little idea in advance what our study would say about the value of proposed additional funding. But in our analysis of five technologies covered by the Energy Act — advanced nuclear, energy storage, direct air capture, advanced geothermal and natural gas with carbon capture — we found that the act would provide striking economic and environmental benefits for Americans. We conducted multi-hour cost projection surveys of 26 technology experts, followed by electricity sector modeling based on the survey answers. The resulting estimates indicate that, for each dollar invested in technology innovations, society would benefit by an average of $7 through electricity bill savings and climate and health benefits. And this is without any additional federal climate policies.

If a new federal climate policy was enacted, like the clean electricity standard proposed in the CLEAN Future Act of 2021, those average projected benefits would increase to $10 per dollar invested. Those benefits would be mostly in the form of lower electricity rates from lower compliance costs of meeting clean energy targets.

The electricity bill savings would be especially beneficial for low-income Americans, who face an “energy burden” three times higher than other households (energy costs can make up 10 percent of income or more). More low-cost technologies competing in the market benefit consumers in the form of lower electricity prices.
Funding for these technologies is also likely to have benefits outside of the power sector and in other countries. Each of the technologies may be important for decarbonizing or reducing costs in other sectors of our economy like industry and transportation, both of which are more difficult to decarbonize than the power sector.

Our research is also encouraging about possible additional funding beyond the Energy Act of 2020. Each dollar of cost reduction tends to produce larger benefits than the last because it applies to an increasingly large amount of generation. This implies that the benefits per dollar of R&D funding could actually grow larger as funding amounts increase. The very high benefit-to-cost ratios that we found, which we would argue are likely conservative, are indicative of the large net benefits to society that these investments would be likely to create.

As the United States moves towards lower emissions, innovation policy can play an important role. From improved vaccines and agriculture to the rise of the internet, innovation has been a critical part of improving lives. Our research indicates that clean energy presents a similarly promising opportunity. I hope that members of Congress will keep this in mind as they consider fulfilling the funding authorized in the Energy Act of 2020 and providing additional clean energy innovation funding beyond that.

To read the op-ed on The Hill’s website, click here.

Resources for the Future (RFF) is an independent, nonprofit research institution in Washington, DC.
The Value of Advanced Energy Funding

Projected Effects of Proposed US Funding for Advanced Energy Technologies

Daniel Shawhan, Kathryn Cleary, Christoph Funke, and Steven Witkin

With important contributions from Kristin Hayes, Vincent Gonzales, Valentina Bosetti, and Javier Ortiz
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Diurnal energy storage: John Hertter, Jesse Jenkins, Oliver Schmidt, Addison Stark, and Jay Whitacre

Geothermal energy: Konraad Beckers, Tim Latimer, Michal Moore, Spencer Nelson, Lev Ring, and Jamie Beard

Multiday energy storage: James Carkula, Peggy Beltran, Stephen Comello, John Hertter, Jesse Jenkins, and Jay Whitacre

About RFF

Resources for the Future (RFF) is an independent, nonprofit research institution in Washington, DC. Its mission is to improve environmental, energy, and natural resource decisions through impartial economic research and policy engagement. RFF is committed to being the most widely trusted source of research insights and policy solutions leading to a healthy environment and a thriving economy.

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Executive Summary

This study estimates some effects of proposed additional US government funding for research, development, and demonstration (RD&D) of five advanced clean energy technologies: advanced nuclear, generation from natural gas with carbon capture and sequestration (NG-CCS), advanced geothermal, diurnal energy storage, and direct-from-air capture of CO₂ (DAC). Specifically, we estimate the effects of the additional funding on the costs of these technologies and some of the societal benefits that would result from these cost reductions.

The Energy Act of 2020, which became US law in December 2020, authorizes additional funding for those five advanced energy technologies (AETs). Although work on this study began before the law passed, the funding levels we evaluate in the study were based on a remarkably close prediction of the final bill’s programs and authorized funding amounts for the AETs. It is uncertain how much funding each of the technologies will receive—they could receive less than authorized in the act, or more, perhaps as part of stimulus, infrastructure, or energy legislation.

In a rigorous expert elicitation process, we asked 26 experts in these five technologies to estimate the effect of additional funding on the levelized costs of new facilities using these technologies, in 2035. We asked the experts to assume that the added funding would be provided for 10 years, from 2022 to 2031. Their answers indicate that additional funding would result in average cost reductions of approximately 29 percent for advanced geothermal, 29 percent for DAC, 25 percent for nuclear, 16 percent for diurnal storage, and 9 percent for NG-CCS in 2035. These percentages reflect estimates of how much lower the cost of each technology would be with the added RD&D funding than without it.

Figure ES1. Estimated Benefit-to-Cost Ratios from 10 Years of Higher RD&D Funding

- Benefit-to-cost ratio without CES
- Benefit-to-cost ratio with CES
- Benefit-to-cost ratio with economy-wide carbon cap
To estimate some of the benefits of these cost reductions for society, we used detailed power sector simulations of the year 2050 with and without a national clean electricity standard (CES) that requires 94 percent clean power by 2050. We make the conservative assumption that the experts' cost projections for 2035 would still apply in 2050, even though costs tend to decline over time, deployment accelerates the cost reductions, and lower costs significantly increase the benefit from further cost reductions. Our simulations indicate that without a national CES, the benefits from the additional funding would be a mix of electricity bill savings, reduced health damages, and reduced climate damages. With a national CES, on the other hand, the benefits would come mainly from electricity bill savings. These electricity user savings amount to an average of approximately $14 per household per year for each technology without a CES and $56 per household per year for each technology with a CES.

Figure B.8 shows the estimated benefit-to-cost ratios of additional funding for each technology. The costs are the added US public and private RD&D spending, based on the experts' responses. We assume the benefits estimated by the simulation last 20 years (mid-2040 to mid-2060). The ratios are present value of benefits over present value of costs, using a 3 percent real discount rate. Overall, we estimate that the additional funding would produce an average benefit-to-cost ratio for each technology of 6.9 without the CES and 10.5 with it. Without the CES, three of the five technologies have benefit-cost ratios above 1 (in fact, above 6). With the CES, all five technologies have benefit-cost ratios above 4. These benefit-to-cost ratios do not count benefits outside the years 2040 to 2060, US RD&D expenditure changes outside the 10-year period from 2022 to 2031, US export revenues, US benefits from reduced foreign emissions, or net benefits abroad.

Further, these benefit-to-cost ratios count only the benefits inside the electricity sector, whereas in reality, benefits in other sectors, such as industry, transportation, and consumer products, are likely for all five of the technologies.

A DAC study by Hafstead (2020) allows us to also estimate the US economy-wide benefit-to-cost ratio for the added DAC RD&D funding in the presence of a policy that cost-effectively reduces economy-wide emissions to approximately 50 percent below 2005 levels by 2050. In this situation, we estimate that benefits of additional DAC funding would be 27 times as great as the costs, as shown in the right-most portion of Figure B.8.

Our results also indicate that the benefits of each $1 reduction in expected levelized cost per MWh grow substantially larger as expected cost falls. This implies that the expected benefits per dollar of additional RD&D funding for each technology could actually grow larger per dollar spent on that technology.
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1. Introduction

Many US states and utility companies are pursuing ambitious clean energy policies to curb greenhouse gas emissions from electricity generation. Achieving these goals requires substantial investment in zero-carbon and carbon-negative technologies within the electricity sector. Generation from wind and solar energy has become inexpensive, but because of the variability of these resources, achieving ambitious targets is likely to require other, nonvariable, nonemitting technologies. Making these other technologies less costly could increase their use and produce substantial benefits for society by enabling the power sector to meet existing and future climate targets at a lower cost.

Innovation policy, which includes funding for research, development, and demonstration (RD&D), is intended to help technologies develop, lower their costs, and ultimately achieve commercial operation at scale.

The Energy Act of 2020 proposes funding for RD&D to advance several clean energy technologies, including geothermal energy, diurnal storage, direct air capture (DAC) of carbon dioxide, natural gas with carbon capture and sequestration (NG-CCS), and advanced nuclear. These advanced energy technologies, which we will call “the AETs,” can contribute to the energy system by reducing the cost of the electricity supply, especially in the presence of clean energy goals.

Shawhan, Funko, and Wilkin (2020) find that reducing the costs of the AETs would have significant benefits under scenarios both with and without a national clean electricity standard (CES), in the form of reduced compliance costs, lower costs for electricity users, and reduced emissions from the electricity sector. Their study indicates that cost reductions of these technologies targeted by the Energy Act of 2020 could produce billions of dollars per year of benefits even if there is no new national clean energy policy to further increase the demand for such technologies. Without a CES, the benefits are a mix of lower electricity bills, health benefits, and climate benefits. With a CES, the main benefit is lower electricity bills.

The legislation authorizes significant increases in funding to the AETs. Each year, the US Congress must decide how much funding to actually provide. One outstanding question is how much the innovation funding authorized in the legislation is likely to contribute to achieving cost reductions for these energy technologies. Estimating this effect requires comparing future costs of the technologies with and without the funding—and both costs are difficult to predict. A common method for estimating the effect of innovation policy on technology costs is to survey experts who are very knowledgeable about the technologies through a careful expert elicitation. Like other available options, this method is far from perfect, as we discuss more in the Methods and Discussion sections below; however, it can still be informative. This study estimates the effects of additional funding, very similar to that authorized in the Energy Act of 2020, on the costs of the energy technologies through an expert elicitation. Additionally, this study makes use of simulations reported in Shawhan, Funko, and Wilkin (2020) and Halstead (2020) that estimate the societal value of cost reductions for the same five technologies.
Notably, this study began prior to the passage of the Energy Act of 2020 in December 2020, so the programs and funding levels that we asked the experts to assume in projecting the costs of the technologies do not exactly match the authorized funding levels passed into law. However, thanks to knowledgeable and prescient legislative staff, our expert elicitation and this report are based on legislation, programs, and authorized funding levels very similar to what passed. Specific research programs in the act are structurally nearly identical to what we asked the experts to assume, and the funding amount for each technology is also very similar to what we asked the experts to assume.
2. Methods for Conducting the Expert Elicitation

To design and conduct the expert elicitation, we drew on lessons from prior experience and literature, including Baker et al. (2009), Diaz et al. (2013, 2016), Few et al. (2018), Klaassen et al. (2005), Morgan (2014), National Research Council (2005, 2007), Nemet et al. (2015), Verdozzi et al. (2018), and Wiser et al. (2016). We sought out a diverse set of experts in academia, industry, and nongovernmental institutions for each of the five technologies. In the expert elicitation portion of this study, we also include a sixth technology, multiday energy storage, which was not analyzed in Shawhan, Funke, and Wilkie’s (2020) simulation modeling. We found experts primarily through searches of recent literature on the technologies and through recommendations from other experts and contacted nearly 190 experts, 29 of whom fully participated in the study. Because of overlapping expertise, three of the experts in diurnal storage also provided answers for multiday storage. We ultimately had five participants for each technology except for DAC, for which we had four because of the limited number of experts able to participate. We asked the experts for their unbiased projections and agreed not to individually attribute their responses. Each expert was paid $1,000 for participating.

Experts were asked to complete a detailed questionnaire specific to their technology that required them to provide numerous estimates, including the levelized cost of their technology in the year 2035 with and without the legislation. We asked them to assume that the facility is designed in the year 2035 and built shortly thereafter. Levelized cost can be an ambiguous metric, but in this study we asked for the details that go into it, so it is not ambiguous and we can apply uniform background assumptions.

In addition to the questionnaire itself, experts were given detailed instructions and a list of assumptions for answering the questions, a detailed summary of the legislation written by RFF researchers, and a copy of the text from the bill. After completing the questionnaire, the experts completed an hour-long phone interview with the principal investigator (Shawhan), after which they typically revised one or more answers in response to reminders about details of the instructions (most commonly, changing their projected costs of capital from nominal to real). Copies of all questionnaires, instructions, bill summaries, and the bill excerpts are available in the online appendix.

A summary of the pieces of legislation given to the experts and their projected effects on RD&D funding for these technologies is provided in Table 1, and detailed summaries of the legislation by technology are in the online appendix. The funding projections below are for fiscal year (FY) 2022 through FY 2031. The funding projections without the legislation are based on continuation of FY 2020 funding levels in real terms. (Nominal annual values increase at an assumed annual inflation rate of 1.4 percent). The funding projections with the legislation are based on the funding authorizations.

1 The AETs require different time periods to be built. Diurnal storage units may be buildable within one year, whereas nuclear power plants may take 10 years to come online after being designed.
which were for five years, but for the purpose of this study we assume a total of 10 years, since it is common for authorized funding increases to continue beyond the term mentioned in the authorizing legislation. We asked the experts to assume that after the 10 years of increased funding for the technologies, the US government funding would return to the level it would have been if the legislation had not passed. The funding authorized in the legislation is almost entirely US Department of Energy funding and does not necessarily include all US government funding for the technologies. The dollars used differ from technology to technology because the annualized funding streams have different anchor years.

The questionnaire was composed of three parts. The first part asked experts which specific technology subtypes (e.g., which types of energy storage) they expected to be the most competitive and second-most competitive in 2035, and to estimate total private and public R&D spending, both in the United States and abroad, for the technology if the legislation were enacted and if it were not. The second part was a checklist to help the experts confirm that their answers correctly reflected the questions being asked.

The third part asked experts to provide the 90th, 50th, and 10th percentiles of the levelized cost of energy (LCOE) of the technology in 2035 (or in the case of DAC, the levelized cost of capture), as well as the corresponding most likely or representative values of the cost components that make up that technology’s LCOE calculation. The cost components included capital expenditures, fixed costs, energy input costs, other variable costs, weighted average cost of capital, co-product profits, operating lifetime, and total outage rates. We asked experts to provide separate cost estimates for two scenarios, one in which the legislation was enacted and fully funded and one in which it was not enacted. We asked about costs in the year 2035 because we judged, with input from the literature and two other researchers, that asking about costs further in the future would involve too much speculation and uncertainty about what might happen in the intervening years and how it would affect costs.

We note several challenges associated with conducting an expert elicitation of this type. Some (and possibly most) of the participants are likely not experts with respect to all the cost and performance features, their probability distributions, and how a given policy is likely to affect those probability distributions. The ideal expert response would involve a joint probability distribution for all nine or more cost components of the technology with end without the added funding; however, this would be extremely difficult even to communicate, and even more difficult to estimate.

The method chosen for this expert elicitation questionnaire strikes a balance between obtaining detailed answers and being cognitively achievable, albeit still demanding for the experts. We asked for the probability distribution only of levelized cost (90th, 50th, and 90th percentile values), and not for the probability distributions of individual cost components. We did, however, ask experts to provide the “most likely or representative combination of component values” consistent with each levelized cost estimate.
Table 1. Summary of Funding Assumptions, by Technology

| Technology | Summary of Legislation
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<tr>
<td>Advanced nuclear (from Clean Energy Jobs and Innovation Act)</td>
<td>Would increase nuclear program funding from $9.35 billion to $17.9 billion ($6.55 billion increase) (2020 dollars) over 10 years with additional funds dedicated to RD&amp;D programs for advanced nuclear reactors, nuclear hybrid energy, used nuclear fuel, and light water reactors, plus workforce development.</td>
</tr>
<tr>
<td>Natural gas carbon capture and sequestration (NG-CCS) (from American Energy Innovation Act)</td>
<td>Would increase funding for gas and coal CCS from $4.9 billion to $11.2 billion ($6.3 billion increase) (2020 dollars) over 10 years for demonstration of carbon capture for coal and natural gas plants, carbon storage validation and testing, and carbon utilization research and demonstration. These values include funding for CCS for both NG and coal plants. Three experts specified expected proportion for NG-CCS; average was 60%.</td>
</tr>
<tr>
<td>Direct air capture (DAC) (from American Energy Innovation Act)</td>
<td>Would increase funding from $104 million to $727 million (563 million increase) (nominal dollars) over 10 years for RD&amp;D of DAC technologies, including sorbent-based DAC as well as bioenergy, enhanced geological weathering, forest management, and other carbon sinks.</td>
</tr>
<tr>
<td>Geothermal energy (from American Energy Innovation Act)</td>
<td>Would increase funding from $1.2 billion to $1.75 billion ($550 million increase) (nominal dollars) over 10 years for geothermal RD&amp;D programs for geothermal energy systems, including enhanced geothermal, geothermal heat pumps, and direct use.</td>
</tr>
<tr>
<td>Diurnal energy storage (from AEIA)</td>
<td>Would increase funding from $592 million to $2.3 billion ($1.7 billion increase) (2024 dollars) over 10 years for electricity storage to improve reliability, supply energy during peak periods, and improve feasibility of microgrids, among others, and for expanded research on battery material disposal, vehicle-to-grid integration, distributed storage, pumped hydroelectric systems, and others. Some funding would be for longer-duration and shorter-duration storage.</td>
</tr>
<tr>
<td>Multiday energy storage (from American Energy Innovation Act)</td>
<td>Would authorize $500 million (2024 dollars) over 10 years for demonstration program for long-duration storage projects. This is in addition to funding for energy storage (preceding row), which also supports long-duration storage.</td>
</tr>
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</table>

*Legislative funding as summarized in table 1 is from the Clean Energy Jobs and Innovation Act for advanced nuclear and from the American Energy Innovation Act for the other AEIs. Both pieces of legislation were introduced in the 116th Congress and ultimately passed as modified versions as part of the Energy Act of 2020, with slightly different authorized funding amounts.
We use the cost component values to harmonize answers between different experts. Some components, such as capital costs, measure differences in technological advancement. Other components, such as fuel costs, storage duration, and capacity factors, do not. To allow for an apples-to-apples comparison of experts’ answers, we modify component values in the latter category so that they are consistent among all expert responses for a given technology. Furthermore, we adjust each expert’s weighted average cost of capital (WACC) values based on a calibration question on which we asked for the WACC of onshore wind, to adjust for the fact that some experts expect higher costs of capital for all generation technologies. For a detailed list of cost adjustments and the technologies to which they were applied, see Appendix A.

Since the experts’ answers for each technology are highly variable, we devised a method of aggregating expert responses into a single cost distribution. To develop probability distributions for each technology’s harmonized levelized cost both with and without the legislation, we used a least squares optimizer to fit a cumulative probability distribution function to the experts’ harmonized levelized cost answers. We used a nonlinear weighted least squares setup where the weights are determined by the variance of the estimated 10th, 50th, and 90th percentiles relative to the experts’ responses. We opted for weights to minimize standard errors in the tails of the distribution, given the wide distribution of cost predictions. The optimizer helps minimize the sum of squared residuals between the true percentile cost estimates of the experts and the predicted costs based on the probability distribution. We used the skew-normal distribution because it can represent the often highly skewed nature of the cost distributions. Also, the distribution need not start from zero, which is a primary reason we preferred the skew-normal distribution over the gamma distribution. The three parameters that we optimized over are the location, scale, and shape parameters for the distribution.
3. Results

This section summarizes the experts' projections of the AET costs and combines them with the results of energy sector modeling to estimate the benefits of providing the funding authorized in the Energy Act of 2020. Section 3.1 reports the estimated effects of the additional public RD&D funding, as summarized in Table 1, on total public and private spending for each technology in the United States and abroad. Section 3.2 provides experts' estimates of the effect of the additional RD&D funding on future technology costs. Section 3.3 estimates the societal benefits of these cost reductions in the year 2050, based on simulations done in Shawhan, Funko, and Witkin (2020). Section 3.4 compares the estimated benefits from Section 3.3 with the average annual public and private costs to show a benefit-cost ratio of the legislation for each technology.

3.1. Effects of the Funding on Public and Private RD&D Spending

An increase in public spending on a technology is typically expected to increase private spending on that technology because of lower costs or increased public support in development. Public funding of technologies in the United States can also have spillover effects in other countries.

The questionnaire asked the expert participants to estimate total public and private R&D spending for FY 2022 through FY 2031 in and outside the United States both with and without the legislation. This section was intended to provide estimates of (1) the effect of the additional funding from the legislation on total public and private RD&D funding in the United States for the technology and (2) the spillover effect of the legislation on total RD&D spending outside the United States.

Figure 1 displays the average incremental public and private R&D spending in and outside the United States that the experts expect to occur from FY 2022 through FY 2031 as a result of full enactment and 10-year funding of the legislation, as described in the detailed legislation summaries that we provided. The dark blue portions come directly from the legislation. For NG-CCS, we assumed, based on estimates from three experts, that 60 percent of the CCS funding would be for NG-CCS only (as specified in Table 1, the authorized funding was for both coal and NG). We assumed, based on the legislative language, that 60 percent of the storage total would be for diurnal storage, one-third would be for multiday storage, and the remaining 6.7 percent would be for storage of other durations. The US government funding increases differ substantially among the technologies.
For every technology, the experts predicted that the legislation would increase private US RD&D spending and foreign RD&D funding relative to a scenario without the legislation. Their responses varied, however, on the extent of this effect. The experts estimated that the legislation, if fully funded, would increase FY 2022–FY 2031 total private RD&D spending in the United States by more than $6.8 billion for nuclear but by about $0.55 billion for geothermal. These responses roughly reflect differences in funding authorizations in the legislation, since of the technologies, advanced nuclear receives the highest amount of additional US government RD&D funding and geothermal receives one of the lowest amounts.

Most experts projected that total public and private RD&D spending outside the United States would be boosted by the legislation, though to a lesser degree than within the United States. The exception was for diurnal storage, where experts predicted that the increase in foreign RD&D spending as a result of the legislation would be higher than the increase within the United States, perhaps because of very high battery RD&D spending outside the United States by multiple companies and governments.

The estimates of the spillover effects of the legislation on private and public spending differed by technology and by the scale of the funding. The experts estimated that domestic private spending would increase between $0.59 and $1.91 for every dollar of US government funding increase. They estimated that outside the United States, RD&D spending would increase between $0.17 and $2.96 for every dollar increase in US government funding.
3.2. Effects of the Funding on Future Technology Costs

This section summarizes and analyzes the experts’ estimates for future levelized costs of the AETs in 2035 with and without the legislation, as presented to them in the detailed legislation summaries. All cost values presented here were harmonized to a standard set of assumptions, as described in the Methods section.

The technology experts predicted that the additional funding authorized by the legislation would have the largest percentage effect on the levelized costs of DAC and geothermal (for both, an expected reduction of 29 percent), followed by advanced nuclear (a 16 percent reduction) and energy storage (a 15 percent reduction). NG-CCS and multiperiod storage show the lowest expected reductions in costs from the legislation, at 9 percent and 7 percent, respectively.2

On average, the expert responses indicate that in 2035, the carbon capture rate of NG-CCS units will be 92 percent at the 90th percentile cost and 96 percent at the 10th percentile cost. Similarly, the experts estimate that the mean diurnal storage duration in 2035 will be 8.9 hours and the mean multiday storage duration will be 6.7 days. All subsequent cost estimates for diurnal storage and multiday storage reported in this section are thus cost estimates for storage units with 8.9-hour and 6.7-day durations, respectively.

Figures 2 through 7 show the individual experts’ estimates for the 90th, 50th, and 10th percentiles of harmonized levelized cost for each technology, both without and with the legislation. Individual experts’ estimates are shown by the horizontal bars. The two endpoints represent the 10th and 90th percentiles, respectively, and the circled point in the middle indicates the 50th percentile. The red bars show the projections without the legislation, and the blue bars show the projections with the legislation. For each technology, the first red bar is from the same expert as the first blue bar, the second red bar is from the same expert as the second blue bar, and so on. Note that five graphs show levelized cost per MWh of electricity delivered to the grid, the DAC graph shows levelized cost per short ton of CO₂ captured.

Superimposed on the plots is the least-squares fitted probability distribution of levelized cost, determined as described in Section 2. The red curve is the estimated probability density without the legislation, and the blue curve is the estimated probability density with the legislation. The curves show the probability distributions of levelized cost for each technology in 2035, based on the experts’ responses.

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2 These percentage difference estimates are based on weighted averages of the experts’ estimates with and without the legislation, with weights of 30, 40, and 30 percent for the 90th, 50th, and 10th percentile cost estimates of each technology, respectively.
Figure 2. Expert Levelized Cost Projections for Advanced Nuclear in 2035, in Cases with and without the Additional Funding

Figure 3. Expert Levelized Cost Projections for NG-CCS in 2035, in Cases with and without the Additional Funding
Figure 4. Expert Levelized Cost Projections for Advanced Geothermal in 2035, in Cases with and without the Additional Funding

Figure 5. Expert Levelized Cost Projections for Diurnal Storage in 2035, in Cases with and without the Additional Funding

Note: Cost projections are for units 80 hour storage duration.
Figure 6. Expert Levelized Cost Projections for Multiday Storage in 2035, in Cases with and without the Additional Funding

Note: Cost projections are for units 6.7 day storage duration.

Figure 7. Expert Levelized Cost Projections for DAC in 2035, in Cases with and without the Additional Funding

Those plots display the wide distribution of projected costs for the technologies with and without the added funding authorized in the legislation. These wide distributions highlight the uncertainty associated with innovation policy and the value of advancing multiple technologies, since it is impossible to know which will become the most cost-effective.
To allow for easy comparison of the cost distributions in the above figures, Figure 8 shows side-by-side cost distributions of all technologies. The values shown in this box-and-whisker plot are percentiles based on the least-squares fitted cost distributions shown in Figures 2-7, above. The line across each box shows the estimated 50th percentile for each technology. The boxes extend to the 25th and 75th percentiles of the distribution, spanning the interquartile range, and the whiskers extend to the 5th and 95th percentiles of the distribution, such that the plots represent the middle 90 percent of each technology’s estimated levelized cost distribution both without and with the additional RD&D funding assumed to result from the legislation.

To provide context for these cost reduction estimates, we have included estimates of cost-competitiveness thresholds from Shawhan, Funka, and Witkin (2020), where possible. That report simulated various policy scenarios with and without a national CES to estimate the costs that would make each AET cost-competitive in the year 2050, defined as accounting for at least 1 percent of US power generation. The cost needed for competitiveness may be a tipping point. Once a technology becomes cost-competitive, its cost may continue to decline because of large-scale use and learning-by-doing. These 2050 cost-competitiveness threshold values are overlaid on the box plot, represented by dashed horizontal lines. The horizontal green line (higher, lighter dashed line) shows the cost needed for cost-competitiveness in the 2050 simulations with the CES; the horizontal brown line (lower, darker dashed line) shows the cost needed for cost-competitiveness in 2050 without the CES. Shawhan, Funka, and Witkin (2020) did not include simulations for midday storage and assumed a different duration for diurnal storage than the one assumed here, so we do not have cost-competitiveness estimates for those two technologies. DAC shows a line only for the case with the CES because DAC was not implemented at large scale without a stringent emission policy, at any of the costs simulated.

The thresholds for competitiveness vary because the technologies differ in terms of the value of their generation and where they can cost-effectively be built. With the national CES, NG–CCS differs from the other technologies in that it does not receive a full CES credit per MWh because it has some emissions. In addition, the scale for DAC is different from the scale for the other technologies.

3 Ingersoll et al. (2020) and Bielinski et al. (2019) are prior studies that have also estimated the cost and/or performance requirements for a technology to be competitive. Both studies do so for advanced nuclear power.
Figure 8. Probability Distributions of Levelized Cost, Without and With Added RD&D Funding

Notes: Costs for diurnal storage are for 8.9-hour storage units, and costs for multiday storage are for 6.7-day storage units. The figure also shows estimated cost-competitive thresholds in 2050 with and without a national CES.

The box-and-whisker plot (Figure 8) offers several takeaways. First, the experts expect the additional funding from the legislation to reduce the levelized costs of these technologies across the board. Second, the plot shows differences in expectations for the impact of this additional funding on future costs across technologies. The expected cost reductions are 25 percent for advanced nuclear, 9 percent for NG-CCS, 29 percent for advanced geothermal, 16 percent for diurnal storage, 7 percent for multiday storage, and 29 percent for DAC. Third, the plot reveals which technologies have higher uncertainty with respect to costs, with NG-CCS showing the smallest cost uncertainty among the technologies and DAC showing the largest.

As mentioned above, the horizontal dashed lines, which indicate cost-competitive thresholds in 2050 for each technology in the CES and no-CES policy cases, provide context for these estimates of cost reductions. For example, without the national CES (brown dashed line), new nuclear plants are approximately 25 percent likely to be cost-competitive in 2050 without the additional RD&D funding and approximately 50 percent likely to be cost-competitive in 2050 with the additional RD&D funding. With the national CES, the probabilities increase to a little over 50 percent and a little over 75 percent, without and with the added funding. For NG-CCS, the probabilities

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4. These percentage difference estimates are based on weighted averages with and without the proposed additional funding. We used weights of 30, 40, and 30 percent for the 90th, 50th, and 10th percentile cost estimates of each technology, respectively.
are higher than those for nuclear. For DAC, they are lower than those for nuclear. For geothermal, they are lower without the added funding but higher with the added funding.

The experts provided some insights about why the funding could be more effective for some technologies than others. For example, a geothermal expert explained that geothermal technologies do not receive much private R&D funding, and thus additional public funding could potentially have a large effect on costs while encouraging private sector R&D funding. In contrast, some storage experts projected that the private sector globally would fund much R&D for diurnal storage even without any US government spending, particularly for lithium-ion batteries. Additional federal funding could have a larger effect on the costs of technologies that have received less total public and private RD&D funding to date. How the funding is allocated for each technology could also be an important factor, with some funding uses being more effective in reducing costs than others.

### 3.3. Benefits of Additional RD&D Funding

The experts' responses indicate that the additional public funding from the legislation is expected to reduce technology costs, either directly or indirectly, by triggering additional private sector investment. However, reductions in technology costs alone do not necessarily produce societal benefits; the additional funding must reduce costs enough to affect the deployment and use of the technology for electricity generation. Such benefits can be estimated using an electricity sector model that considers technology costs for determining generator dispatch and investment. Baker et al. (2000), Clarke et al. (2006), Ingersoll et al. (2020), Murphy et al. (2017), Palmer et al. (2018), and Shawhan (2018) are prior studies that have used energy system models to estimate the effects when an energy technology becomes less costly.

To estimate the annual benefits of the additional funding for these technologies in 2050, we expand on work of Shawhan, Funk, and Wiltkin (2020), who used a detailed model of the US electricity sector—the Engineering, Economic, and Environmental Electricity Simulation Tool (E4ST)—to estimate societal benefits in 2050 as a function of AET technology costs. E4ST predicts the future hourly operation of each generator, along with generator retirements and construction, using a detailed engineering model of the electric power grid. It solves a large optimization problem that represents the decision criteria of both generation investor-owners and electricity users. Shawhan, Funk, and Wiltkin (2020) provide benefit functions (as a function of technology cost) for all AETs except midday storage, which will therefore be omitted from the subsequent analysis. The benefit functions show how societal benefits vary as a

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5 For diurnal storage as well, the probabilities would be higher than those for nuclear. In fact, with the national CES, diurnal storage would be competitive even at its current cost. However, we do not have precise calculations of the diurnal storage levelized costs necessary for competitiveness because Shawhan, Funk, and Wiltkin (2020) assumed diurnal storage with a duration (ability to discharge without recharging) of 4 hours, whereas this plot assumes the average duration projected by the experts, which is 8.9 hours.
function of technology costs, assuming that all other AET costs remain constant. Shawhan, Funke, and Winik (2020) define benefits as the sum of five components: (1) electricity users’ savings; (2) producers’ profits; (3) reductions in health damages from sulfur dioxide and nitrogen oxide emissions; (4) reductions in estimated damages from emissions of CO₂ and methane; and (5) increases in government net revenue. We adopt their definition of benefits in this analysis.

The benefit functions can be used to estimate only the benefits from reduced cost of an individual technology, not the benefits from simultaneous cost reductions for all technologies. Since the AET technologies compete against one another, the total benefit from simultaneous cost reductions for all technologies will be less than the sum of the benefits from individual cost reductions.

Shawhan, Funke, and Winik (2020) estimated the total benefits to society of the AETs under two policy scenarios: (1) the no clean electricity standard (without CES) case assumes that no new clean energy or environmental policies are made by the US government (other than potentially the added RD&D funding); and (2) the CES scenario assumes that a federal clean electricity standard requires 100 percent of retail sales of electricity (94 percent of electricity generated) to come from clean sources by 2050. In the CES scenario, generation sources receive full or partial credits toward meeting the requirement in proportion to how far their CO₂-equivalent emissions rates are below 0.82 metric tons per MWh, and a ton of methane is counted as equivalent to 32 tons of CO₂. Direct air capture receives one credit for each 0.82 metric ton captured. In the subsequent sections, we report benefit-cost ratios under the two policy scenarios.

We use benefit curves from Shawhan, Funke, and Winik (2020) to estimate the societal benefits of the experts’ cost estimate reductions. For example, we estimate the benefits of the additional funding at the 10th percentile cost using the following two-step method: First, we use the benefit curves in Shawhan, Funke, and Winik (2020) to estimate the benefits when the technology’s cost is at the 10th percentile of its distribution both with and without the added RD&D funding. Second, we subtract the latter from the former to estimate the benefit of the added funding.

The experts’ cost projections are for the year 2035, and the benefit functions are based on costs in 2050. By using the experts’ costs in the benefit functions, we implicitly assume no further technological advancement between 2035 and 2050. This is quite a conservative assumption, since in reality we would expect costs to fall further during this time period. As our results will show, reductions in expected cost tend to produce larger benefits if the starting cost is lower. A small challenge in this approach was that some of the experts’ cost projections were outside the domain of the benefit curves. This was true for low nuclear and geothermal costs, and for the high nuclear, NG-CCS, and dual-use storage costs. In these cases, we extrapolated the benefit curves using the same estimated function that was used in the original paper to plot the curves.

6 0.82 metric ton per megawatt-hour (MWh) is the same benchmark emissions rate used in the Clean Energy Innovation and Deployment Act of 2020 (HR 7516). That bill also would have given DAC one credit for each 0.82 metric ton captured.
We also had to make minor adjustments to fuel costs and storage duration to harmonize the experts’ costs with those used in Shawhan, Funka, and Winkin (2020). First, we adjusted the fuel costs from their original values to account for differences between 2050 and 2035. Second, we adjusted the experts’ costs for diurnal storage for 4-hour storage duration, to match the storage parameters used in Shawhan, Funka, and Winkin (2020). This adjustment was possible because the experts gave us cost components that allowed us to adjust their estimates to diurnal storage systems of any duration.

To calculate benefit-cost ratios, we conservatively assume that the benefits begin in 2040 and end in 2060, and we assume that our estimated benefits in 2050 are representative of the annual benefits in that 20-year period. Assuming a 3 percent real discount rate, we calculate the net present value of benefits and the net present value of the increased RD&D spending from 2022 through 2039 (the costs). Both are net present values from the perspective of 2021. Figures 9 and 10 show the resulting benefit-cost ratios for the technologies. These benefit-cost ratios illustrate the value of the additional funding authorized in the legislation.

Figure 9. Benefit-Cost Ratios for Added RD&D Spending without National Clean Electricity Standard
Across nine of the 10 trios of benefits, the 10th percentile bar is larger than the 50th percentile bar, which is larger than the 90th percentile bar. That indicates that the benefits of cost reduction for a technology tend to be larger if the reduction begins from a lower starting cost. This implies that the benefits per dollar of additional RD&D funding do not necessarily decline with increased funding. This has implications for higher funding of clean energy RD&D in general and funding above the levels in the Energy Act of 2020 in particular.

The figures also illustrate how a market-based national clean electricity policy can increase the societal benefits of the additional funding authorized by the legislation. The societal benefits in 2050 that result from the added RD&D funding are higher with the CES than without. There are just two exceptions: for advanced nuclear at the 10th percentiles of its cost and advanced geothermal at the 90th percentiles of its cost, benefits are higher without a new national policy because then the technologies displace more coal-fired generation and its associated harmful emissions.

Nuclear at its 90th percentile costs has a small negative benefit because less costly nuclear reduces the CES credit price. Reducing the credit price raises wholesale electricity prices, which increases coal-fired generation, with its high sulfur dioxide and nitrogen oxide emissions. The small cost savings in the nuclear 90th percentile cost case are not large enough to offset the additional coal-related health damage. Any nonmitting technology could have this effect, under a narrow range of circumstances.

The negative benefits from less costly NG-CCS at its 90th percentile costs result from
the assumption in Shwahn, Funka, and Witkin (2020) that this technology earns full credit in some state and utility policies even though it produces some emissions. If it received credit only in proportion to its emissions advantage relative to conventional generation, it would not produce negative net benefits, or they would be smaller, like those of nuclear.

In the no-national CES scenarios and to a lesser extent in the scenarios with a national CES, the benefits of the additional AET RD&D depend in part on state and utility policies, since those policies increase the value of the AETs. This is particularly true for DAC. In the simulation assumptions, one medium-sized state has a net zero power sector emissions requirement, and that is the main use of DAC in the absence of a national CES. In reality, by 2050, more states or utilities could have similarly stringent policies.

We can combine each trio of bars in Figures 9 and 10 into an approximate expected value by calculating a weighted average of the three values, as in Figure 11. We use weights of 30 percent on the 10th percentile and 90th percentile values and 40 percent on the 50th percentile value.

**Figure 11. Estimated Benefit-Cost Ratios from 10 Years of RD&D Funding, Using Weighted Average Benefits over 20 Years**

Without the national CES, the benefit-to-cost ratio for the 20-year benefits period of 2040 to 2060 is greater than 5 for geothermal, advanced nuclear, and diurnal storage. For NG-CCS it is 0.7, and for DAC it is 0.4. With the national CES, the benefit-to-cost ratio is greater than 5 for all five technologies. The simple averages across the five technologies are 6.8 without the national CES and 10.5 with it. On average, the estimated benefits of the additional funding from the legislation are $30 billion under the without-CES scenario and $39 billion under the with-CES scenario, per technology.
assuming a 20-year benefit stream. These are net present values, from the perspective of 2021, calculated using a 3 percent real discount rate.

Advanced geothermal has the highest estimated benefit-cost ratio of all technologies with or without the national CES. Advanced geothermal thus has the highest estimated benefits per dollar of additional RD&D spending.

The above benefit-cost ratios assume conservatively that the benefits of the added RD&D funding last from mid-2040 to mid-2063. As sensitivities, we also calculate the benefit-cost ratios if the benefits last for 30 years (2050 to 2080) and 10 years (2045 to 2055), as shown in Table 2.

Table 2 also shows benefits separate from costs. Again, these costs are total US public and private RD&D spending on each technology from FY 2022 through FY 2031, as estimated by the experts. In this table, the benefits and costs are net present values from the perspective of 2021 and are expressed in 2020 dollars. Of all the technologies, nuclear has both the largest estimated cost and the largest estimated benefits.

### Table 2. Benefit-Cost Ratios for 10-, 20-, and 30-Year Benefits, by Technology

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Advanced nuclear</td>
<td>10</td>
<td>46.3</td>
<td>3.5</td>
<td>40.7</td>
<td>31</td>
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<td></td>
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<td></td>
<td>20</td>
<td>93.7</td>
<td>7.1</td>
<td>82.2</td>
<td>6.3</td>
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<td></td>
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<tr>
<td></td>
<td>30</td>
<td>142.1</td>
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<td>125.6</td>
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<td>20</td>
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<td>38.7</td>
<td>7.6</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>6.2</td>
<td>1.0</td>
<td>59.2</td>
<td>11.6</td>
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<td>Geothermal</td>
<td>10</td>
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<td>9.8</td>
<td>28.1</td>
<td>12.4</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>4.2</td>
<td>19.5</td>
<td>56.9</td>
<td>25.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>7.3</td>
<td>29.8</td>
<td>86.9</td>
<td>36.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diurnal storage</td>
<td>10</td>
<td>1.3</td>
<td>4.5</td>
<td>5.4</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>9.1</td>
<td>6.8</td>
<td>10.9</td>
<td>8.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>14.0</td>
<td>10.4</td>
<td>16.6</td>
<td>12.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct air capture</td>
<td>10</td>
<td>0.2</td>
<td>0.2</td>
<td>3.4</td>
<td>2.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>0.5</td>
<td>0.4</td>
<td>6.9</td>
<td>5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>0.7</td>
<td>0.6</td>
<td>10.6</td>
<td>8.3</td>
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</tr>
</tbody>
</table>
Finally, using results from Shawhan, Funke and Witkin (2020), we can decompose the above benefits into their components. In the without-CES case, the benefits are 74 percent from reduced climate and health damages, 49 percent from electricity bill reductions, ~20 percent from changes in producer profit, and ~23 percent from changes in government revenue. With a CES, the benefits come 151 percent from electricity bill reductions, 6 percent from climate and health benefits, and ~56 percent from changes in producer profit. Negative percentages indicate negative benefits, such as a reduction in the profits of producers of electricity. In summary, without a CES, the benefits of the AET cost reductions are a mix of emissions reductions and electricity bill reductions, whereas with a CES, the benefits are primarily from electricity bill reductions. This pattern would not necessarily hold if the CES had a price cap, if the CES were at its price cap instead of reaching its clean energy target, emissions reductions would likely account for a larger share of benefits relative to electricity bill reductions because the AET cost reductions would likely enable more clean energy production at the same CES credit price, reducing emissions more and not reducing electricity prices as much.

From the benefit components, we compute the expected total electricity bill savings per household that result from the added RD&D funding. The values in Table 3 were calculated by dividing the expected total national electricity bill savings in 2050 by the total number of US households. Therefore, values include not just savings on residential electricity bills but also electricity savings for businesses and other organizations, which are eventually passed to households in the form of lower product prices and higher profits and wages. The estimated effect on residential electricity bills alone would be roughly one-third of the savings in Table 3, since residential electricity consumption constitutes approximately one-third of total US electricity consumption. As seen in the table, the additional funding of AETs could potentially lead to large pocketbook benefits for households, especially in the event of a new national CES.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Savings per household (without CES)</th>
<th>Savings per household (with CES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
<td>28</td>
<td>102</td>
</tr>
<tr>
<td>NG-CDS</td>
<td>2</td>
<td>82</td>
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<tr>
<td>Advanced geothermal</td>
<td>31</td>
<td>77</td>
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<tr>
<td>Diurnal storage</td>
<td>8</td>
<td>11</td>
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<tr>
<td>Direct air capture</td>
<td>2</td>
<td>6</td>
</tr>
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</table>
3.4. Economy-Wide Benefits of Increased RD&D Funding for DAC

Our analysis thus far includes only those benefits that result from uses of the AETs in the electricity sector, but cost reductions for the AETs can also produce benefits outside that sector. For example, electricity storage can support decarbonization of transportation and improvement of various consumer products, DAC can be used to offset emissions that would be very costly to eliminate, CCS can be used to decarbonize industrial processes, and geothermal, CCS, and nuclear can provide heat for various direct uses in industry and buildings.

For DAC, Hafstead (2020) estimated benefit curves that we can use to estimate the economy-wide benefits of the cost reductions from the additional RD&D spending. Hafstead uses the Dynamic Regional Computable General Equilibrium (RFF-DR) model to estimate the economy-wide benefits of DAC in 2049. The RFF-DR model is a dynamic multi-region and multi-industry intertemporal model of the US economy with international trade. Like most computable general equilibrium models, it does not separately represent every generation type, so it does not separately represent the other AETs. It does, however, separately represent DAC, which makes it an excellent model for representing the whole-economy effects of less costly DAC. The model assumes multiple technologies are available for reducing emissions, but DAC is the only available technology for removing CO₂ from the air. Like Shavell, Funk, and Wilkin (2020), Hafstead provides the benefits of DAC for various cost levels of the technology. We therefore apply methods identical to the ones in the previous section.

Figure 12 shows the updated benefit-to-cost ratios for DAC using benefit estimates from Hafstead (2020) that take into account economy-wide benefits of DAC deployment. The results assume a policy or set of policies that cause a cost-effective CO₂ emissions reduction of approximately 50 percent by 2050, relative to 2005 levels. Under a more stringent policy or set of policies, we would expect the benefits of DAC to be even higher than the ones presented here.

At the 90th percentile costs, DAC is not competitive for use in the economy, regardless of whether it received additional funding. On the other hand, if DAC is already widely cost-competitive, decreases in the costs of DAC have large benefits to society. As seen in the figure, the additional DAC funding produces zero benefit if the cost of DAC remains high (a benefit-to-cost ratio of 3.5 at the 50th percentile costs) but benefits more than 80 times as large as the added RD&D spending if DAC becomes widely cost-competitive. We estimate that the expected value of the benefit-cost ratio is 27 (using a weighted average, with 30, 40, and 30 percent weights on ratios at the 10th, 50th, and 90th percentiles, respectively).
As in the power-sector-only benefit and cost estimates, the results in Figure 12 assume that the annual 2049 benefits are received for a 20-year period centered on 2050, discounted to present values at a 3 percent discount rate. To test the sensitivity of the results to the 20-year benefits period, Table 4 shows how the weighted average benefit-cost ratio changes with the benefits period. In all cases, the expected benefit-cost ratio of the additional funding for DAC exceeds 10, indicating exceptionally large potential societal returns to the greater DAC RD&D envisioned in the Energy Act of 2020.

**Table 4. Economy-Wide Benefits and Costs for DAC under Three Benefits Scenarios**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Benefits lifetime (years)</th>
<th>Total costs (billion 2020$)</th>
<th>Total benefits (billion 2020$)</th>
<th>Benefit-cost ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct air capture (economy-wide benefits)</td>
<td>10</td>
<td>1.3</td>
<td>16.9</td>
<td>13.2</td>
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<tr>
<td></td>
<td>20</td>
<td>1.3</td>
<td>34.1</td>
<td>26.7</td>
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<tr>
<td></td>
<td>30</td>
<td>1.3</td>
<td>52.1</td>
<td>40.7</td>
</tr>
</tbody>
</table>

Note: All benefit values are weighted averages of benefits in the 10th, 50th, and 90th percentile cases.
4. Discussion

There are several caveats associated with our results and methodology. First, the results omit benefits from the use of the less costly AETs outside the power sector (except in the supplementary DAC analysis), benefits outside a 20-year (or 10- or 30-year) period, US RD&D expenditure changes outside the 10-year period from 2022 to 2033, benefits abroad from use of the less costly AETs there, US benefits from the resulting emissions reductions abroad, and US benefits from higher export profits. The amount of electricity generated outside the United States is currently approximately four times the amount generated domestically.

Second, even for the benefits and costs that we do estimate, the benefit estimates are subject to a large amount of unavoidable uncertainty around the central estimates that we provide. A substantial part of this comes from the cost projections; projecting the probability distributions of the levelized cost of a technology with and without a given set of additional RD&D legislation and funding is difficult.

Third, as can be the case with any expert elicitation, the results have a potential for bias. Often, professionals who have expertise in these technologies may benefit from increased government funding for the technologies. Although we asked for unbiased estimates, the experts’ answers could still reflect some bias in favor of the legislation. However, it is also possible that experts underestimate technological change, which could result in cost projections that are too high. Wiser et al. (2016) observe that

that has been the case with expert elicitation on solar energy, where prior studies, such as Curtin et al. (2008), have underpredicted cost reductions under various policy scenarios. Underprediction of cost reductions has also been the case for other technologies even when the experts surveyed had a vested interest in giving answers that encourage more government RD&D funding even most experts may not be able to see all the opportunities for cost reductions. Also, the experts’ cost projections were for projects designed in 2025 and built shortly thereafter, but we assume that they are representative of the costs of building and operating new AET facilities in 2050. As a result, if the experts were overly optimistic about the pace of cost reductions by approximately a decade, their answers would still not be too low for the way we use them.

Fourth, as discussed in the Results section, we conservatively assume that the experts’ cost projections for 2035 will apply in 2050. Costs tend to decrease over time, especially with use, and our results show that cost reductions tend to significantly increase the expected benefits of further cost reductions.

Finally, the set of experts we ultimately interviewed was not random because of the limited number of experts in each field and the limited number who were willing and able to participate in the study. Many of our respondents were recommended by experts whom we had already interviewed, so their answers could have been similarly biased.

7 Gregory Nemec, University of Wisconsin–Madison, personal communication, December 18, 2020.
5. Conclusion

This study provides insights from experts and from simulation modeling about the effects of additional RD&D funding on future technology costs of five advanced energy technologies—advanced nuclear, advanced geothermal, diurnal energy storage, carbon capture and sequestration, and direct air capture. Experts were asked to predict the levelized costs of these technologies in the year 2035 under scenarios with and without additional federal RD&D funding very similar to that authorized in the recently enacted Energy Act of 2020. The actual funding amounts are decided annually, so estimates of the benefit-cost ratios of the funding have an ongoing potential to be helpful to members of the US Congress and presidential administration.

We note salient points from the results. First, we report the average of experts' predictions for total public and private RD&D spending in and outside the United States in the coming 10 years, from 2022 through 2031, both with and without the legislation. We observe that the experts expect increased US government funding as authorized in the legislation to have positive spillover effects for both US private and foreign RD&D for the same technologies. Second, the general consensus of the experts was that the legislation would reduce costs for all five advanced energy technologies, and additionally for midday energy storage (which was included in the legislation but not in the simulation modeling). The extent of the projected reductions varied by expert and by technology.

To estimate the benefits to society of these technology cost reductions, we interpolated the results of simulations from Breslauer, Funke, and Wilkin (2020). We conservatively assumed that the benefits would last for just 20 years, from 2040 through 2060. With a national clean energy standard, the estimated benefit-cost ratios for all technologies are greater than 1—in fact, greater than 2. Even without a national clean energy standard, the benefit-cost ratios are greater than 1—in fact, greater than 2— for three technologies: advanced geothermal, advanced nuclear, and diurnal storage. The results suggest that the value of fulfilling the spending authorizations in the 2020 legislation would be high. They also suggest that there are likely to be further opportunities for beneficial additional funding increases, above those authorized in the Energy Act of 2020.

In a future paper, we will expand our reporting of the experts' answers and add to the benefit-cost analysis provided in this manuscript.
6. References

Note: For readers' convenience, references cited together in the text are organized by topic, as indicated by the three topic headings below.


How Much Climate Policy Would Reduce the Cost of an Energy Technology


The Effects of Falling Costs of an Energy Technology


Cost and Performance Requirements for Competitiveness of a Generation Technology


Appendix A. Cost Assumptions for Harmonizing Experts’ Answers

The following assumptions and cost adjustments were made to harmonize the experts’ answers:

- Since advanced nuclear, geothermal, and DAC technologies tend to run all or almost all the time except when an outage occurs, we assumed the capacity factor for these technologies to be 1 – total outage rate.

- NG-CCS was assumed to have a capacity factor of 80 percent.

- The capacity factor for multiday storage was assumed to be 33.333 percent. This is equivalent to discharging (generating) one-third of the time, or full output. Assuming a lower capacity factor would have resulted in a higher levelized cost.

- Diurnal storage was assumed to charge and discharge its full energy capacity once per day. For example, a diurnal storage system with a duration (energy capacity divided by power capacity) of 8.9 hours (the average duration projected by the experts) was assumed to have a capacity factor of 8.9/24 = 37%.

- Storage durations for diurnal and multiday storage technologies were assumed to be the averages of all expert responses. This assumption made the durations uniform for diurnal storage and uniform for multiday storage.

- For both storage technologies, we adjusted the input price of electricity. For diurnal storage, we set the input electricity price to $0/MWh so that our levelized cost estimate is levelized cost of storage, not counting the cost of input energy. For multiday storage, however, we assumed an input electricity price of $22.45/MWh. This figure is between the levelized cost of energy from solar and wind. In 2038, as reported in the 2020 Annual Technology Baseline from the National Renewable Energy Laboratory, after adjusting for inflation. This is consistent with the multiday storage representing 100 percent “green” storage, charged with incremental nonemitting generation.

- For DAC, we set the electricity input price to the average price across all expert responses.

- The natural gas fuel cost per MMBtu for NG-CCS and DAC is the same price we use in simulation modeling for 2039: $3.8/MMBtu for DAC, and $3.76/MMBtu for NG-CCS.

- The weighted average cost of capital (WACC) we requested was postconstruction real WACC. The postconstruction real WACC answers provided by the experts reflect (1) the expert’s judgment about the riskiness of investing in the technology and also (2) the expert’s assumptions about the type of investor-owner and the real WACC across all investments. To remove the effect of (2), we also asked the experts for projected WACC for an established technology.
arrays of land-based wind turbine generators (wind farms). We replace each postconstruction real WACC answer with the difference between that answer and the same expert’s corresponding wind farm postconstruction real WACC answer, plus 2.96 percent real, which is a projection of the postconstruction real WACC of wind farms in 2035, from the National Renewable Energy Laboratory’s 2020 Annual Technology Baseline. In this way, we use a standard WACC assumption for wind farms plus the expert’s estimated difference between the WACC for the technology in question and the WACC for wind.

8 We did this for each of the six scenarios, where a scenario is a combination absence or presence of the additional RD&D funding and percentile of levelized cost of the technology in question (for example, 90th percentile levelized cost of energy from enhanced geothermal without additional RD&D funding).
Appendix B. Projected Competitiveness of Technology Types

The questionnaire asked experts to predict most cost-competitive and second-most cost-competitive technology subtypes for their technology in 2035, both with and without the legislation. Respondents’ answers varied, but notably, most respondents (90 percent) estimated that the legislation would not affect which technology was the most competitive in 2035. These results suggest that the legislation may not be highly likely to change the relative competitiveness of technology types but would instead give an added push to reduce the costs of the subtechnologies that were already likely to be the most competitive.

Experts had varied predictions for the most competitive and second-most competitive technologies across the categories, with some consensus on certain technologies. For example, for advanced nuclear, three of the five experts predicted that small light-water reactors would be the most cost-competitive in 2035 with or without the legislation. Experts in diurnal storage were largely in agreement that the most competitive technology in 2035 with the legislation would be lithium-ion batteries. The NG-CCS experts provided a larger range of responses.

Figure B1 displays the tallies of experts’ answers about the most competitive technology subtypes in 2035 with the legislation. As noted above, the responses given for the scenario without the legislation were very similar.
Figure B1. Tally of Expert Answers: Most Competitive Technology Subtypes in 2035, With Legislation

<table>
<thead>
<tr>
<th>Technology Type</th>
<th>Subtype</th>
<th>Total Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced nuclear (5 total)</td>
<td>Small modular light water reactor</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Molten salt reactor</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Gas-cooled reactor</td>
<td>1</td>
</tr>
<tr>
<td>Diurnal storage (5 total)</td>
<td>Lithium-ion batteries</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Compressed/liquid air storage</td>
<td>1</td>
</tr>
<tr>
<td>Multiday storage (5 total)</td>
<td>Hydrogen electrolysis</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Pumped hydro</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Metal air batteries</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Aqueous sulfur flow battery</td>
<td>1</td>
</tr>
<tr>
<td>CCS (5 total)</td>
<td>Solvent-based post-combustion capture</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Sorbent-based post-combustion capture</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Amine-based post-combustion capture</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Oxy-fired sCO2 cycle</td>
<td>1</td>
</tr>
<tr>
<td>Geothermal (5 total)</td>
<td>EGS with binary cycle</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Flash cycle EGS</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>EGS and AGS hybrid system</td>
<td>1</td>
</tr>
<tr>
<td>DAC (4 total)</td>
<td>Solid sorbent</td>
<td>4</td>
</tr>
</tbody>
</table>

When asked to predict the second-most competitive technology in 2035, most experts (72 percent) gave the same response under both scenarios, which suggests, as in the responses to the first question, that the legislation may not influence which technology subtypes are most likely to be successful. However, some experts who believed that the legislation would not change which technology was the most competitive chose different technologies as the second-most competitive under each scenario. These responses suggest that some subtypes may be sufficiently advanced to be the clear winners today, but that the second-place technology could be more readily influenced by R&D funding.
June 24, 2021

Kate Miller
Director of Government Affairs

The Honorable Joe Manchin, Chair
Senate Energy and Natural Resources
U.S. Senate, Washington, DC 20510

The Honorable John Barrasso, Ranking Member
Senate Energy and Natural Resources
U.S. Senate, Washington, DC 20510

RE: Full Committee Hearing to Examine Infrastructure Needs (06/24/2021).

Dear Chairman Manchin and Ranking Member Barrasso:

I am writing on behalf of Trout Unlimited (TU), and our more than 300,000 members and supporters across the country regarding this week’s full committee hearing to examine the infrastructure needs of the U.S. energy sector, western water, and public lands. In addition, we offer our initial perspective on the Energy Infrastructure Act Discussion Draft.

Thank you for holding this important hearing. Clean water, resilient waterways, and healthy public lands are critical elements of the Nation’s infrastructure system. Today we can see that more clearly than ever before. As individuals, we need clean water to wash our hands and to drink. As communities, we need healthy waterways to sustain our fisheries, our recreation, and our economies. And as anglers and hunters, we see the inseparable connection between healthy public lands, forests, and watersheds and the health of fish and wildlife populations. TU urges the committee to advance a robust, bipartisan infrastructure bill to address the many pressing climate change, public lands, western water, watershed resilience, and abandoned mine cleanup needs, within its jurisdiction.

TU has a deep expertise in many of the Energy Infrastructure Act’s provisions and we will be providing the Committee more detailed recommendations after the June 24th hearing. Until then please consider the following:

**Climate change** – Our members and staff are dealing with the harmful impacts of climate change on our rivers and streams right now. Trout and salmon living in coldwater habitats are naturally vulnerable to a warming climate and related impacts such as increased wildfires and floods. Scientists tell us that higher water temperatures and more destructive floods, fire and drought that lie ahead of us could eliminate 50 to 75 percent of trout habitat by 2080. No surprise then that anglers are deeply worried about climate change and its impact on fish and wildlife. We appreciate the Discussion Draft’s attention to this pressing issue through its funding for clean energy and carbon capture to reduce atmospheric carbon levels, and public lands watershed resilience projects to adapt to the new climate reality.

**Western water** – The intense drought that is gripping the western U.S. is a striking example of climate change impacts on our aquatic resources, and we are pleased that the Draft makes this issue a funding priority. TU applauds the inclusion of western water in the Energy Infrastructure Act as a recognition of
how vital our water supply infrastructure is—both built and natural—to the nation’s economy. Title IX recognizes this foundational role of western water infrastructure in § 9001(a)(1)(C) where eligible projects include those funded through the Bureau of Reclamation’s WaterSMART programs. TU strongly recommends, however, a substitution of “environmental water resources projects” for the listed “drought resiliency projects” in § 9001(a)(1)(C) (page 414, lines 5-6), while also providing the option of funding “a WaterSMART project, including [the listed programs]” as additional text on line 5, page 414. New groundwater pumping is the single largest type of project funded through drought resiliency projects over the life of this Reclamation program. The new pumping is in drought-stressed aquifers, which over the long-term, is at odds with WaterSMART program goals of supporting investments in water conservation or water delivery infrastructure with sustainability benefits. In contrast, WaterSMART’s “environmental water resources projects” include multi-benefit irrigation infrastructure projects that improve watershed health and reliability of irrigation water delivery. Environmental restoration projects that improve watershed resilience to drought are also funded among “environmental water resources” projects. Such projects are also documented job creators, making 17.4 jobs for every $1 million invested, exceeding investments across the transportation and energy sectors in creating job opportunities.

**Watershed restoration** — We are heartened to see Title VIII address the immense need for ecosystem restoration to make our aquatic systems more resilient to the effects of climate change. In particular, the proposed “Collaborative-based, Aquatic-focused, Landscape-scale Restoration Program” envisioned in Section 8004(d) is a good start to begin addressing an estimated $675 million in restoration actions for “priority watersheds” on our National Forests. Of course, the watershed restoration backlog is broader in scope than priority watersheds alone and funding needs are much greater than the $100 million proposed in the Discussion Draft. However, the funding provided in section 8004 will help complete near-term, high-priority watershed restoration projects and these dollars can be leveraged to bring additional resources to the table. Additionally, we appreciate the author’s efforts to reduce watershed impacts from forest management activities, including grants for state-managed programs to rent portable skidder bridges, providing cost-effective ways to minimize stream bed disturbances.

**Legacy Roads and Trails** — We support the Draft’s provisions and funding for the Forest Service’s Legacy Roads and Trails Program. The Forest Service is the largest federal land and road manager in the lower 48 states, responsible for maintaining more than 375,000 miles of roads, 12,000 bridges and 143,000 miles of trails. There is an immense amount of work to be done to fix Forest Service road problems and establishing Legacy Roads and Trails as a Congressionally authorized program will allow the Forest Service and numerous partners to scale-up this vital work and help make our forests and watersheds more resilient to the effects of climate change.

**Forest health** — Over the past two decades, forests in the western United States have been subjected to unprecedented periods of extended drought, making them vulnerable to massive beetle kills. The combination of dead trees and decades of fire suppression have left much of the West a tinderbox. As precipitation patterns change and snow melts earlier, watersheds become drier and wildfires grow in frequency and intensity. Our challenge is to prevent fires that threaten communities, fix what ails the forests, and address the underlying threat posed by climate change. Central to this effort must be
restoring overall forest ecosystem health so that fire can play a more natural and less destructive role in forest ecosystems. We appreciate the Discussion Draft's attention to this pressing issue in Title VIII, including the need to increase workforce capacity for our federal land management agencies – we will be providing additional recommendations for consideration.

**Renewable Energy on Public Lands**

We urge the Committee to include in this package provisions of the Public Land Renewable Development Act (PLREDA), which has been introduced in some form each Congress since 2011, each time with broad and bipartisan support. Just last year, several provisions were included in the end of year omnibus, and signed into law (Energy Act of 2020, Title III, Subtitle B). While we were pleased to see those provisions advance, we were disappointed that the heart of the bill was left behind. This Discussion Draft would benefit from inclusion of the remaining portions of PLREDA—provisions on updating the upfront planning process for solar, wind and geothermal energy development and the revenue sharing program that will support responsible development of renewable energy resources on public lands in a way that invests in local communities and in fish and wildlife resources.

**Hydropower**

Sections 3304 and 10006 include funding for investment in water power research and incentive payments for certain hydropower operations and efficiency improvements. As Congress and the Administration looks to invest in infrastructure and chart a course for a cleaner energy future, it is imperative that we look to systems as a whole, directing investments wisely to create the most good for the most needs. As previously noted, changes to climate and precipitation patterns are placing intense pressure on rivers and streams across the country. It is imperative that, when looking to invest in technologies and infrastructure that will further impact river and aquatic systems, we direct investment and incentives into projects and programs that will reduce environmental impacts and improve environmental performance, address legacy impacts from existing powered and non-powered infrastructure and support more resilient ecosystems. There is opportunity to further refine the Discussion Draft provisions to better target opportunities to support power generation while reducing impacts of dams on rivers. We look forward to working with the committee and other stakeholders to further address these considerations.

**Abandoned mine cleanups**

We appreciate that the Draft bill makes abandoned coal mine clean up a funding priority by investing in the Abandoned Mine Reclamation Fund established under Title IV of the Surface Mining Control and Reclamation Act (SMCRA). Abandoned mine cleanup projects through this program not only provide critical benefit to ecosystems and watershed resilience, these projects also support jobs, recreation, and economic values. In addition to the critical funding support, we urge the Committee to also include reauthorization of the AML Title IV program in this bill, or as soon as possible on a separate track, as this valuable funding source must be reauthorized by the end of this fiscal year. Funding provided through Title IV for abandoned mine cleanups will help restore water supplies, remediate water pollution sources throughout coalfield communities, and eliminate public hazards such as open mine portals. We note, too, that hardrock mining restoration also brings important job opportunities to remote areas but lacks in funding, in part because there are no royalties paid from the extraction of hard rock minerals from public lands. Moreover, liability issues deter so-called “Good
Samaritans’ from tackling both coal and hardrock abandoned mine cleanups, limiting the multiple benefits for water quality and community health that these cleanups could provide. Congress can fix this problem by passing Good Samaritan legislation that provides targeted liability relief to complete remediation projects.

**Critical minerals** – Minerals like lithium and cobalt help form the building blocks of renewable energy technologies that are essential to help combat climate change. The demand for these minerals is increasing dramatically and where and how these minerals are sourced is an important issue for anglers and hunters. Like any commodity, extracting these minerals must be done thoughtfully and in ways that avoid and minimize impacts to communities, clean water and fish and wildlife habitat. Full funding for provisions in the Energy Act of 2020 is something we support and we see great potential for the National Cooperative Geologic Mapping Program to identify opportunities where abandoned mine cleanups can provide both cleaner water and the raw material for clean energy technologies. Lastly, there is a tremendous opportunity for recycling to help meet the need for critical minerals, an issue that the Battery Material Processing Grant Program would help address.

**Conclusion**

Thank you for working to assemble such a broad set of proposals to invest in and improve infrastructure in the U.S. energy sector, western water, and public lands. We appreciate the opportunity to share this initial feedback on the Energy Infrastructure Act Discussion Draft and we look forward to continued engagement with the Energy and Natural Resources Committee as this legislative proposal is further refined, debated and advances in Congress.

Sincerely,

Kate Miller
Dear Chairman Manchin and Ranking Member Barrasso,

We write to you on behalf of a wide range of nonprofit organizations, to express our support for the Nonprofit Energy Efficiency Act, S.196, and our support for its inclusion in the Committee’s legislative proposal on infrastructure. We thank you for including the Nonprofit Energy Efficiency Act within the larger package the Committee will examine today. Your friendship and support for the nonprofit community is greatly appreciated.

This bipartisan legislation will establish a pilot program at the U.S. Department of Energy to provide financial grants to nonprofit organizations. These grants would help make buildings they own and operate more energy efficient. S.196 would enable America’s houses of worship, schools, youth centers, hospitals, and other nonprofits to reduce their operating costs and lessen their impact on the environment.

The staggering economic and environmental costs of maintenance on nonprofit-owned buildings is forcing many to consider closing their doors. To date, most of the energy efficiency incentive or support programs have been structured in the form of tax credits and rebates. Nonprofits—being tax exempt entities—have not been able to take advantage of these programs. S.196 offers a solution to this problem.

We are grateful for your leadership this Congress, particularly in holding today’s hearing. This legislation will provide vital improvements to nonprofit-owned buildings with a focus on the fundamental need for green infrastructure. Thank you and we look forward to working with you and your staff on this important issue.

Respectfully,

The Union of Orthodox Jewish Congregations of America, along with

Girl Scouts of the USA
The Henry Ford
Independent Sector
The Jewish Federations of North America
KABOOM!
National Council of Nonprofits
NIFAG
YMCA OF THE USA
July 2, 2021

Written Statement on Hearing to Examine Infrastructure Needs
Committee on Energy and Natural Resources
United States Senate

June 24, 2021
Patricia Sinicrope
Executive Director
WaterReuse Association

Thank you for providing the opportunity to submit written testimony regarding western water infrastructure needs and the Energy Infrastructure Act, as proposed during the June 24, 2021 Senate Committee on Energy and Natural Resources Committee hearing. I submit this testimony today on behalf of the WaterReuse Association and its members to highlight the importance of water reuse and recycling in building resiliency, creating economic opportunities, and strengthening America’s infrastructure.

The WaterReuse Association is a not-for-profit trade association for water utilities, businesses, industrial and commercial enterprises, non-profit organizations, and research entities that engage in and on water recycling. WaterReuse and its state and regional sections represent more than 200 water utilities serving over 60 million customers, and over 300 businesses and organizations across the country. Our mission is to engage our members in a movement for safe and sustainable water supplies, to promote acceptance and support of recycled water, and to advocate for policies and funding that increase water reuse.

We write to express our strong support for investing in the U.S. Bureau of Reclamation’s (USBR) Title XVI-WIN Water Reclamation and Reuse Competitive Grants Program in upcoming infrastructure legislation. The Title XVI-WIN program has helped communities across the West build drought resilience, keep pollutants out of sensitive waterways, save billions of dollars relative to importing water, and grow sustainable economies. It is a key economic and drought preparedness tool but is hamstrung by insufficient funding.

We commend the Committee for including $5 billion for Western water infrastructure in the Energy Infrastructure Act. This funding includes the Title XVI program; however, it is not clear from the language whether this would include new competitive grant projects as
authorized in section 409(c) of the Water Infrastructure Improvements for the Nation Act. We urge the Committee to provide at least $100 million per year in direct spending for the Title XVI-WIN competitive grants program, and to ensure that both new and existing Title XVI-WIN projects are eligible for this funding.

The USBR's Title XVI program is the only federal program with water reuse as its sole focus. Since Title XVI's inception in 1992, Congress has authorized 53 Title XVI recycling projects producing more than 400,000 acre-feet of drought-resistant water supply. To date, Congress has appropriated over $700 million in federal funding, which has been leveraged with non-federal funding to implement more than $3.3 billion in water reuse improvements—a nearly 5:1 leverage ratio.

In 2016, the Water Infrastructure Improvements for the Nation (WIIN) Act established a mechanism, colloquially known as Title XVI-WIIN, to enable new projects to apply for competitive grants within Title XVI. Due to the popularity of Title XVI-WIIN in its first few years, the program now has a large and growing backlog exceeding $700 million in federal cost share for eligible projects, and demand is expected to grow as more projects become eligible.

Water projects funded through the Title XVI program have been used to increase the supply of fresh drinking water, generate sustainable irrigation water, restore sensitive ecosystems, and help industries expand and create jobs, among other purposes. The program is not limited to the reuse of municipal wastewater—it also helps communities identify beneficial uses for industrial, agricultural, and domestic wastewater, as well as impaired ground and surface water. Investments through the Title XVI competitive grants program have helped both urban and rural communities across the West build a strong and secure economic future.

A recent GAO report (GAO-19-110) highlighted several illustrative Title XVI projects. For example, program investments helped one drought-stricken water district in California develop infrastructure to use more than 2 billion gallons of recycled water to irrigate sports fields, golf courses, parks, and school grounds, invigorating the local economy and improving the quality of life for residents. Another project is providing drought-resistant recycled water to farmers to irrigate 45,000 acres of farmland, reducing demand on the area's over-drafted groundwater basin.

In Texas, El Paso Water is using water recycling and saline groundwater desalination to produce a drought-resilient, cost-effective, and reliable water supply to support a vibrant local economy. Compared to the next best alternative (importing groundwater), El Paso’s water reuse program is addressing affordability challenges by saving more than $1.2 billion, or 74 percent. In Southern California's Chino Basin, local leaders developed the Optimum Basin Management Program (OBMP) to address the region's water challenges. The OBMP saves ratepayers an estimated $2.4 billion in water supply costs (a 153 percent return on investment), restores instream flows and water quality in the Santa Ana River, and replenishes the Chino groundwater Basin. Other Title XVI projects have been used to prevent saltwater intrusion into aquifers, restore marshes, wetlands, and other habitat, and create potable drinking water.
As climate change accelerates, and its associated adverse impacts on water resources increase, it is vitally important that the nation invest in water recycling to build resilience, manage energy demands, and ensure America's economic prosperity. Water recycling projects compare favorably to other water supply options by often imposing a smaller carbon footprint and generating fewer air pollution emissions, producing a stable locally controlled water source, reducing extractive water demands and replenishing groundwater.

Investment in water reuse builds communities that are modern, sustainable and stable—ready for families to flourish and businesses to grow. We urge Congress to act swiftly to help communities modernize their infrastructure and protect public health and the environment. Thank you for considering our views.

Sincerely,

[Signature]

Patricia Sinicrope
Executive Director

www.wateruse.org
Dear Senator:

Thank you for considering our input on key titles of the Committee’s draft legislation to invest in the energy and outdoor infrastructure of the United States. While this draft contains several important steps Congress should take to re-invest in our nation’s infrastructure, it falls short of the full investments urgently needed to tackle the climate crisis by transitioning to clean energy and protecting and restoring our lands and waters, while putting people to work across our country. In addition to considering improvements to this package, we strongly encourage the Committee to take additional steps to invest in clean energy, lands restoration and resilience and other natural infrastructure policies with the ambition and scale necessary to address the nation’s climate, job and equity crises.

Thank you again for your consideration of our recommendations below.

TITLE II—SUPPLY CHAINS FOR CLEAN ENERGY TECHNOLOGIES

Sec. 2006 - Critical minerals supply chains and reliability

The Wilderness Society opposes Section 2006, which would put a strong finger on the scale in favor of limiting environmental review, short-changing public input, and approving large destructive mining projects on our public lands. Short circuiting environmental review and community input is particularly alarming considering the woefully inadequate safeguards for mining on federal lands, which date back more than a century. Large scale mining on public lands has had substantial negative impacts for our clean water, air quality, wildlife, and communities, especially tribal communities. Instead of cutting more corners to chase a false narrative about environmental permitting delays, Congress should update the antiquated laws that already leave our lands, waters, and communities at risk. Congress rejected this controversial language when it was considered for the Energy Act of 2020 and should once again reject it.

TITLE VI—METHANE REDUCTION INFRASTRUCTURE

Sec. 6001. Orphaned well site plugging, remediation, and restoration.

The Wilderness Society appreciates the Committee’s efforts to address the problem of leaking, polluting orphaned oil and gas wells on public and private lands. As the Committee advances this draft bill, we encourage lawmakers to also address the underlying problem that has created this dangerous network of polluting wells: inadequate reclamation bonding. Wells without dedicated funding to plug and reclaim them often sit unmonitored for years or decades, leaking oil, gas, and brine that can pollute drinking water, contaminate land and the air, pose risks to public health and safety, and contribute to climate
change. Unless Congress addresses the underlying problem of insufficient bonds that gave rise to the proliferation of orphaned wells in the first place, taxpayers will continue to bear the burden of cleaning up expensive, toxic orphan wells.

S. 2177 both funds the cleanup of existing orphaned wells, as this section does, and also updates bonding requirements to ensure that taxpayers won’t continue to foot the bill for the oil and gas industry’s irresponsibility and that front-line communities won’t continue to be impacted by the pollution of new orphaned wells. We encourage the Committee to include well remediation and bonding reform as it advances this discussion draft.

Sec. 6002. NEPA review of certain pipeline placement activities.

The Wilderness Society opposes Section 6002, which would broaden the scope of a categorical exclusion to the National Environmental Policy Act (NEPA). NEPA is a critical statute for ensuring environmental harms are minimized and for combating environmental injustice by requiring public input and transparency in the project approval process. Attempts to circumvent this important law for the sake of efficiency are misguided, as studies have shown that a lack of funding, and not the environmental review process, is to blame for project delays. The language in Section 6002 could result in increased methane and other air pollution with inadequate environmental review, which is troubling both from a climate change perspective and from an environmental justice perspective, particularly where these emissions occur in or near frontline or fenceline communities.

TITLE VIII—NATURAL RESOURCES-RELATED INFRASTRUCTURE, WILDFIRE MANAGEMENT, AND ECOSYSTEM RESTORATION

Secs. 8001, 8003 and 8004

Sections 8001, 8003, and 8004 contain many provisions that are important pieces of achieving the ambitious goals of the American Jobs Plan. The Wilderness Society supports the inclusion of, and increased funding for, beneficial restoration programs, such as the Legacy Roads and Trail Remediation Program and the Collaborative Forest Landscape Restoration Program.

Sections 8003 and 8004 also provide billions of dollars to reduce the wildfire risk on federal forests across the country, including funding to reduce hazardous fuels. While The Wilderness Society supports these projects to help address the increased fire risks that result from climate change, it is equally important to ensure these funds are used for ecologically and scientifically sound projects that improve the health of our forests and protect communities from wildfire risks in a meaningful way. As drafted, the proposed legislation falls short of these important goals.

We have many concerns with the language and look forward to continuing to work with the Committee to ensure this critical funding prioritizes projects that will restore degraded forests, protect at-risk communities from wildfire, and protect ecologically critical public lands.

Missed Opportunity: Investment in Local and Urban Park Infrastructure

The Wilderness Society is disappointed that local and urban park infrastructure needs are not included in the draft legislation. Local parks have always been critical infrastructure, providing communities with jobs, economic development, health benefits, and outdoor recreation opportunities.
Funding local park infrastructure will bolster local economies that have been badly weakened by the pandemic. In 2017 alone, local parks and recreation agencies generated over $166 billion in economic activity and supported more than 3.1 million jobs.

Local park infrastructure has lasting benefits for public health. Scientific research finds that parks, green space, and outdoor activity reduce anxiety, stress, and depression, and improve physical health. Yet, over 100 million people in the U.S., including 28 million children, do not have a quality park or green space within a half-mile of home. The health benefits of local park infrastructure are more important than ever, providing physical activity and outdoor recreation opportunities.

TWS supports legislation like the Parks, Jobs, and Equity Act that would invest in local park infrastructure, create jobs, improve local economies, support community health, and address park equity. It could preserve up to 100,000 at-risk local seasonal jobs, provide at least 8,000 new jobs, and renovate more than 500 sites, all while adding $1.37 billion in economic activity in underserved communities. This historic investment in local park infrastructure prioritizes shovel-ready park development.

In addition to this one-time relief funding for local parks, we support including the Outdoors for All Act, which would codify the existing Outdoor Recreation Legacy Partnership (ORLP) program and dedicate a portion of the Land and Water Conservation Fund (LWCF) State and Local Assistance Program to the ORLP, providing stable funding for local and urban park infrastructure.

Local and urban park infrastructure needs to be a priority in any infrastructure legislation. We urge the Committee to address the lack of local park infrastructure in this draft as the bill moves forward.

**Missed Opportunity: Civilian Climate Corps**

The discussion draft makes two references to service, conservation and climate corps. Section 5103 makes service and conservation corps eligible recipients for grants to be used for increasing energy efficiency in buildings. Section 8003 appropriates $200 million for hazardous fuels reduction on federal land, and states that this work could be done through Civilian Climate Corps established under Executive Order 14008. Engaging corps in increasing energy efficiency in buildings and in reducing fire risks on public land is valuable work. However, the scope of work authorized by these two sections of the draft is limited. Consequently, a wide range of climate change remediation and public lands stewardship needs will be left entirely unaddressed if the discussion draft becomes law.

There is widespread support in the Administration and in Congress for making a major commitment to conservation and climate corps and investing significant resources in a climate corps program. Congress should support hundreds of thousands of workers over the next ten years by providing $10 billion for one of several congressional proposals to create a Climate Corps, reinstate the Civilian Conservation Corps, or invest in existing conservation service corps and other stewardship organizations (see Rep. Neguse's 21st Century Conservation Corps Act/H.R. 1162). This program should fund work on climate resilience and natural infrastructure on public lands and waters and restoration of degraded public lands and waters, among other projects. It would also ensure partnerships with unions and with quality workforce training programs, such as pre-apprenticeship pathways into registered apprenticeship programs and other union training programs as well as community colleges and non-profit organizations. It should also include strong protections against private and public sector job
displacement. Land restoration efforts should be coordinated with abandoned mine and orphan well clean-up programs, pollution remediation, and watershed restoration to improve water quality in polluted communities. This new program should center equity at its core, ensure a living wage for workers, and ensure greater opportunity and career pathways for women and people of color.

We urge Congress to expand this bill to bring the collective vision of a strong and vibrant civilian climate corps to fruition in an infrastructure package.

**Missed Opportunity: Renewable Energy Development on our Public Lands**

The Public Lands Renewable Energy Development Act, legislation with longstanding bipartisan, bicameral support, would promote the responsible development of 25 GW of wind, solar, and geothermal resources on public lands by identifying priority areas and encouraging smart siting and efficient permitting of project in places with high energy potential and lower impact on wildlife and habitat. This bill provides economic benefits to states and counties, puts people back to work, and reinvests in local communities’ recreation and habitat conservation. We regret that it was not included in the discussion draft and encourage the Committee to include it in any final bill.

In addition to the missed opportunities noted above to invest in targeted infrastructure projects on federal lands, we strongly urge the Committee to consider a suite of energy and natural resource investments aimed at tackling climate change at the scale and pace the crisis demands. This should include policies and investments to rapidly deploy clean energy across the economy, overdue reforms to the federal onshore oil and gas leasing program, relief of state dependence on fossil fuel revenues, deeper investments in workers and communities affected by energy transitions, and protection of vital lands and waters.

Thank you again for your consideration of our views and recommendations.

Sincerely,

Drew McConville  
Senior Managing Director for Government Relations  
The Wilderness Society
United States Senate
COMMITTEE ON COMMERCE, SCIENCE,
AND TRANSPORTATION
WASHINGTON, DC 20510-6335
Website: http://commerce.senate.gov
October 28, 2020

The Honorable Ajit Pai, Chairman
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Dear Chairman Pai,

The COVID-19 pandemic has changed life dramatically for almost every American. Normal activities such as work, school, and health care services now increasingly take place online. According to one estimate, average broadband usage has risen by 47 percent since the pandemic began.

Through initiatives led by the Federal Communications Commission (FCC or Commission) and private investment, a number of steps have been taken to expand broadband access to unserved areas and to address immediate connectivity needs stemming from the COVID-19 crisis. Notably, the FCC’s 2020 Broadband Deployment Report finds that the number of households without access to broadband service continues to decline. Despite these encouraging advances, there is still significant work that needs to be done to connect all Americans.

As you know, timely, reasonable, and equitable access to utility poles is a critical part of expanding the availability of reliable and high-speed broadband internet service. Indeed, the Telecommunications Act of 1996 requires utilities to provide nondiscriminatory access to utility poles as they are essential to the efficient deployment of broadband facilities. The Act also requires the FCC to adopt procedures to ensure that the rates, terms, and conditions for pole attachments are just and reasonable.

In accordance with the law, we encourage the FCC to move expeditiously to clarify rules governing broadband providers’ access to utility poles and to resolve quickly any pole attachment disputes that arise in unserved areas. These actions would help remove impediments to broadband deployment and allow more resources to be devoted to connecting homes and businesses across the country.

We appreciate the FCC’s ongoing work to reduce costs and remove regulatory barriers in order to close the digital divide. Thank you for your consideration of this important matter.

Sincerely,

[Signature]

Roger F. Wicker
Chairman
Senate Committee on Commerce, Science, and Transportation

[Signature]

John Barrasso, M.D.
Chairman
Senate Committee on Environment and Public Works
January 6, 2021

The Honorable John Barrasso  
United States Senate  
307 Dirksen Senate Office Building  
Washington, DC. 20510

Dear Senator Barrasso:

Thank you for your letter regarding the Commission’s efforts to remove barriers to broadband deployment—specifically as it relates to pole attachment rules and processes. Closing the digital divide has been my top priority since becoming Chairman. Ensuring that broadband providers can build out infrastructure quickly and cost effectively is essential. That’s why I worked to adopt a “one-touch make-ready” pole attachment regime in 2018, which will promote broadband deployment and competition by speeding up the process and reducing the costs of attaching new network facilities to utility poles.

Easing access to utility poles, combined with making it easier for companies to transition from copper lines to fiber networks and abolishing rules that heavily regulate the Internet, has facilitated broadband deployment. Millions more Americans have access to the Internet today than in 2016. In both 2018 and 2019, the United States set records for annual fiber deployment. Average download speeds for fixed broadband have doubled since the end of 2017. The number of Americans enjoying more than two options for standard fixed terrestrial broadband service has increased by 52%. And a new study from USTelecom shows that, compared to 2015, average consumers are paying 28% less for broadband in real terms while enjoying faster speeds.

In a related matter, NCTA—The Internet & Television Association filed a Petition for Declaratory Ruling that asks the Commission to declare that pole owners must share in the costs of pole replacements in unserved areas and give pole attachment disputes in unserved areas priority treatment, among other things. The Wireline Competition Bureau sought comment on the petition and the comment period ended on September 17. Bureau staff is currently reviewing the record. Please be assured that we will take into consideration the issues and concerns presented by all stakeholders as the Commission deliberates on the appropriate course of action.

Please let me know if I can be of any further assistance.

Sincerely,

[Signature]

Ajit V. Pai
American Rescue Plan outlays post 2021
Source: CBO Estimated Budgetary Effects of H.R. 1391; American Rescue Plan Act of 2021

Top 10 (outlays are 2022-31)
1. Elementary and Secondary School Fund: $117 B
2. Multiemployer Pensions: $83 B
3. State and Local Funding: $78 B
4. Child Tax Credit Expansion: $70 B
5. Testing, Contact Tracing, and Mitigation: $38 B*
6. FEMA: $36 B
7. Higher Education Relief Fund: $34 B
8. Child Care Stabilization: $20 B
9. Obamacare Subsidy Expansion: $19 B
10. Federal Transit Administration: $18 B

*Administration has already transferred $100 B.