C2ES CENTER FOR CLIMATE AND ENERGY SOLUTIONS

HEARING BEFORE THE

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COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY

FOSSIL ENERGY RESEARCH: ENABLING OUR CLEAN ENERGY FUTURE

Testimony of

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Chairman Lamb, Ranking Member Weber, and members of the Committee, thank you for the opportunity to offer testimony today on proposed legislation aimed at strengthening the nation's foundation of research, development, and deployment of technologies to reduce greenhouse gas (GHG) emissions.

My name is Jeffrey Bobeck, and I am pleased to offer the views of the Center for Climate and Energy Solutions, or C2ES, on this issue and relevant proposed legislation. I serve as Director of Energy Policy Engagement at C2ES and previously was honored to serve as Director of the Office of Communications and External Affairs at the Department of Energy from 2006–2009.

C2ES is an independent, nonpartisan organization and is widely recognized as an influential and pragmatic voice on climate issues. Our mission is to advance strong policy and action to reduce GHG emissions, promote clean energy, and strengthen resilience to climate impacts. We believe a sound climate strategy is essential to ensuring a strong, sustainable economy.

Our goal is to focus on real-world solutions, which we seek to identify and advance through our convening and collaboration with the business community, federal, state and local governments, and other stakeholders. Our efforts include:

- Engaging with negotiators from around the world to help them fulfill the Paris Agreement;
- Bringing together Fortune 500 companies through our Business Environmental Leadership Council (BELC), a group of 34 industry leading, mostly Fortune 500 companies;

- Partnering with the U.S. Conference of Mayors to help mayors and business leaders work together to reduce greenhouse gas emissions; and
- Co-convening the Carbon Capture Coalition to build support for development and deployment of clean energy technologies.

Since early 2018, C2ES has worked with companies to frame a comprehensive U.S. response to climate change through our Climate Innovation 2050 initiative. We brought together businesses from a variety of sectors to develop a long-range, economy-wide decarbonization strategy. As part of that effort, we identified a set of near-term federal actions to address climate change. That plan, released in February, includes fulfilling the goals of the legislation we consider here today: providing more funding and action-oriented program direction for the Department of Energy's research and development of clean energy and GHG-reducing technologies.

Carbon Capture's Role in a Decarbonized Economy

We believe that the capture, utilization and storage of carbon oxides—referred to collectively as "carbon capture"—is an essential component of a comprehensive response to climate change. Nearly 40 million tons of carbon dioxide are annually captured and stored around the world, demonstrating that carbon capture is both proven and has untapped potential as a climate tool.

Moreover, we believe that the Department of Energy's Fossil Energy (DOE FE) R&D program can and should be a key driver in accelerating the deployment of carbon capture technologies. While our focus at C2ES is on climate, we strongly believe that carbon capture can be a win-win for the economy. The United States is the recognized global leader in research and deployment of carbon capture, and Congress has the opportunity to enhance that leadership as it considers legislation like the bills before the Committee today.

In 2011, C2ES and the Great Plains Institute together helped to create a coalition of businesses, labor unions, nonprofits (NGOs), and technology and project developers in support of reforming and extending the 45Q tax credit for carbon storage.

Our collective efforts were successful: In February of last year, Congress enacted a new tax credit aimed at encouraging geologic storage of carbon dioxide, both in saline formations and through enhanced oil recovery, along with utilization of carbon oxides and direct air capture of carbon dioxide. Meanwhile, besides passage of the new tax credit, much has changed since 2011:

- Stakeholder support for carbon capture has grown stronger, as evidenced by the diversity of the more than 60 organizations that now participate in the Carbon Capture Coalition;
- That stakeholder support is well-reflected in Congress, where members of both parties from varying regions of the country have expressed their support for policy action to reap the potential of carbon capture's environmental and economic benefits;
- Carbon capture's potential has grown steadily, as technology has improved and the climate imperative has increased;
- The consensus has grown that carbon capture represents an essential component in the world's collective response to climate change; but

- So, too, has the concern that we are "behind the curve" in deploying carbon capture, if it is to provide the needed portion of GHG reduction.

From a climate standpoint, the International Energy Agency's modeling of climate responses repeatedly has found that, if the 2050 two-degree warming scenario is to be met, approximately 12–15 percent of GHG reductions must come from carbon capture. IEA additionally found that removing carbon capture from the emission reduction toolbox would *more than double* the cost of keeping warming below two degrees. In other words, carbon capture has a significant role in cost-effectively reducing GHG emissions and preventing the worst impacts of climate change.

The reasons for this are intuitive. The recent growth in renewable energy is desirable and serves as proof that supportive government policies can succeed in taking energy technologies from work bench to the commercial scale. However, we believe the most effective and economical path to decarbonization would include a variety of other technologies in addition to renewables. In the power sector, when the penetration of renewables reaches 50-60 percent, the intermittency of the sources becomes increasingly more expensive to manage. Therefore, some level of dispatchable, *emissions-abated* fossil-powered generation likely will remain necessary for decades to come (along with other non-emitting baseload power sources like hydropower, geothermal, existing nuclear, and new small and advanced modular nuclear power plants).

Second, the manufacture of products such as steel, cement, and methanol emit greenhouse gases as part of their manufacturing processes. These emissions represent approximately 22 percent of U.S. GHG emissions, and the most effective (and in some cases, the only) option for abating them is carbon capture.

While the 45Q tax credit will provide a boost for project financing (once the Internal Revenue Service issues its long-awaited guidance), a suite of supportive policies is needed if the pace of carbon capture deployment is to accelerate, especially to address two critical aspects: the continued improvement in available technologies, and the reduction in the associated costs. That brings us to the legislation before the Committee today.

Fossil Energy Research and Development Act

While the post-combustion capture of carbon dioxide has been theoretically possible for generations, the constant improvements in efficiency and cost made possible through the DOE Fossil Energy R&D program have improved carbon capture's viability as an emissions tool. The FE R&D program has been responsible for many of those improvements in carbon capture technology through work led by DOE's National Energy Technology Laboratory (NETL) headquartered outside Pittsburgh.

NETL's Carbon Capture Program research is aimed at providing step-change reductions in both cost and energy penalty compared to currently available technologies. The program supports research projects that develop and test a variety of carbon dioxide control technologies, including advanced solvents, sorbents, and membranes.

The scale of NETL's research ranges from lab/bench-scale testing, through small pilot-scale testing, up to large pilot-scale demonstration scale testing. Many NETL-sponsored carbon capture technologies have progressed through numerous cooperative agreements from successful bench-scale testing, and some technologies have moved beyond NETL sponsorship and are being used commercially.

As cost is a major factor in eventual deployment, reducing it is an intrinsic part of this work. From an estimated average cost of capture that, in 2012, sat in the neighborhood of $80-100 per metric ton of carbon dioxide, DOE hopes to achieve a capture cost of $45 per ton by next year and $30 per ton by 2030. Reducing the cost factor to that level will improve carbon capture's viability and acceptance to private sector efforts to decarbonize.

Despite these achievements, the program still operates under its 2005 authorization, thus many of its current research objectives weren't even envisioned by Congress at that time. For instance, the concept of carbon utilization—the beneficial use of captured carbon oxides in commercial products such as building materials, fuels, and chemicals—was barely imagined when the FE R&D program was last authorized. Now it offers an important economic pathway to decarbonization in hard-to-decarbonize products and geographic areas (*i.e.,* where geologic storage options may be limited).

The *Fossil Energy Research and Development Act* brings the program's statutory direction into the modern era. It would provide updated program guidance while allowing for flexibility as priorities and technologies change. Building off the concept of the National Carbon Capture Center, it would establish regional centers to address region-specific capture, storage, and utilization needs. And it would provide higher funding authorization levels. On this last point, we suggest you will find widespread agreement among a wide variety of stakeholders, including the private sector and NGOs, that the higher authorization levels that this authorization lays out would support more rapid deployment of technologies.

In particular, the FE R&D program has been responsible for important advances in the development of technologies for carbon utilization, also known as carbon recycling. C2ES believes carbon utilization holds great promise as a pathway for decarbonization and will soon publish a new report on the subject. Its conclusions are relevant to both bills before the Committee today.

Carbon utilization (beyond that involving enhanced oil recovery) can be especially effective in addressing harder-to-decarbonize industrial sectors. For instance, aviation fuel emissions cannot be "captured" in real time by traditional means, but their lifecycle emissions may be reduced pre-combustion by converting low-carbon ethanol produced from captured waste emissions into jet fuel.

The draft Fossil Energy R&D Act would strengthen DOE's mission to develop these technologies, while the industrial decarbonization bill could lead to a stronger government-wide action plan on how carbon utilization can be applied to address emissions at particular industrial locations. Our research shows that both the market and GHG reduction potential of carbon utilization is great. However, if carbon utilization technology and markets have not developed within the next decade to the point where commercial forces are driving continued growth, the contribution of utilization to decarbonization may never catch up. We believe legislation like that before the Committee today could quickly accelerate carbon utilization's development and deployment.

Industrial Decarbonization Technology Development Act

As mentioned previously, much of the government's focus on decarbonization has gone to the power sector, which, according to the U.S. EPA, accounted for 28 percent of GHG emissions in 2017 versus decarbonization of industrial processes responsible for 22 percent of GHG emissions in the same period.

Emissions from industry subsectors such as steel, concrete, aluminum, and chemicals are challenging because they are energy-intensive and process-related, intrinsic to the product with no readily available alternative. For example, cement is commonly made by melting limestone and thereby releasing carbon dioxide (although research on lower-emitting cement-making processes is among innovative carbon utilization technologies being considered by the Carbon XPRIZE competition).

C2ES suggests that a successful approach to addressing industrial GHG emissions would be multi-faceted, both in terms of addressing the emissions themselves and in setting other complementary market-driving decarbonization policies. It would double down on both capture and utilization technology R&D specifically applicable to industrial processes. It would facilitate transportation of carbon dioxide emissions (*e.g.,* through pipelines) from the industrial sources to either geologic storage formations, or to where the carbon dioxide could be utilized in enhanced oil recovery or the making of products. And it would provide at least a level playing field for financing and taxation of these operations in comparison with natural resource development and renewables.

Lastly, C2ES strongly believes that enacting some form of a carbon pricing system would provide a positive market-oriented force that would help to "pull" these other elements along as industries incorporate GHG emissions abatement into how they do business, as they previously have done with reducing other types of emissions. While this is outside the Committee's jurisdiction, we urge every Member of Congress to consider how such a system would help foster a lower-carbon economy.

The development and deployment of lower- and non-emitting industrial processes is an important goal, but technology development is only one aspect of industrial decarbonization. In addition, other relevant solutions may include incorporating carbon capture into those processes (linking it to carbon utilization applications) and adoption of carbon capture for on-site power generation.

Carbon capture is currently in use at-scale (i.e., capturing at least one million tons of carbon dioxide per year) at two industrial plants in the United States, including Air Products' hydrogen production facility in Texas and Archer Daniels Midland's ethanol production facility in Illinois. However, significantly more and different types of industrial decarbonization projects will be needed in the coming decades.

The draft *Industrial Decarbonization Technology Development Act* (IDTD) would elevate the issue of industrial GHG emissions within the government and provide better cross-agency coordination of policy. It would establish a Transformative Industrial Technology Program led by DOE to leverage existing resources among relevant agencies, and enable grants, contracts, cooperative agreements, and public-private partnerships to carry out the program. The bill would also seek better intergovernmental cooperation on industrial emissions and would require development of a national roadmap for decarbonization of difficult-to-decarbonize industries.

C2ES believes these are good first steps. In particular, the IDTD acknowledges that, as state and local governments increasingly adopt their own environmental and energy plans, the alignment of policies between federal, state, and local policies is critical. Industrial challenges for steelmaking in Pennsylvania are different from those for chemical processing in Texas, and the federal government must encourage their local and state

counterparts to formulate and implement their own industrial emissions plans specific to their own economies.

We understand that a companion bill to the IDTD is being developed concurrently in the Senate, and we commend the Committee for seeking to address the issue. As your legislative draft advances, we stand ready to offer our ability to convene stakeholders for the purpose of continuing the process of developing an effective action plan. We suggest that addressing the issue of industrial decarbonization should be on the short list of priorities as Congress considers how to craft national climate policy.

Setting a Successful GHG Reduction Policy

On the subject of process, allow me to comment on how this Committee has gone about developing these bills. While the industrial decarbonization bill is relatively new, the drafting of the Fossil Energy R&D legislation should be considered a model for stakeholder engagement and bipartisan legislative drafting. Committee members and staff on both sides of the aisle are to be commended for conducting an open and thorough process.

I first heard of the effort to reform the FE R&D program more than two years ago when the then-minority staff reached out to me and other stakeholder groups asking that we offer our views on the subject. Through countless meetings and many iterations, the objective remained steady: How can we authorize the most effective program? No bill can please everyone, but a process that takes many views into account is more likely to succeed.

Allow me to close with a thought about the general notion of "innovation" and how it relates to the broader policy scheme that will be needed if Congress hopes to accelerate carbon capture deployment. Innovation is not an end in itself, but rather a critical means to deploying more effective and economical technologies that will lead to the greatest possible GHG reduction. The seeds planted by federally supported innovation will not bear fruit without other policies mentioned earlier, without commensurate action at the local and state levels, and certainly not without strong commitment by the private sector to shoulder some of the risk.

To be sure, innovation benefits from strong, strategic federal funding. We believe this is an area where every additional dollar has the potential for accelerating our transition to a lower-carbon economy and for maintaining U.S. global leadership in that quest.

Lastly, innovation succeeds only with follow-through. The single metric of success in this case should be the number of new projects in the ground and the corresponding GHG reductions they represent. On the other hand, if projects are instead falling into the financial "valley of death" before they reach commercial scale, something is wrong. An innovative project that never happens is a far poorer public investment than one that needs one last federal boost to reach scale.

We believe Congress's response to climate must be both urgent and comprehensive. No proposed single policy reform offers a "silver bullet;" rather, a portfolio of policies is needed to address technology development, financing, and market preferences. Moreover, federal action alone is not sufficient. States and local governments can best tailor policies that will reap the maximum environmental and economic benefits of developing carbon capture.

And we are behind. As I said at the beginning, that nearly 40 million metric tons of carbon dioxide are currently stored or utilized annually around the world proves that carbon capture can play a major role in GHG reduction. However, according to the International Energy Agency, the amount of carbon dioxide captured needs to grow by *a factor of 100 by 2040* if carbon capture's necessary contribution to GHG reduction is to keep pace.

We commend the Committee for proactively proposing thoughtful climate policies within its jurisdiction and we look forward to working with you going forward. Thank you for your attention.

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Jeffrey Bobeck brings three decades of policy experience to C2ES, where he serves as Director of Energy Policy Engagement.

Jeff leads the work of C2ES in co-convening the national Carbon Capture Coalition. In that role, he directs stakeholder work groups on carbon utilization and natural gas/carbon capture.

Jeff's government experience includes serving on the staffs of two senior Members of the U.S. House of Representatives, where he contributed to major tax and international trade legislation, and was designated as an official observer to the negotiations to end the war in El Salvador. In 2006, President George W. Bush appointed him Director of Communications and External Affairs for the U.S. Department of Energy.

In the private sector, Jeff served as Director of External Liaison with the American Automobile Manufacturers, where he focused on international harmonization of automotive environmental and safety regulations. He testified annually before Congress on the implementation of the North American Free Trade Agreement (NAFTA) and later helped to manage the auto industry's North American environmental sustainability coalition which was authorized by NAFTA's environmental side agreement. He later served as the Washington-based North America policy lead for the Global CCS Institute.

Jeff has contributed numerous op-eds to publications such as the *Washington Post* and *New York Times*, appeared on national news outlets including CNN and NPR, and is a frequent speaker at energy and environmental policy conferences.

He is a graduate of Ohio University in Athens, Ohio, and has done graduate work in environmental and security policy at George Washington University in Washington, DC